# Sticking With Electronics for Crafting Practices: An Inclusive Approach to Promote Making Literacy Among Older Adults

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Figure 1: Pictures illustrating our initial consultation activities to design the scope of a making literacy workshop, a group of older adult women engaged in our electronic cards making workshop, and the electronic cards made by participants arranged on a table in the community centre

## Abstract

Making activities have been shown to offer potential for inclusive access to digital literacy amongst marginalized groups, but research exploring such approaches with older adults is still scarce. Our study introduces an electronic-card-making workshop, co-developed with Japanese older women to foster engagement aligning with their purpose, physical and cognitive skills. The workshop was initially delivered to 14 women. Following initial success, 4 participants decided to deliver a second workshop, with the support of our team, for 15 local children. We present findings from both these workshops unpacking how women's motivation for engaging in eMaking revolved around the idea of sharing, both through displaying created artefacts and the transmission of knowledge, how their learning consolidated around implicit actions and was supported by the creation of escalation strategies when they felt that demands exceeded their level of proficiency. Based on our results, we propose guidelines for inclusive eMaking involving novice older women.

## CCS Concepts

• **Human-centered computing → Empirical studies in HCI**; **Empirical studies in accessibility**.

## Keywords

Older adults, digital literacy, making, crafting, Japan

## 1 Introduction

As the cumulative prevalence of digital technologies intertwined within innumerable dimensions of day-to-day presence, renders competency in these domains essential for operative navigation, owning an obligatory notch of digital literacy should no longer be regarded as discretionary, but rather necessary, regardless of an individual's age or personal traits [27, 69, 110]. The assertion that the *Grey Digital Divide*, categorized by inadequate dispersal of digital resources amongst older adults, branches solely from unsophisticated ageist assumptions on their technological dispositions have been deflated through comprehensive research endeavours trailed by scholars and designers allied with both the Human-Computer Interaction (HCI) community and wider disciplinal settings, revealing that such incongruities arise out of complex consolidations of structural hurdles, entrenched perceptions, and contextual conditions necessitating nuanced intervention strategies [26, 71, 87, 107]. Prior academic efforts in the quest to comprehend, provoke, and lighten present barriers impeding digital access and literacy among older adults have unified varied initiatives ranging from inclusive guidelines modified for social networks and shared transportation apps, which were pitched toward enhancing elderly users' engrossment, refining flexible virtual milieus attuned to their requirements in bridging divides and foster greater affinity throughout ageing demographics [83, 91], exploring new avenues for interaction with AI [22, 109], delivering Information and Communication Technology (ICT) training courses [20, 86], and creating dedicated applications for conversational agents [80, 126].

In contrast, there has been relatively little research that has explored the potential of promoting creative engagement with technology for older adults through physical electronics making (or eMaking) [57–59, 73, 98, 99]. This represents a potential missed opportunity as previous studies featuring observations, interviews, and group discussions with older adults have highlighted the widespread nature and the importance of crafting activities both as personal hobbies and opportunities for social connection and belonging in the community [19, 28, 57, 65, 73, 105]. Crafting objects, especially objects that are relevant to one's culture, with or without the involvement of technology, has also shown great impact in promoting well-being and preventing cognitive decline in later years [1, 19, 94]. Previous studies on the broader *maker movement* and on the involvement of children in classes focused on eMaking literacy have shown that the value of these experiences encompasses both the pride in the created artefact, as well as the engagement in the act of making itself, including its value for embodied skill learning [19, 27, 73, 97, 115]. However, it is not clear to what extent older adults are interested in engaging in eMaking, what value if any they

perceive it can yield for them, and how activities can be designed in a manner that better accounts for their physical and cognitive capabilities.

Our study documents the process undertaken to co-create and deliver a workshop focused on eMaking for older women in Japan. We purposefully sought to engage women as previous literature has shown that external and internalized ageist stereotypes are more prevalent for women[24, 68], and eMaking activities can be more difficult to access for women in general [17, 18, 73]. We collaborated with a local resident association led by older adults in a suburban area of Yachiyo Chiba, with multiple iterations to define the appropriate scope and format of the activity to best match participants' purpose, physical and cognitive skills [34]. Our initial proposal attempted to re-purpose the previously designed and tested TapeBlocks toolkit [33], chosen for its low entry barrier, ease of use with limited manual dexterity, overlapping competencies with multiple forms of manual crafting, and flexibility to accommodate personal creativity. Preliminary discussions revealed that while older women were intrigued by the learning perspectives and the incorporation of crafting, the standard form factor of the toolkit and the activities it enabled did not resonate with their own crafting practices and interests. Collaborative brainstorming helped us to co-develop a new idea to extrapolate the principles of the TapeBlocks toolkit and method [33] and apply it to the creation of customized electronic New Year cards, thus blending the existing practice of making collages with the idea of creating electronic circuits, for creating artefacts with a specific cultural meaning. Through the development and delivery of these workshops, we hoped to address the following research question: How can we make eMaking more accessible and inviting to older women in Japan? How do we relate non-digital crafting activities, which are meaningful in the Japanese context, to support eMaking? Observational data assembled from a card-making session encompassing 14 elder women verified participants' aptitude for attaining and exhibiting substantial implied knowledge of rudimentary electronic creeds, promptly developing from passive learner status to active peer supporter roles, illustrating internalized skill acquisition and communal aid competencies sharpened through experiential engagement. Beginning the card-making activity from a familiar ground of collage composition also helped to gain confidence enabling women to apply a constructivist approach to their circuit building as they learned how to make basic connections and independently built on this by trialing and debugging more complex ones. Participants showed pride in the cards that they created which were displayed in the community center to showcase everyone's skill and creativity. Following the competition of the introductory card-fabrication workshop attended by elder female cohort members, who successfully seized foundational electronic precepts and subsequently presumed supplementary instructional role vis-à-vis peers, participants designated to implement a following session specifically for neighbourhood juveniles tasked with making their own e-greeting cards – imploring assistance from our research team in facilitating said follow-up event. Data collected from this second event highlight how the women had become more confident of their knowledge as well as their lack thereof, assisting children with certain operations and enlisting the help of our team members to support them when needed. Moreover, the electronic-making activity represented a way for older women

to leverage new skills to build a connection with the interests of children. Based on our findings we articulated a series of reflections around the potential of rethinking how we propose and structure eMaking and other digital skills initiatives for older adults, moving away from the concept of older adults as "novice learners" of technology trying to keep pace with a changing society, towards one that empowers them to be teachers and key contributors in their community according to their desired social roles. We also propose practical strategies to unpack physical skills and cognitive processes of non-digital crafts to support eMaking activities. Our contributions include the adaptation of the approach leveraged by the accessible making toolkit TapeBlocks to an audience of older adult women, a detailed account of the development and delivery of a digital-making activity that saw older adult women as learners and facilitators, a reflection on how to create eMaking activities more meaningful and inclusive towards older women.

## 2 Related Work

To better contextualize our work, we present related literature in three different areas of research. First, we provide a brief overview of the cultural relevance of crafting practices in Japan, particularly concerning older women. Secondly, we examine key literature around accessibility and inclusion in eMaking, drawing from works involving both older adults and disabled people due to shared experiences of marginalization. Finally, we explore relevant studies examining the motivations and value systems that drive older adults engagement with technologies to understand how similar considerations might apply to engagement with eMaking activities.

## 2.1 Older Adults and Crafting Practices in Japan

Japan's modern compulsory education has been offering a wide range of traditional arts—from tea ceremonies to flower arrangements to sewing outfits to playing instruments or marshal arts—not as normal classes but as extracurricular activities [23]. This cultural asset roots back to the Edo period (17-19th century) when learning was considered a status symbol; boys accessed education around family business, girls accessed the traditional arts which were considered as 'practical matters' that were 'useful to their lives' [48]. In recent years, the 2021 Ministry of Internal Affairs and Communications study of participation rate in leisure activities popular among people age 65[1] have articulated that women over men are likely to enjoy a wide range of 'hobbies and amusement' activities including sewing or dressmaking, knitting or embroidering, playing instruments, cooking, gardening, or photography. Crafting has been a key factor for the 'Successful Aging' [102] in Japan, specifically for women who are one of the world's longest living with an average life expectancy of over 87 years as of 2021 according to the World Bank[2]. A unique case of a senior female app-developer Masako Wakamiya—who developed her first smartphone game app *hinadan* at age 81—creates pixel art using Excel to design patterns for textile fabric printing as of age 87[3].

The combination of a community for active engagement [67] and the social capital [54] are significant for the *ikigai* (meaning 'life worth living') [119] since the lack of a healthy condition can lead to less social relations specifically for women [56], and crafting activities can be an essential source of symbolic capital for these women and brings them respect and social acceptance [121]. A case study in Okinawa Islands indicated how *Basho-fu* weaving has been carried to almost all older women in a village, which helps maintain an active engagement with life as healthy and productive members of society [122]. A startup *BABA Lab*[4] in Saitama (near Tokyo) runs a 'grandma community business' that makes and sells traditional handicraft goods by older women, which has been successful in launching international collaborations with Singapore[5]. Despite the richness of crafting culture in Japan amongst older adults, and women in particular, and the government's emphasis on promoting digital literacy for older adults [88, 92], we were unable to find studies based in Japan that focused on exploring the engagement potential of eMaking activities as a community.

## 2.2 Approaches for inclusive eMaking with marginalised groups

The term Electronic Making, or eMaking, is intended to encompass a wide variety of activities which feature the creation of electrical circuits using physical components often in combination with different forms of manual crafting [34]. While coding is often part of eMaking activities it is not a necessary component and previous researchers have argued that it might limit the inclusivity of eMaking for marginalised groups due to the increased complexity threshold and the inaccessibility of many of the interfaces used for computer programming [99, 106]. Overall eMaking activities aim to provide individuals with opportunities to craft and build personally meaningful projects. Similarly, makerspaces are designed to foster creativity, hands-on learning, and the sharing of knowledge [115]. Despite the benefits of making which is designed to provide anyone with the opportunity to innovate [46] participation has often failed to be inclusive of people from non-dominant communities [8, 10, 115].

To address these gaps scholars and practitioners from the HCI community and beyond have strived to explore inclusive strategies and approaches together with different marginalised groups. A substantial number of studies has focused on the participation of disabled people including those experiencing visual impairment [9, 12, 15, 42], physical impairment and mobility limitations [50, 81], and intellectual disabilities [35, 39]. These innovative research projects have helped to uncover key insights around how to render eMaking activities more meaningful and accessible. In particular, the work of scholars such as Das et al [31] and Borgos et al [15] highlights the importance of incorporating the physical skills which people with disabilities have acquired through traditional forms of crafting into eMaking as these are not just accessible, but represent specific strengths and competencies individuals feel confident in. Similarly, Ellis et al [35] underscores the need for instructional frameworks that match the cognitive capabilities and preferred format of target participants and Giles et al [42] points to the need for

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designing eMaking activities without assuming a prior knowledge of computing or electronic principles which some, or all, might not possess. Finally, both Bennet et al [12] and Meissner et al [81] shows how the motivation that drives and sustains engagement with eMaking should be understood and prioritised, whether one's purpose is to craft a device for a specific use, express personal identity and values, develop technical skills, or find empowerment through the process of making itself.

Building on the existing body of evidence around accessible eMaking, Ellis et al. [34] proposes the Inclusive Activity Maker Model (IAMM) as a reflective tool to unpack how making activities can be made inclusive towards learners with intellectual disabilities. The IAMM is composed of three components: understanding the purpose that can motivate the individual to engage in eMaking, harnessing as part of the eMaking process the physical skills that the person already possesses, and matching complexity and instruction modalities with the cognitive skills of the learner. Although such a model was created for a specific population, it resonates with the broader inclusive eMaking movement [3, 16, 37, 42, 104, 106].

Studies exploring eMaking with older adults have revealed important aspects that can make such activities more accessible to their specific needs. For example Jelen et al. [57] investigated how electronic toolkits could be used to augment and support older adults existing crafting practices, focusing particularly on the need to build on more simple and familiar materials with more easily predictable affordances, and the importance to facilitate progressive learning, and account for aesthetic goals. Others, have specifically highlighted the opportunities that lay in leveraging older adults' creativity to elicit novel design ideas [22, 98, 99]. Attention has also been drawn to the importance of eMaking practices to supporting the creation of personalized artefacts for health and self-care thus highlighting the potential values intrinsic to the act of making, but also of the resulting objects [58, 59]. Finally, albeit not specifically focused on eMaking, the prolonged investigation by Kalma et al. [65] with two communities of older adults crafter allowed to observe and speculate how technology might be utilised to support the essential values that participants attributed to their crafting practices namely a sense of belonging to a community, creative explorations made possible by novel and traditional elements, and an appreciation for the quality of made artefacts, as well as sharing of techniques. These studies can help to capture how eMaking can be made more accessible and compatible with specific analogue practices more common among older adults. However, there remains a paucity of studies looking at how we can co-create eMaking workshops which can be more flexibly attuned to the motivations and skills of groups of older adults, highlighting the aspects that give values to the incorporation of technology in such activities.

## 2.3 The Value of Technology for Older Adults

Alongside the large body of literature arguing for the needs to promote better access to technologies for older adults, understand barriers to adoption, and increase digital literacy to promote more meaningful engagement [20, 69, 80, 83, 86, 91, 110, 126], there is also research that unpacks the values and motivations that drive older adults to engage with technologies, beyond specific circumstantial needs, and incorporate it in their daily lives [29, 32, 47, 65, 85, 93, 96,

125]. Surveys, interviews, or focus groups investigating the types of technologies commonly adopted by older adults identified a large varieties of physical devices and digital applications including mobile phone, laptops, conversational agents, smart TVs, smart watches, automotive vehicles, messaging applications, video-calling software, digital camera and more [32, 44, 63, 65, 85].

Although the types of technologies that older adults decide to use might differ depending on their needs, degrees of digital literacy, access, and personal preferences, there are common trends in the motivations that drive adoption overtime. One of the values which is likely reported more often is the relative advantage, in terms of convenience or enhanced capabilities that technology can unlock. For example, Desai et al. [32] explains how when describing technologies they loved to use in everyday life, older adult participants often highlighted how good technologies facilitated meaningful activities, whereas the devices they abandoned, had often made tasks more complicated. Similarly, older adults participating in speculative workshops leveraging novel technologies by Zhao et al. [125] were interested in their potential to support healthy ageing at home. Unsurprisingly, learnability and availability of resources to support use, including training, troubleshooting, upskilling, an maintenance, including both human assistance and self-paced materials such as printed instructions or videos or interactive guides are also key values that determine the acceptability and long term use of technologies among older adults [11, 32, 47, 66, 85, 93].

Despite outdated notions that stereotypically label older adults as being adverse to novelty and technological changes both Desai et al. [32] and Heinz et al. [47] emphasise the evident desire of staying up to date with technological innovations alongside a preference for access to new models of devices they appreciate. At the same time high material cost is a deterrent to adoption, and economic incentives such as discounts or instalment payments can increase preference towards a particular technology [32, 64, 76, 85, 93]. Finally, multiple researchers have pointed out how a key element that determines the extent to which older adults value and attribute meaning to technology is linked to its ability to foster positive emotions during use and support the formation and maintenance of social identity in their communities [32, 47, 65, 93, 125].

These studies reveal the complexity of factors that shape the willingness of older adults not only to use technology in response to a particular necessity, but to consider it a meaningful tool for daily life. Considering the promise of engagement as well as personal and community benefits of crafting in older age, our study sought to explore the values motivations that could drive engagement in eMaking activities for older adult women in Japan and design a workshop which could be easily adapted to their physical and cognitive skills.

## 3 Formative study - Co-developing the card-making workshop

### 3.1 Settings & Team Positionality

Japan is routinely described as a super-aged society, one where the percentage of people above the age of 65 years is above 21% [90]. Nationally, the estimated ageing rate across the country is 29.1%,

according to government data [6], but the rate can be significantly higher in specific areas, particularly sub-urban areas where many older Japanese chose to re-locate seeking to be closer to families, access health services, and find affordable housing [103]. Our study took place in one of such sub-urban housing complexes in Yachiyo, with an ageing rate of 45%, substantially higher than the national average. Over the last two decades, in light of the foreseen challenges of supporting the participation and engagement of its increasingly older population, the Ministry of Health, the Ministry of Labor and Welfare, as well as local authorities across the country have invested significant effort in creating stronger networks of centres across the community which organize activities for residents, including educational opportunities, cultural festivals, and health promotion events [6, 7, 55]. The local Social Welfare Council in Yachiyo has been particularly prolific in this regard, and one of the most successful projects they had implemented was the creation of a community centre, in the Yonamoto housing complex. The community centre is run and maintained by a core group of older residents and operates as a free local cafe and congregation space to establish a collaborative framework, which is run by the community for the community, to encourage mutual support. The centre also runs regular events including exercise classes, after-school clubs for children, movie screenings, clothes swaps, and crafting activities.

Our research team has an extensive history of collaboration with the local Social Welfare Office as well as the community centre which spans back to 2019, many of our members have run projects and activities, with the support and participation of older residents,- which have led to a strong relationship of trust and friendship. This has created blurred boundaries which shape both our and participants' positionality. In many respects, the background of our diverse research team, composed of both Japanese and international researchers between 20 and 50 years of age with different expertise including HCI, accessibility, service design, psychology, game design, electrical engineering, and more, is in stark contrast to one of our participants, a relatively homogeneous group of Japanese women between the age of 70 and 80 years living in the same neighbourhood. However, the open relationship built over the years allows us to engage in consistent dialogue and exchanges about which projects can, or should be, undertaken and how with community leaders acting as collaborators to not only mobilize other residents and participants but to drive both the scope and methodological approach of our research. The current study was initially motivated by some of these informal conversations that took place between residents and members of the research team in which older adult women mentioned interest in learning more about technology, but not necessarily through interactions with smartphones or tablets, for which they had limited experience and were perceived as isolating. As we were familiar with the residents' enthusiasm for crafting activities, we decided to tailor our proposal towards forms of physical making that would not require the use of digital devices.

## 3.2 Methodology

## 3.3 Materials

To explore the opportunities of developing eMaking activities that could accommodate a variety of crafting practices according to the preference of older women, and utilizing an approach suitable for a diverse range of physical and cognitive skills, we decided to utilise the TapeBlocks toolkit previously proposed by Ellis et al. [33]. TapeBlocks which leverages wrapping conductive tape around foam blocks to build 3-dimensional circuits with individual electronics components maximizes re-usability and ease of connections [33]. TapeBlocks was originally developed as an accessible toolkit for individuals with intellectual disabilities [33], and in its basic form can support the benefits of using cuboid materials [77]. However, the process by which individual TapeBlocks are created can be adapted to render almost any object or surface on which conductive tape can be used into a block used to connect electronic components [33, 35], supporting creative exploration that we believed could appeal to a group of older adults with an interest in crafting. Moreover, TapeBlocks can be used as completely stand-alone and supports the creation of interactive hand-crafted artefacts, without incorporating programming aspects or other elements which could increase the entry threshold of the activity [33, 35]. Finally, many of the challenges in fine motor skills or sight that were accounted for in the design of TapeBlocks are also relevant to older adults, and the proven accessibility of the tool was seen as an important benefit compared to other potential alternatives [33, 35, 36, 52, 58, 99].

*3.3.1 Procedure.* In line with the approach we usually adopt when collaborating with the Yonamoto community centre, our initial step was to develop a general proposal for the activity we wanted to promote and bring it to the residents for open discussion and critique.

The first author prepared a complete set of basic TapeBlocks, including blocks with batteries, switches, and actuators, as well as material to make additional blocks to illustrate the process at the community centre. More complex blocks incorporating various elements to create basic toys and artefacts were also prepared as a sample to illustrate what it might be possible to create during a future workshop. When the research team travelled to visit the community centre in October 2023, the first and second authors introduced the TapeBlocks set to the two older women who routinely manage the place as well as the six other residents who were present on that day. The authors showed the pre-made blocks and how they could be combined, illustrated how new blocks could be made, and presented potential final artefacts using both the available materials and videos freely available on YouTube, curated by the creator of the TapeBlocks toolkit[7]. The scope and format of a potential workshop, the acceptability and suitability of the toolkit, and the potential community audience who might have an interest in the activity were discussed with the eight women present.

*3.3.2 Data Collection and Analysis.* This formative study followed an established pattern we have leveraged in previous consultations with residents who frequent the centre. The discussion is carried out around one of the tables at the centre of the room, with some

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researchers, in this case, the first and second author, presenting materials, while the others engaged people in the discussion to elicit their opinions and took short recording for research analysis, with the consent of all people present. This informal style of consultation favours not only discussion between potential participants and researchers but also amongst residents themselves. This allows us and the community leaders who manage the centre to gauge interest towards potential activities and understand how participants would want to engage with the proposed task, or artifact, and what barriers would need to be accounted for in deploying our ideas.

The discussion and interactions with participants were captured by one camera placed near the main table where the blocks were being showcased. In the meantime other members of the team solicited comments from older adult presents and took close range pictures and videos to document specific interactions. After the formative consultation, within the following 48 hours, all authors wrote down personal notes which were then copied on a shared document to highlight researchers' own impressions and report important comments expressed by participants. The first author watched all collected videos, identified timestamps of key moments of which transcript dialogues and descriptions of interactions were produced in collaboration with the second author. Such moments were then discussed with the rest of the team first individually and progressively aggregated under broader categories that would reflect the interpreted meaning, in line with the approach presented by Lucero[79]. Based on the insights gained, we then finalized a format and material for the workshop, which was presented again by the first and second authors to the community leaders for confirmation, following which they would mobilize residents.

## 3.4 Findings

From our analysis, we identified two key factors that shaped our decisions of how to articulate the workshop moving forward: *A desire for constructivist learning* and *An activity for our crafting*.

*3.4.1 A desire for constructivist learning.* From the beginning of the consultation session, it was clear that the idea of learning about electronics by making circuits was of great interest to the older women. After the initial introduction by the research team, women started to interact with the pre-made blocks combining them in different orders to explore which combination might cause an LED to light up or activate a vibration motor. When the combination of the blocks would not produce the desired outcome, they tried to re-arrange them adopting strategies they had observed the researcher using in the demonstration. As an example, while a resident was unsuccessfully trying to create a sequence that would activate a propeller when a button was pressed, another suggested *"I think the yellow block (used for buttons blocks), goes between the green (used for battery blocks) and red (used for output blocks)"*.

As they began to grasp some of the simple rules that needed to be followed in the creation of basic circuits, the women quickly started to explore different possibilities, such as creating longer sequences of outputs to see how many LEDs could be powered by the same battery, or mixing different types of switches to understand how the behaviour of the output could be affected. Despite having no previous knowledge of electronics, these older women perceived the activity as accessible thanks to the fact that it accommodated

learning by trial and error, through which one could construct meaning progressively and at their own pace *"I don't know anything about batteries, but I think this is fun and you can understand how to make things work by trying"*.

These observations helped us to understand that, while they stated that their confidence with technology was very limited and that they would struggle to understand *"complicated things about electricity"*, older women could quickly acquire basic electronics concepts and had both the willingness and skills to apply a constructivist approach to progressively expand their knowledge as part of a more structured workshop.

*3.4.2 An asset to our crafting.* Although the women were very interested in the principles of combining electronic components to activate lights, and motors which would respond to various switches, it became quickly apparent that they had very limited interest in the form factor of the block themselves. None of the women present was keen on trying to make their own TapeBlock when asked by the researchers, and several commented on the fact that while combining blocks was fun, they could not see them as being something they could use to create a meaningful artefact. Even when shown simple toys and objects that could be made, women simply stated that *"Children would like to make them, but it is not for grandmas"*.

We began to enquire about what kind of crafted artefacts they would be interested in making and the women pointed to some of the paper and fabric-based objects that were displayed on the walls of the centre. One resident explained how *"I sew my own clothes and I make handbags, I think it would be nice to make them with lights. I could give them as presents and they would be stylish to wear"*. Others agreed but also pointed out the need to organize an activity that could be accessible to a wide audience, like *"the collage workshop we did with before with [name of one of the researchers] where we all made beautiful things"*. Another aspect emphasized was the desire to create something for a meaningful occasion, which could be displayed at the center. One resident pointed to a piece of fabric art that a group had recently crafted for Halloween as a good example. Our research team looked at upcoming events and traditions and proposed the idea to create a workshop where electronic components could be used to create some interactive objects for the New Year celebration. The suggestion instantly appealed to the women who highlighted how making and exchanging cards was an important part of Japanese tradition for the New Year, which is a particularly important celebration.

Our discussion here highlights that while it was important for the workshop to build on the skills of the women, it was also expected to represent a meaningful activity that would align with their crafting practices and result in the creation of artefacts that could be shared with others. Delivering an eMaking workshop centred around the purpose of learning about electronics was not sufficient, considering the effort invested, participants expected that it would deliver additional values to the community enabling the creation of meaningful cultural artefacts that could be shared and exchanged.

# 4 Workshops Implementation - Learning and Teaching Electronic Card Making

The feedback provided by the older residents helped us to identify the desired format for the workshop and, according to the suggestion provided, the first author developed a modality for making electronic cards that would combine collaging with circuit building following a similar approach to the one used for the TapeBlocks toolkit [33]. A prototype card design was conceptualized and formally introduced to the resident leaders operating the community hub during an informal consultatory meeting held in November 2023 by three contributing authors, marking a deliberate step toward founding rapport and initiating dialogues surrounding forthcoming participatory events aligned with the project's objectives. The new proposal was approved and together we agreed to set up the workshop date for the 3rd of December 2023. To enable enrolment of candidates for imminent workshop sessions, our research group produced promotional materials specifying key particulars and disseminated these to the coordinating community centre – entrusting staff members with strategic placement of informational flyers intended to attract eligible participants.

Following the successful completion of the electronic card making workshop, four of the participating women approached us stating that they wanted to run a second card-making workshop the following week for the children who normally attend the centre for after-school activities on Wednesday afternoon, and asked for our support to provide materials and assist for technical support. The workshop date was set for Wednesday the 6th of December, but in this case no specific advertisement material was created or shared, as the four older women explained to us that they would simply propose the activity to the children on the day rather than announcing it as a separate event.

## 4.1 Methodology

*4.1.1 Participants.* In total fourteen older adult women signed up to take part in the workshop, all were residents from the Yonamoto housing complex. They were all native Japanese and aged between 70 and 80 years (age, gender, gender, and nationality were not restricted in our call for participation). None of the women had previous experience with electronics or digital crafting, however six of them had access to a smartphone that they utilised primarily for calls, messaging apps and taking pictures. Six had problems with manual dexterity as a result of arthritis, and seven had previously taken part in some collage-making activities run by one of our researchers as part of a different project. Ten women had previous experience with other kinds of manual crafting activities including knitting, sewing, drawing, and water colouring. A picture of the 14 women displaying the cards they created as part of the workshop is shown in Figure2.

The four women who decided to organize and run the second workshop were (P10, P11, P12, and P13) from Figure 2. Three of these women (P10, P11, P12, and P13) are the community leads who manage the centre on a daily basis and are often interesting in hosting or organizing new activities for local residents. In total 15 children (7 Girls and 8 Boys) between the age of 9 and 15 years took part in the workshop run by the older women on the following week. Children largely came to the community centre by themselves,

although one younger girl was accompanied by her grandfather who also helped her make her electronic card. Children were asked if they wanted to take part in the crafting activity but they could also play other games if they wished. The majority of children at the community centre chose to participate, but about 5 preferred not to and continued to engage in other games while interacting with the children who made the cards.

*4.1.2 Materials and procedures.* During the first workshop, the card-making workflow was streamlined to allow each person to follow a basic template while being free to adapt it in whichever way they wanted and create cards with images and pictures that resonated with them. Our team prepared thick cardboard A5 sheets that could be used as a semi-rigid back for the cards, on which the circuit would be laid out. For the front of the card, participants could choose a base layer of thin cardboard in their favorite color, onto which they could create a personalized collage, or draw their own pictures if they preferred.

The first part of the workshop was dedicated to collage making, with participants crafting the front of their cards using favourite images from magazines, printed pictures with a New Year theme, photographs, stickers, and other decorative materials that had been prepared by our team in advance, or brought to the workshop by participants themselves, which we invited them to do in the flyer used for recruitment (See Figure 1 in the centre picture ).

After completing their collage, participants decided where they wanted to insert their electronic outputs (such as LEDs, vibration motors, propellers, etc.). The front and back layers of the card were overlaid and the final position of the component was marked on the back cardboard sheet using a needle. Based on the number and type of electronic components they wanted to insert, participants had to figure out how many batteries they would need. This was achieved by using a Voltage test bed, a simple sheet of cardboard where two stripes of conductive fabric tape were used to extend the wires of a single battery. Participants will lay down the desired components onto the fabric tape, matching the polarity of the battery, to figure out how many components could be powered by a 3V battery (See Figure 3).

After establishing the final position of the outputs on the base layer, as well as the number and allocation of required batteries for chosen components, participants began to wire their own circuits. Concepts such as the polarity of LEDs, and the importance of not "shorting" the circuit by creating overlaps when laying down the conductive tape were explained by the first author before the start of the phase. When participants completed the wiring and tested that the circuit was working as expected, they could complete the card by using double-sided tape to secure the front and back layers together, to create a separation buffer and avoid the circuit being compressed by the top layer, we used 0.5cm thick cardboard spacers placed on the two long sides of the card (See Figure 3). After completing the basic design of the card participants could add their final touches and additional decorations if they wished to.

The workshop lasted for approximately 3 hours and was led by the first author with the second, third, fourth, fifth and sixth authors acting as facilitators, providing assistance and troubleshooting advice as needed.
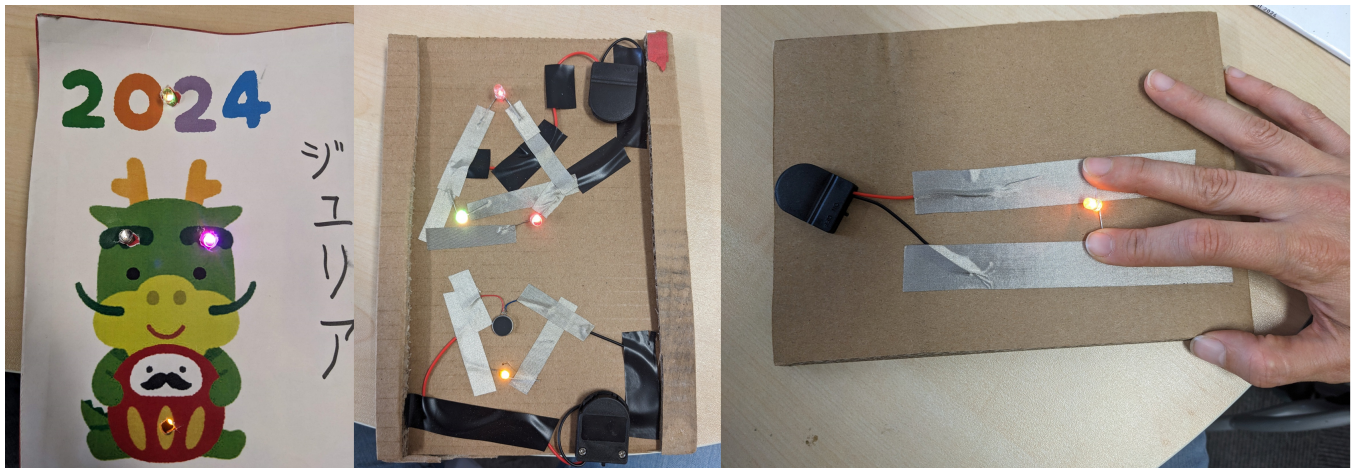
Figure 2: Card Designs by the 14 participants



Figure 3: Outside of a sample card made by the team, inside wiring, and simple Voltage test bed made for the workshop

The second workshop delivered by the four older women to the children featured the same sequence of activities for how cards where to be made. However, women explained how they envisioned it might be difficult to establish a fixed structure since children often arrived and left at different times depending on how far from the community centre their school was, when their classes finished, and when their parents or relatives would come and collect them. As a result, it was decided that the card-making activity would be proposed to children when they arrived and that facilitating women and our research team would provide tailored support to the children as they were crafting their electronic cards. The women

did not ask our team to cover specific roles or lead a particular portion of the activities, thus our mindset in approaching the second workshop was to let them make executive decisions and provide whatever support they needed when they requested it. The third, fourth, and fifth authors participated in the second workshop as facilitators.

*4.1.3 Data Collection and Analysis.* The first workshop was video recorded in its entirety from a camera placed in one corner of the room in order to capture a bird-eye view of all participants. As researchers went around the room supporting participants with

various tasks, they also engaged the older women in conversation to understand their impressions, capture any difficulties, and document their individual processes. Short videos and pictures of individual participants were also captured with their consent. For the second workshop, due due to the reduced size of our team, we focused primarily on providing assistance to participants rather than seeking to elicit information from them to gain a deeper insight into their impressions and primarily leveraged the fixed camera to capture interactions and utterances from participants. The day following each workshop we conducted a debriefing session to share individual insights, and opinions collected from participants, and highlight specific episodes that were considered meaningful. Notes from this de-briefing sessions were also added to the data corpus .

To analyze data we followed a similar approach to the one outlined in Section 3.3.2. The first author watched the videos from both workshop, identified key moments and interactions and with the collaboration of the second author produced transcripts and annotations for the selected portions of the videos. Short videos and notes from the other researchers were also reviewed and integrated with the rest of the data corpus. Coding of these meaningful episodes was discussed first amongst the first two authors in following the chronological order of events, whereas aggregation was done collectively by all the authors during a series of hybrid discussion in which we leveraged visual affinity diagrams to build consensus around a series of key themes that could be used to map the key elements which determined the accessibility and value of the proposed eMaking activities for the older women participating in our study [45, 79].

## 4.2 Findings

The analysis of videos and notes from the two workshops helped us to conceptualize five main themes illustrating key elements that shaped how older women engaged with the card-making activities and the meaning they attributed to the experience and the artefacts they created: *Practical learning and flexible support*, *Approachability of the task*, *Accounting for aesthetics*, *Promoting positive social identities*, and *Delivering meaningful community impact*.

*4.2.1 Flexible learning and support.* From our first interactions with the older women it was evident that they had a strong desire to engage in novel activities, acquire new skills, and be exposed to new concepts. Like previous studies debunking myths around older adults being by default suspicious of novel technologies [32, 47], the women who took part in our workshop were genuinely curious about key concepts of electronics with which they were unfamiliar. However, their interest was not learning for the sake of acquiring abstract theoretical knowledge, but to directly apply it to the creation of the electronic cards *"I want to learn how to make beautiful cards that everyone love and with lights that brighten up the images" - P8*, or other activities that the women where passionate about *"We do many hangings decorations and pictures for many occasion and I like to be able to use lights to decorate them as well" - P2*.

The interest towards practical actions over theoretical notions was also reflected in a learning process that distinctly favored implicit over explicit knowledge. Despite the fact that the first author

provided initial instructions concerning circuit building and other facilitators helped to create connections while illustrating basic principles of electronics from polarities of specific electronic components, forward voltage drop, resistance of various LEDs, and current dispersion disperse when using longer "wires" (in our case in the form of conductive tape), women seemed initially perplexed by such aspects. But as the workshop progressed it became clear that they had in fact grasped many of these concepts, they simply lacked the vocabulary or the pre-requisites theoretical notions we rely on to articulate explicit explanations. Women lacked the explicit knowledge of basic electronics to illustrate how current in a circuit flows from a positive terminal to a negative one and that the orientation of an LED component needs to respect this law, but they had acquired implicit knowledge from observation and interaction with facilitators to confidently tell someone else who might be facing an issue with their wiring that *"The long led of the light needs to be taped to the red wire, otherwise it does not work" - P13*. Notions of voltage and resistance might have been too abstract to learn within the short time-frame of the activity, yet, but at the end of the workshop, everyone knew that *"If you try to connect too many lights they flicker and go dull" - P12*, or that *"The battery has to be close to the other things to work" - P8*.

To support practical learning the availability of support from the research team was essential to the success of the workshop as well as the decisions of the women to organize a second session with the children. P10 explained how *"We like to organize activities for the children but it can be very difficult to do everything by yourself. We knew that we could ask for help if we had challenges making some connections for the children, so it was easy to feel confident"*. While the women generally preferred the researchers to demonstrate the actions which needed to be undertaken for troubleshooting their own circuits, rather than receive verbal explanations, during the second workshop they seemed to acknowledge that children might benefit from a different approach. As a result, they were happy to call on the researcher's expertise to provide the initial explanation of circuit making, but also the reason why two components could not be paired together in a particular way (such as why two blue LEDs would require separate batteries, or why pairing a propeller and a light would cause one to stop working), or to illustrate what could have gone wrong when a bug could not be solved using one of the strategies that they had previously learned. These nuances resonates with some of the findings from previous studies which highlighted how learnability of tools and methods and the availability of tailored support are essential for the successful implementation of eMaking activities amongst older adults, but also expand on the idea of *Mentorability* proposed by Batbold et al. [11] illustrating how older adults can play both the role of mentors and mentees creating more fluctuating interdependent relationships which go beyond traditional dicotomies of researchers as facilitators and participants as learners.

*4.2.2 Approachability of the task.* Despite their keen interested in learning new eMaking skills, women who took part in the workshops they were initially concerned that the complexity of the technical components could prove to be too great, particularly considering that none of them had any previous exposure to electronics

concepts. When the first author gave a brief explanation of the card-making process and introduced the materials to be used, many of the women looked very hesitant. Electronic components were left untouched at the centre of the table, and P5 also asked one of the facilitators to confirm whether her lack of experience with technology could become a problem throughout the session. As the flow of the workshop first focused on the collage making part and only returned to the integration of electronic components later, such hesitancy would quickly dissipate. Even when the workshop moved to the *circuit building* activities, after the first author gave a brief overview of the steps of how one could choose, evaluate, and tape the electronic components, women simply began the task smoothly. Mistakes of course happened, and facilitators were called to help figure out potential errors or unexpected outcomes ("I want to put two blue lights but only one works, but P1 has two red lights and they are both on" - P7). However, in contrast to the start, participants did not wait to be given specific instructions before attempting to progress for fear of making mistakes but felt confident enough to engage with the task at hand and ask for help when they encountered obstacles that they could not navigate alone.

On the other hand, when it came to organise and deliver the workshop with children older women decided on a slightly different format from the one we originally used in the first workshop. Children were not provided with any initial overview of what making electronic cards would involve, nor given explanation about basic concepts which determine the structure of an electric circuit. Older women started by showing one of the completed cards from the previous workshop and ask children *"Do you want to make something like this?"*, if children showed an interest they would be first assisted by one of the facilitating women in creating the collage that made the front of the card. Only when the collage was completed, women would introduce the LEDs and other electrical components, asking children where they wanted to place them to make their compositions more festive and attractive. After the children left, when we enquired with the women about the reasons for such a decision they provided us with a very elaborate explanation that showed how such a change was implemented as a result of a reflection of the challenges faced during the initial workshop.

*"Starting from scratch is tough, when you are not sure about what to do. But if you are starting from an initial template and then you just have to understand how to do your own decoration is easier. You do not get confused and you can ask questions if you want to learn" - P12*

The insight shared by the older women who acted as facilitators during the second workshop showed how, although collaging was not the primary goal of the workshop, utilizing it as a starting point and presenting the electronic making solely as a way to make the cards more lively, rather than placing the focus on electronic wiring as central part of the activity, made the concept of eMaking more approachable, allowing participants to build on their initial success and existing skills to feel more confident to approach task that they had no previous knowledge of.

Another aspect that women mentioned it was important in presenting eMaking as something that could be accessible to them, both as learners and facilitators, was to focus on activities which leveraged tools and materials which were easy to mainipulate, inexpensive and as much as possible familiar to participants to facilitate interactions. Partially, this is to support participants making inferences about how to utilise conductive materials to create circuits. When hearing that the workshop would involved electronic components, P5 mentioned that she was concerned about having to use wires, which were unfamiliar to her and she thought she would have struggled to utilise. Although it served exactly the same purpose, she considered conductive tape as easier and less intimidating *"You can move it around if you make a mistake and just stick it back onto the card, it is really just like normal tape"*. P13 mentioned how the lack of specialised equipment was one of the reasons while they also considered the workshop for children and something they could largely manage on their own *"There is no dangerous parts, heavy things for which we need help move, or things that might cause an injury so it is we can feel safe when the children do things by themselves"*

*4.2.3 Accounting for aesthetics.* If learning new skills and being able to access support to engage with activities that felt challenging but manageable was essential to ensure the accessibility of eMaking, the an important aspect that gave value to the experience was the possibility to create beautiful artefacts that would reflect the the preferences and style of the individual. Women were very deliberate in how they chose and arrange pictures to compose their own collages, or in choosing alternative strategies, such as hand-drawing to follow their creative vision(*"I want to draw on the card instead of making a collage, is that ok?" - P4*). We noticed how participants valued elements that were personally or culturally relevant, both in their meaning and their style, and as the electronic card making activity was considered a playful endeavour, preferred images that aligned with the Japanese concept of cuteness or "Kawaii" [118] *("I chose the Hina dragons because Hina dolls are cute and very Japanese and next year is the year of the dragon. They are cute, aren't they? - P9)*. Similar considerations were also applied to the organization of the workshop with children with P10 recommending that we replenished materials for collage making between the two sessions, as well as asking that we printed some additional pictures which could best appeal to the children, including for example the illustration of the popular mascot of the local ward. P12 also elaborated on how while the card had a new year theme that could serve as a broader template for ideation, sufficient variability of both printed materials for collage and electronic components for the lighting was important for personalization *"You want everyone to make something together from a template, but also have everyone add their own decoration to personalize it so the cards are all different"*.

The integration of electronic components was also driven by aesthetics considerations with placement of the LEDs being determined by the visual impact, for example P7 positioning of 2 blue LEDs to align with the eyes of the seahorses depicted in her card or P13 choice of having green lights placed under the nostrils of the dragon. Such focus on ensuring the quality of the created artefacts and their appeal was important as the cards were intended not just to be kept by the maker, but be shown to others. In some occasions this was done with the purpose of attracting the interest of others and motivate them to participate in the activity. An example of this was when the first 15 years old girls who was the only one who immediately decided to make her own electronic card and managed to successfully wire components to actuate lights and vibration

motors. P11 who was offering assistance suggested she showed her work to the other children. The girl approached some of her friends to show them the card prompting a chorus of "Kawaii! (meaning cute in Japanese)" after which more girls became interested in making their own cards. The liveliness of the group also attracted the attention of several of the boys at the centre, and more children decided to join the workshop. Finally, the four older women who hosted the workshop for the children also explained how the electronic cards could represent a tangible outcome of one's effort that could be shown to family as a way to share the enjoyment of the afternoon and act as a physical memory of the making experience *"For the children when you do activities where you make your own objects like in today's card-making workshop is great. The kids can take their cards home, show them to their family, and maybe stick them on the fridge. These badges can become a talking point at home: 'Look what I made!' and any time you look at it you can remember the fun you had"* - P11

*4.2.4 Promoting positive social identities.* The positive impact resulting from the creation of a beautiful artefact that one can show to others is not just associated with the aesthetical value of the object itself but it also works as a physical proof of the skills of the creator. As she was finalizing the decoration on her card P9 turned to P8 who was sitting beside her and stated *"Even though we're regular at the activities here, if other residents saw what we made, they'd definitely think, "Wow, you can make something like that!"*. Technology, particularly in its raw format of electronic components to be connected to create circuits was something that women had no previous interactions with and did not feel confident about. Despite eagerness to learn, there was also a concern that they would not be able to complete the tasks alone and would have to rely on the help of the researchers, decreasing confidence in their ability. On the other hand, one of the most surprising things we observed during the workshop was how quickly women were able to switch roles from learners to teachers as they progressed in the activities. If they received help or were explained a particular concept by one of the facilitators they immediately looked if they could share their newfound knowledge to support someone else who was currently facing similar issues. Although, throughout the session women were expected to largely work on their own cards with the help, if needed, of facilitators, many started to devote time and effort to supporting each other. This was not just limited to people sitting side-by-side sharing information, women such as P5, P7, P12, and P13 started moving around the room to find someone who might be currently dealing with an issue and was not already assisted by a facilitator, to help them (see Figure 4). Collective success and making sure that everyone could complete their card to their satisfaction by the end of the workshop was ultimately more important than solely focusing on finishing their task.

Instead of focusing on hands-on support, throughout the second workshop, we observed how women became particularly skilled at triaging children's questions and requests and deciding whether they felt comfortable trying to address them themselves, or they rather call on the assistance of one of the researchers. This showed, that while they had of course acquired knowledge in the first workshop, and they had a reasonable degree of confidence in it, they were also quite aware of where the boundaries of their knowledge

were and how far they could be stretched. Moreover, it was clearly important for women to project an image of competence in their interaction with the children, however, this did not necessarily have to translate into having to be the person who had all the answers, but could also mean being the person who was able to direct questions to whom could most reliably address it.

Previous literature highlighted how older adults value technologies that support their ability to feel competent and fulfil their desired social roles in everyday interactions [32, 47, 65, 125]. Our findings show how eMaking activities can satisfy a similar desire, and that successful workshops can deliver the dual benefits of providing a venue for older adult women to acquire and share new skills, showcase them via the resulting artefacts, as well as create opportunities for further engaement at the community level.

*4.2.5 Delivering meaningful community impact.* This idea of leveraging the making activity as a way to provide some form of a benefit for the community was further reflected in two aspects. At the end of the workshop, it was clear that all the women were happy and proud of their own work, many posed for pictures with our research team and with each other, and cards were passed around so that everyone could be complimented on their hard work. However, women collectively decided that they wanted to leave the cards exposed in the community centre until the New Year celebration was over to help liven the area with a festive theme, only after everyone brought home their own cards. Figure 1 on the right, shows the cards exposed together so that they could be visible to anyone visiting the centre in the following days.

Another contribution to the community came in the form of the second card-making workshop they organised with children. As we observed the interactions between the women and the children who decided to take part in the session, we were able to observe how the *technology element* of the electronic cards was a key aspect that they leveraged to connect the more digitally oriented interests of the children, with their ones which centred around crafting and cultural traditions. Creating New Year's electronic card together allowed bonding over a practical activity that could be accessible and enjoyable to both, as well as representing a way to *refresh* a tradition, important for older adults, and making it more appealing to younger audiences.

Older women also sought to extend this idea of community engagement beyond the direct interactions they had with children or researchers, by utilizing a snowball approach to involve other residents. An older man present at the community centre during the second workshop, whose young niece took part in the eMaking activity, was given a brief explanation of the workflow to ensure he could assist his niece by P10 and told that if they encountered obstacles they could ask for further help. Similarly, two of the children were unable to finish the wiring for their cards before their parents came to collect them. P12 and P13 took time to explain the card-making activities to the parents, gave them additional conductive tape so that they could successfully connect components at home, and asked that the parents help the child complete the card.

This process of progressive engagement that starts from a core group and ripples to involve progressively more people was particularly evident in this second workshop, but it resonates from

**Figure 4: Participants supporting each other and providing advice during crafting activities**

what we observed in other sessions. The approach used to spread activities in the community is not necessarily to seek immediate participation from as many people as possible, but to rely on a more gentle nudging approach that seeks to leverage the bonds of mutual trust between individuals, and the social capital of community leaders, as a way to vouch for the value of a particular initiative and promote a broader sense of belonging that connects residents of different ages and backgrounds into one cohesive community.

The increasing importance of inter-generational connections [5], particularly outside the family unit due to the shrinking population that leads to a greater risk of social isolation for older adults, is at the core of many social policies and initiatives in Japan [70, 116, 124]. The second workshop carried out by older women at the community centre represents a self-directed attempt of *sedaikan kōryū* (inter-generational connection in Japanese), where older adults seek to transmit values and practices that are meaningful to them to the children in their community, while engaging the interests of younger generations, as well as learning something new in the process. This aligns with the previously cited (refer to Section 2.1) 87-year-old female app-developer stating how essential *"older people with skills and knowledge step forward and work more"* is, and encourage to *"not say "I'm too old" but that they rather take on new challenges without fear of failure"*, which would lead to a common understanding that *"we have things in common, such as feeling cold in winter or thinking about our own families"* thus would benefit the younger generation as well[8].

[8]https://social-innovation.hitachi/en/article/colors-wakamiya-masako/

## 5 Discussion

Our study represents an example of co-creating and delivering eMaking activities in alignment with their purpose, and physical and cognitive skills as suggested by the Inclusive Activity Maker Model (IAMM) [34], built on insights from previous work on the value of technologies for older adults [32], and approaches for accessible electronic crafting with older adults [57, 59]. On the one hand, it should be noted that how our work unfolded is significantly shaped by a series of cultural and contextual factors. Firstly, as highlighted in Section 2.1 handcrafting is popular among women of various age groups in Japan, with particular appeal in older adults where it is connected with specific traditions and associated with health and wellbeing benefit [14, 48, 114]. This has likely positively affected engagement in our study. Moreover, the lively and repeated exchanges between residents at the community centre and our research team are only made possible by the existence of a long-standing collaboration and a mutual sense of trust and respect. Participants, who had a lower degree of familiarity with the research team, might have given less honest feedback in the initial stages, letting us develop an activity that might have been accessible from a physical and cognitive standpoint, but would not have been meaningful in the context of their purpose as individuals and as a community. Finally, the success of our initiative is largely dependent on the presence of the community centre and the specific role it plays in the housing complex. The mutual support displayed by women in the first workshop and the decision to run a second one, are shaped by the pre-existence of social bonds within the group

Figure 5: Children engaging in the electronics card-making activity supported by older women

and the local community at large. Yet, although these elements might have shaped our circumstances, we believe that there are a series of lessons learned and recommendations emerging from our experience, which are likely relevant to other researchers seeking to develop future eMaking initiatives targeting older adults. We divide structure these reconsolidations under three sub-sections Uncover stated and unstated, Develop tools and approaches to match crafting practices, Build deep and broad community engagement

## 5.1 Uncovering stated and unstated purposes for eMaking engagement

Numerous scholars have pointed to the importance of ensuring that the goals and formats of eMaking activities align with the priorities of participants, especially those from marginalised groups that often feel excluded by technologies which are consistently portrayed as not being "for them" [10, 12, 13, 15, 35]. To date, many eMaking and digital literacy initiatives that target older adults are either framed using a needs-based approach, portraying the learning outcome as the key benefit that older adults should wish to pursue [69, 86, 108], or as an explicit means to achieve a specific

meaningful outcome [25, 111]. Although in our very first discussion at the community centre, we presented the TapeBlocks and our planned workshop as an opportunity for older women to learn about electronics and technology, the language was significantly adapted after that. Women were, understandably, not interested in learning for the sake of it. On the other hand, our results show that the purpose that drove older adult women to engage in eMaking was much more complex and multilayered with some more easily identifiable and others which only manifested through the course of the project.

The explicit purpose stated by older adult women during the consultation and the first card-making workshop was the desire to create items which were specifically linked to cultural traditions with the goal of celebrating them and sharing them with others. This aligns with principles of ethnocomputing proposed as a way for Native American Youth to rediscover traditional crafts [62] and the strategies for cultural sharing in families of immigrant and refugees through intergenerational eMaking [51, 78]. In Japan, this resonates with the social role that many older adults attribute to themselves, and are attributed by others, of *keepers* of traditional knowledge

[122] which value lays in being passed on to the next generation. As women in our workshop guessed, embedding technology in making practices that are centred around specific cultural items and traditions could serve as a way to bridge the interests and goals of both younger and older individuals. After all, making together, whether is a dish, an item of clothing or a digital device represents a meaningful moment of connection, that is often preserved as a cherished memory [43, 61, 113, 116].

Finally, one additional purpose for engagement in eMaking, which was never explicitly stated but became increasingly clear as the study progressed, was the desire of older women to move from the role of learners of electronics to teachers. Previous studies around the importance that older adults across different cultural contexts place on the ability to share their knowledge and life experience show clear evidence of improved well-being and support one internal and external social identity [49, 100]. We propose that this could be easily applied and combined with the other insights we gained in our workshop to redesign how we structure eMaking activities for older adults as well as potentially other forms of digital skills training. Rather than emphasising the impact of learning, we can consider and promote such initiatives as a gateway to teaching, and through teaching seek to transmit not just technical knowledge, but also cultural values and traditions. This narrative can help older adults envision technology as a means to fulfil their chosen social role, rather than the agent that frequently robs them of it. While older adults as individuals or communities are likely to have different motivations for engaging in eMaking, the different purposes we identified represent a potential starting point for future investigations.

## 5.2 Develop tools and approaches to match crafting practices

Previous work by researchers working on inclusive eMaking highlighted the importance of building activities not only on the skills that are available to participants regardless of their disabilities but actively incorporating the competencies they had previously developed as a result of lived experience and engagement in traditional forms of crafting [12, 15, 34]. Similarly, being able to discover the crafting practices that older women were interested in and skilled in, ultimately helped us to shape our electronic card-making activity in a way that was not only more relevant but also more approachable. Thanks in large part to the fact that they had been repeatedly told, either by statement or omission, that technology is not for them, older adults and older women in particular are likely to have limited confidence in their ability to learn about electronics or interact with digital devices [4, 30, 41]. The initial form factor of TapeBlocks we proposed was easily accessible to women as they faced no difficulties in combining various blocks to create electronic circuits. However, it did not resonate with any of the crafting practices women knew to be skilled at.

This occurred because of the way in which form factor of the eMaking toolkit influences both how individuals interact with the making process and types of artefacts that it can be used to create [72]. When attempting to provide tools and techniques that can be flexibly adapted to different forms of crafting for new groups of people and integrate materials and components which make

sense in the context of their creative endeavours, we echo the work of Mellis et al. [82] in suggesting the use of *untoolkit* instead of a traditional eMaking toolkit, as it can bypass restrictions of a specific form factor. On the other hand, a *untoolkit* simply offers a way to combine basic electronic parts and other materials according to the skills and desires of the target audience. Rejecting the form factor of Tape-block and maintaining only its untoolkit characteristics allowed us to quickly pivot to a format in which the familiar motions of making a collage could serve to break the ice and give confidence to engage with portions of the workshop that participants had initially no confidence they would be able to tackle [82]. In turn, the card-making activity also worked as a starting point for engaging in other conversations about how we could introduce technology to augment other crafts, could we explore the idea proposed by one of the residents in the initial consultation to make e-textile bags? How about actuating origami? As other scholars working on eMaking with different marginalised groups [38, 117, 123], we invite researchers to focus on building on older adults' strengths rather than only thinking about what might be accessible. When it comes to the creation of tools we argue for a more deconstructed approach where existing crafting practices and goals of older adults become the base on which components and materials are selected for the creation of specific untoolkits with materiality that is familiar to older adults and aligns with their aesthetics goals. Moreover, learning from the approach adopted by the facilitating women during the second workshop, we argure for more subtle approaches that de-epmhasise the role of electronics, and potentially coding, in eMaking activities targeting marginalised groups who are likely to have limited confidence. Keeping the focus on crafting goals and supporting digital learning solely to the extent to which it add aesthetic value to the making of a particular artefact, reduces the pressure on the individual and promote a more goal oriented learning focused on implicit actions, which can be better suited to the preference of older adults.

Ellis et al. [34] articulates the importance of tailoring the complexity of eMaking activities and providing instructions with the *"appropriate language and with the correct tempo and level"* to align with the cognitive skills of participants with intellectual disabilities. Although the older women who participated in our workshop did not report any concern about cognitive decline, we argue that our findings might help to shed some lights around ways in which we can best support the acquisition of new knowledge of eMaking for older adults. Previous studies have shown that while explicit knowledge might be more difficult to acquire and retain in older age, implicit learning is retained, and is often leveraged by older adults when interfacing with digital technologies [84, 101]. Our workshop showed older women's ability to grasp key principles of electronics largely thanks to the embodied process of making which aligns with previous theories of education more broadly [53, 95]. Despite our attempts to simplify language and avoid electronic jargon and ensure that instructions were provided with appropriate pacing, women were not interested and in fact often put off, by explanations about the reasons why a circuit could be wired in a certain way, but not in another. Instead, they were quickly able to imitate the actions of a facilitator or another participant to create a basic electronic circuit and engage in constructivist trial and error to figure out how to adapt it to their needs. This learning style is better aligned with

many traditional crafting practices, particularly in Japan, as well as apprenticeships for trade jobs, which would have been the previous occupation of most of the women we interacted with [21, 40]. This is not to say that we should design eMaking activities for older adults which are solely based on imitation of the actions performed by a researcher. Dialogue and verbal explanations should and did in our case, occur naturally as part of the process. However, we should consider the possibility of simply starting activities by showing and doing, rather than focusing on verbalizing instructions and explanations that older adults might not want or need as part of their learning journey. While electronics are naturally more suited to this type of imitation learning, it is worth considering how it could be expanded to other areas of digital literacy for older adults.

## 5.3 Build deep and broad community engagement

Building rapport with the members of the field and its stakeholders is critical when conducting community-based research [74, 75]. In this study, the researchers have collaborated with the community centre and their members for over 5 years, with constant physical touchpoints without interruption, although the research headquarters is 2 hours away from the research field. While this may look inefficient and time consuming for some researchers that prefer lab-based studies, these efforts can be considered as "the work that occurs before the work" [75] in community-based studies. Patience and active listening are essential before rushing or directly 'parachuting in' technology to the field, which has proven to be unsuccessful specifically in ageing domains [89].

In the context of Japan, it is also significant to not only listen but also carefully investigate the voice of the voiceless; being modest, indirect, and restraint can be more explicit than other parts of the world, due to the concepts of duality and paradox [60]. Japan also has the notion of *Ma*, meaning "in-between" or "between-ness" in Japanese, which values the sensitivity when entering spaces and forming relationships [2]. *Ma*, inflected by Zen Buddhism and others, have explored the inter-relatedness [112] respectfully in the field of participatory design [2], where communication is not just about the functionality or efficiency but also about the caring for the between-ness.

From the field of social theories of learning, the *community of practice* is known to have four components; (1)*meaning* as a experience on the changing ability, (2)*practice* as a way to act around shared historical or social resource, (3)*community* as a way to recognise the social belongings, and (4)*identity* as a way to create personal history and become in the context [120]. The older adults in the Yonamoto community showcase these perspectives explicitly throughout the activities. The notion of *meaning* is explicit in the women gaining competence in transitioning into the facilitator role, supporting each other. The essence of *practice* are visible from their storytelling abilities through their craft. The impact of *community* can be interpreted from displaying their crafted artefacts for public display, aesthetically celebrating the coming of the new years. The core of *identity* can be the willingness to extend the engagement for children, and practically teaching the children what they recently learned. Such active engagement [67] of older adults contribute not only to the individual but also collective social capital [54] to

the 'successful aging' [102] of community, thus lead to a positive impact for the future societal value.

## 6 Conclusion

Incorporating crafting in eMaking initiatives for older adults can help to build on existing skills as well as foster greater interest thanks to the resonance with existing practices. In this paper, we examined our process in developing and conducting an electronic card-making workshop with 14 older adult women in sub-urban Japan using an assets-based approach. Our work showed how the embodied nature of the activity matched with the scaffolding structure that leveraged their crafting abilities promoting confidence as well as fostering implicit learning. Four participants from the original workshop decided to run a second iteration targeting local children. Their successful effort illustrates not only their ability to leverage newly acquired knowledge but also the potential of digitalized crafting to be used as a tool for sharing cultural traditions, promoting intergenerational contact, and reclaiming one's desired societal role.

## Acknowledgments

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