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Co-Designing with AI in Sight

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Abstract

Artificial Intelligence offers a wide variety of capabilities that can potentially address people's needs and desires in their specific contexts. This pilot study presents a collaborative method using a deck of AI cards tested with 58 production, AI, and information science students, and experts from an accessible media agency. The results suggest that, with the support of the method and AI cards, participants can ideate and reach conceptual AI solutions. Such conceptualisations can contribute to a more inclusive integration of AI solutions in society.

Keywords: early design phase, participatory design, artificial intelligence (AI), idea generation, method development

1. Introduction

A basic definition of Artificial Intelligence (AI) is systems that "do what people do"; like perceiving, thinking, deciding and acting (Shneiderman, 2020). However, people who are unfamiliar with AI might find it challenging to understand this technology, since popular fiction and journalists often frame and depict AI notions with misconceptions (Shneiderman, 2020). Examples of current AI applications include recommendation algorithms, smart assistants, translation of languages and many others. AI isn't a matter of academics anymore (Littman et al., 2021) and instead, "AI is everywhere" and is "expected in almost every app" (Smith and Eckroth, 2017). A reason for this is that AI has evolved since its origins due to the augmentation of computer power over the years. Now, through machine learning methods, AI can process enormous amounts of data (Smith and Eckroth, 2017). Such evolution in machine learning, mainly within deep and reinforcement learning, has enabled promising (and concerning) AI applications, enormously affecting the progress of the primary AI subfields over the last five years; for example, vision, decision-making, image generation, and natural processing languages, among others (Littman et al., 2021, pp. 12–18). This advancement is even more impressive in comparison to the first annual conference on Innovative Applications of Artificial Intelligence in 1989; now, it's much simpler to integrate AI into companies' IT infrastructures, and there are more standard options and common IT architectures and practices (Smith and Eckroth, 2017).

Despite the dramatic development of AI over the last decades (Littman et al., 2021), other aspects are still at a very early stage, such as attending to people's context for integrating AI (Mateescu and Elish, 2019). Human-centred AI reframes the technocentric view of AI in which humans are in the loop and, instead, offers a human-centred perspective that AI supports (Shneiderman, 2020). The consequence is that AI investigates ways to enhance humans, not replace them (Harper, 2019; Shneiderman, 2020), and ideally addresses three perspectives: one rationalistic that attends to the technology, one humanistic that listens to people, and a judicial one that looks into policies (Auernhammer, 2020). Then, the current challenge for AI is a "social, cultural, political, and ethical one" (Loi et al., 2018).

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Addressing these broader concerns and including larger audiences is vital to the democratisation of AI. Otherwise, the risk is that only a few people can use AI capabilities (Wolf, 2020). To enable this democratisation, it is necessary to lower the threshold and facilitate the entrance of different disciplines (Wolf, 2020). From a participatory perspective, the co-design aspects of AI development are in their infancy. However, there are inspiring discussions on when and how participation can contribute to AI technology design, such as those in Bratteteig and Verne's work (2018). Furthermore, novel design toolkits for AI have recently been created (d.school, 2018; Futurice-Oy, 2020; JSAI, 2020; Piet, 2020; Triggers and Butler, 2020) to support designers and professionals in ideation and other design dimensions with AI.

This pilot study is a follow-up consequence of a case study that started in 2017 called "Karakuri IoT". The case study aimed to democratise the adoption of the Internet of things (IoT) in industrial settings through a bottom-up approach, by supporting factory workers' expressiveness in the conceptualisation of IoT improvement solutions (Aranda-Muñoz et al., 2021). In the last stages of Karakuri IoT, we identified a lack of methods and tools that involve factory workers for the purpose of using the potential data generated from their IoT proof of concept ideas to find other suitable AI improvements in factories.

To comprehend the current co-design practice with AI, and guide our inquiries for the following years in the industrial domain, we conducted an early exploration with a broader perspective. This broader perspective is what is considered for this pilot study, where we identify a scarcity of literature and studies addressing ideation tools for collaborative design purposes with AI. We acknowledge that more attention is needed to integrate AI (Mateescu and Elish, 2019), specifically in workplaces (Clarke et al., 2019). To address this gap, we designed a collaborative method, including a deck of AI cards (tool), to involve people in the process of generating ideas for the AI applications of products and services. We tested the method and AI cards in a pilot study composed of four online workshops with fifty-eight (58) production, AI, and information science students, and experts from an accessible media agency. The aim is to introduce and analyse the collaborative method, and the usage of AI cards, and highlight found arguments for the involvement of people in the early stages of design opportunities with AI. To address this aim, we present the following question: How can people be supported in the AI idea generation process?

2. Theoretical Perspective

We understand design as a reflective conversation with the materials and design moves of seeing-moving-seeing (Schön, 1992), where metaphors can play a generative role in the consideration of new perspectives and understandings of a situation (Schön, 1993). An example used in information systems is the "assistant" metaphor, which helps people lacking computer experience to approach the technology from their experience of what an assistant can do (Albinsson and Forsgren, 2005).

In the design process, design tools can help non-designers create artefacts, tell stories, and enact futures (Brandt et al., 2012). Researchers often refer to these design tools as generative tools that aim to help the fuzzy front-end and other stages of the design process (Sanders and Stappers, 2012). Such tools can act as instruments of inquiry for designers to support the ideation and exploration of problems in a design space (Dalsgaard, 2017), and include design card decks, toolkits and games (Peters et al., 2020). Specifically, cards are common design tools that support communication among participants and provide structure in the design process (Wölfel and Merrit, 2013). Design cards can be described as attending to five design dimensions: the purpose and scope, the duration, customisation, formal qualities and methodology (Wölfel and Merrit, 2013). Additionally, when creating such tools, the designer's ability to visualise and design the workshops can be related to "visual awareness" (Florin and Eriksson 2020), which can be summarised as the cognisance of the conditions required for visual perception, and how to design to meet requirements of specific situations, contexts and uses (Florin 2015).

3. Related Work

Mateescu and Elish (2019) differentiate between deploying and integrating AI. During deployment, focus is placed on the technological aspects of AI, while integration accounts for the understanding of the context in which the technology is introduced to people (Mateescu and Elish, 2019).

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To address the challenges new AI developments can create, and to find more inclusive solutions, it is essential to involve wider audiences and democratise AI (Wolf, 2020). In such involvement, it is vital to address the public not only regarding technological opportunities but also when it comes to AI integration (Mateescu and Elish, 2019). Participatory Design (PD) can contribute to this AI democratisation process and "has a responsibility to deeply engage" (Loi et al., 2018).

To involve participants in a PD process with AI, Bratteteig and Verne (2018) discuss three ways participation can happen during the design of AI solutions: in the generation of ideas, in the refinement of ideas, and in the evaluation of the result. For the generation of ideas, the authors (Bratteteig and Verne, 2018) suggest that classic methods such as future workshops and scenarios can help, and warn us that "a crucial prerequisite for such methods is a basic understanding of what AI can do and not do" (Bratteteig and Verne, 2018). The need for participants "to understand what AI can do" is also shared by Harper (2019), who further emphasises the need to focus on people's needs and not on the mechanics of how the technology works.

Then, the design inquiry shifts into the capabilities that AI can offer to non-designers, for what purposes AI can be put into play. We find some inspiration in the literature that addresses AI capabilities (Smith and Eckroth, 2017; Zoltán, 2021), in the human-centred AI field (Shneiderman, 2020), as well as in the promising opportunities for AI (Littman et al., 2021, pp. 48–52) and the more general AI technological maps (JSAI, 2020). The applications often discussed include vision, pattern recognition of images and text, the natural language such as applications for translation and language processing, and applications for planning and rule-based systems. Some examples of the collaborative methods being explored are the Wizard of Oz prototyping (Browne, 2019), speculative fiction (Mucha et al., 2020) in combination with artistic methods (Bozic-Yams and Aranda-Muñoz, 2021), and the AI vision tool developed by Malsattar et al. (2019) that helps people experience non-human views.

Other examples can be found in projects and initiatives that research and share AI tools to democratise AI. Google People + AI Research group (PAIR, 2019) provided a workshop kit along with interactive AI explanations called "AI explorables", and Microsoft released a toolkit to help multidisciplinary teams address their researched Human-AI interaction guidelines (Amershi et al., 2019). Concerning AI card decks, there are a few decks available online, like "The Intelligence Augmentation Design Toolkit" (Futurice-Oy, 2020) which supports non-experts in the process of designing AI and ML applications and services; as well as the "AI Meets Design" toolkit which helps designers design with and for AI (Piet, 2020), the "Machine Learning Deck" ideation cards (Triggers and Butler, 2020), the "I Love Algorithms Cards" (d.school, 2018) and the "AI Problem Cards" from the Japanese Society for AI (JSAI, 2020).

4. Method

The researchers conducted a pilot study consisting of four design workshops (Hanington and Martin, 2019) with a co-design perspective (Sanders and Stappers, 2012) to observe how participants use the method and the AI cards (tool) to generate ideas and develop them further into concepts. The researchers conducted a workshop with twenty (20) students from the "Big data and cloud services for industrial applications" course as part of a master's program with a focus on product and process development at Mälardalens University (MDU); a workshop with thirty (30) students from the "Applied AI" bachelor's program at MDU; a workshop with three (3) students from the "Master's Programme in Archival Studies, Library and Information Studies, Museum Studies" at Lund University; and a workshop with five (5) experts (a business developer, strategist, product owner, information technology librarian, and an accessibility expert) from the Swedish Agency for Accessible Media, called MTM (see Table 1). The rationale for this selection of participants was to observe the use of the same method and AI cards in a broad range of domains.

The researchers involved in this study include an industrial PhD student of innovation and design (who acted as a designer, facilitator and researcher), an engineering design researcher (facilitator), a senior engineering design researcher (with a focus on IoT and AI) and two senior information design researchers. The workshops were facilitated online due to restrictions related to the Covid-19 pandemic. Zoom software was used for workshop communication, and Mural software was used to write digital sticky notes and other graphics during online collaboration.

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Table 1. The four workshops facilitated in the pilot study.

Workshops 1-4	1. Master students of product and process development	2. Students of Applied AI	3. Master students of librarian studies	4. Experts from the Swedish Agency for Accessible Media
No. Participants	20	30	3	5
No. Groups	5	7	1	2
Date	16/11/2020	26/11/2020	19/03/2021	26/03/2021

The designer created the deck of digital AI cards (see Section 5, Figure 1) to support participants in ideating and conceptualising solutions with AI in the form of potential products and services. This deck was designed to be used as part of the five-step workshop method (see Section 6) which is exemplified by the narrative from the workshop with librarian students (see Section 7.2).

The units of analysis were both the method and the AI cards. In each workshop, the facilitators presented the same brief in the form of an introduction to AI and the same written instructions and activities, as summarised in Figure 2. During each workshop, participants presented their results twice (after Activities 4 and 5, see Figure 2). During these presentations, the two facilitators were limited to taking field notes to record the descriptions participants gave about their brainstorming sessions, prioritisation, problem descriptions and conceptual solutions. At the end of each workshop, the facilitators conducted a reflective activity to gather feedback from participants about the design activities and the AI cards. In this reflective activity, participants wrote feedback, regarding the use of the cards and the method, on digital sticky notes. Afterwards, the facilitators encouraged the participants to verbally share some of their reflections verbally. The PhD student maintained focus on one group per workshop to observe and take field notes on the use of the cards (tool) and the method, and the group's discussions throughout the different activities. The resulting empirical material collected consisted of the ideas written and diagrams created by participants, as well as and the field notes of the researchers. All the material was analysed by the PhD student and revised during reflective sessions involving all the authors of this paper.

5. The Cards that Describe AI Capabilities and Its Assistant Capacity

Attending to Wölfel and Merrit's framework (2013), the purpose of the AI cards is to serve as a repository of AI capabilities for the ideation and conceptualisation of opportunities with AI: each AI card includes a title, a brief description of the capability or issue that is addressed, and an icon with the intention to inspire users on AI possibilities (see Figure 1). The cards are regarded as a tool, meant to be used in combination with our method (see Section 6) in the scope of workshops, lasting 2 to 2.5 hours, and can be further customised to fit specific contexts through blank cards ("jokers") included in the deck. As formal qualities, the cards were created in Adobe Illustrator and are available as ".png" images that can be printed for physical workshops.. The layout and style of the card design is based on the Karakuri IoT cards designed in the earlier case study with industrial personnel (Aranda-Muñoz et al., 2021), and the icons were created for the cards or retrieved from a website that sells icons (Flaticon).

To decide the content of the AI cards, the PhD student consulted literature concerning human-centred AI, participatory AI, and AI applications. The criteria for including capabilities were restricted to general themes of AI (e.g., applications specific to sectors such as finance or video games were not considered), as well as to their applicability in broad domains (e.g., an AI for robot control was excluded). The result of this process was a deck of eleven AI capabilities: Categoriser, Anomaly detection, Sound recognition, Number prediction, Image recognition, Learning through trial and error, Relation finder, Computer vision, Text analysis, Optimisation and Expert system; with six cards that address some AI concerns: security, inclusivity, privacy, sustainability, transparency and accountability; four cards that act as potential wicked problems: harmful data, no-privacy, inequality, environmental and social; and blank cards that act as "jokers". The researchers kept the number of cards to a minimum so participants would have time to go through all of them during the workshop activities.

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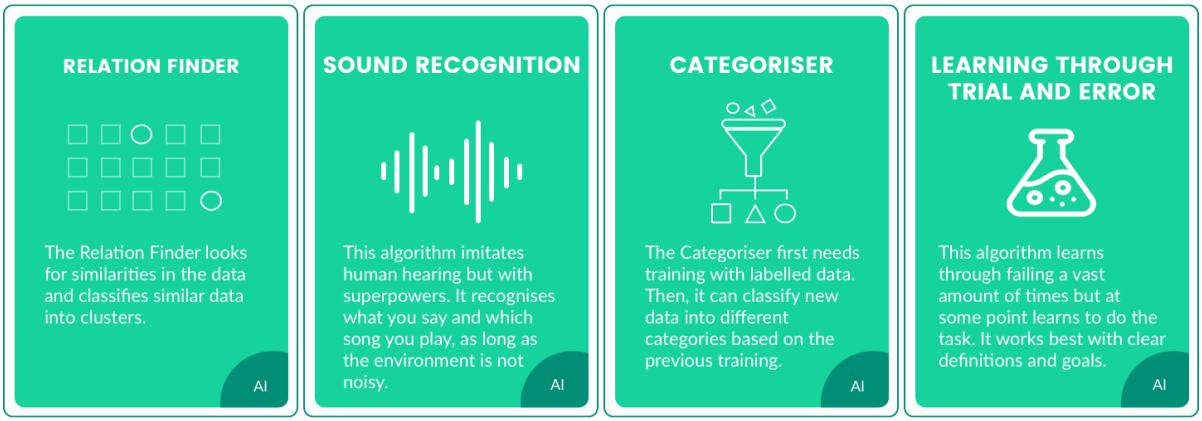

Figure 1. Four of the twenty one AI cards in the deck.

One of the design aims of the AI cards was to abstract the engineering aspects of AI, like supervised, unsupervised and reinforcement learning, and remove the stages of data collection and data processing (e.g., cleaning, discretisation, selection of features, storing, etc.). However, technological terms were still added to the cards (e.g., data, cluster, labelled data) and explained during workshop introductions, because we considered them necessary for aiding participant understanding and use during the activities. During introductions, we explained AI as algorithms that imitate people in perceiving, thinking, deciding and acting, as in (Shneiderman, 2020), described the challenge to go beyond "human-like abilities of AI systems", as in (Shneiderman, 2020), and expanded this basic understanding with descriptions of machine learning, deep learning, and more than ten examples of AI applications. From such an understanding of AI, we considered it a natural approach to utilise the metaphor of "the assistant" as in Albinsson and Forsgren (2005) to represent the role of AI during the workshop. In such a role, the cards assist participants by presenting different AI capabilities.

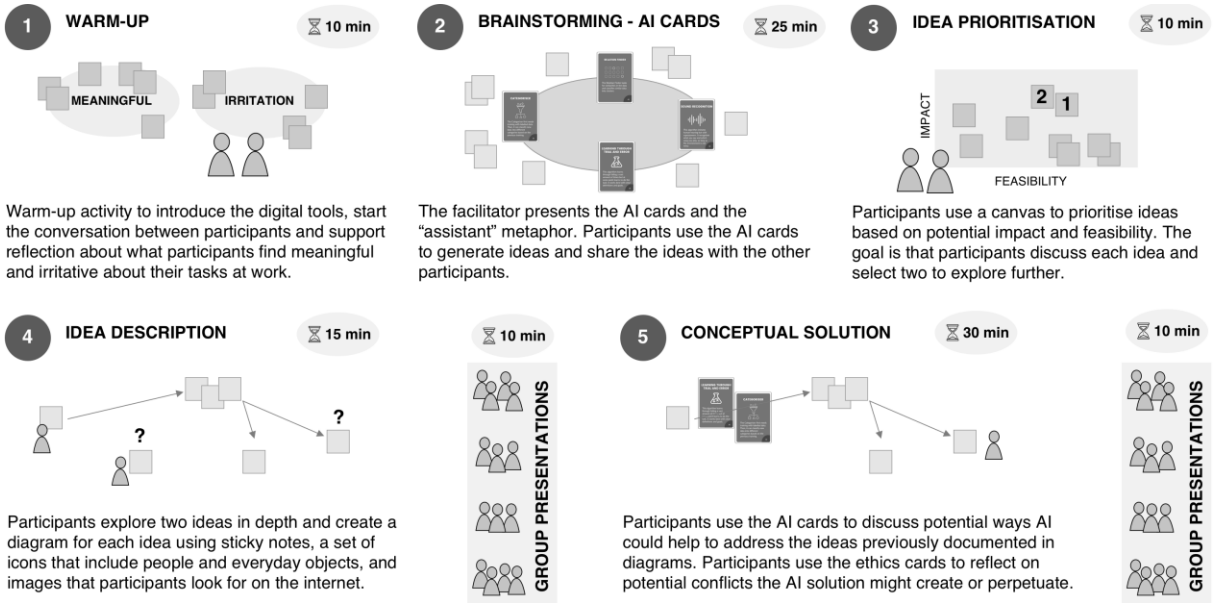

Figure 2. Activities and group presentations researchers facilitated in the workshops.

6. The Collaborative Method with the AI Cards

Each workshop lasted between 2 and 2.5 hours, starting with the same presentation on AI, then continuing with the same five collaborative activities and ending with a group reflection to gather feedback from participants. To facilitate the activities with AI, the researchers designed a template in the web software Mural. The template contained five activities to be performed in groups of 3-5 participants (Table 1) in different virtual rooms. The five activities (see Figure 2) consisted of a warm-

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up, brainstorming with the AI cards, prioritising ideas on a canvas, describing the opportunity selected, and exploring the opportunity further to provide a conceptual solution. Then, the facilitators conducted a reflective activity with the participants.

7. Results

The introduction to AI helped participants understand the basic notions of AI and invited them to reflect on the current AI misconceptions which are often depicted in popular fiction. The participants appreciated this introduction: "The short lecture before was a good introduction to AI and set you up in a good way to then be able to work with the exercises" (Participant feedback from Workshop 3). And the examples gave "a bit of direction to get going" (Workshop 3) and contributed to putting the participants on paths to explore AI capabilities.

The AI cards assisted participants in framing their ideas on a high level and exploring the wide variety of opportunities that AI can offer. In this respect, some participants shared the feedback that "the cards helped to show [them] the breadth of AI and made different aspects visible in a good way" (Workshop 4); as well as that the cards helped with "framing what AI is" (Workshop 4) and "were very helpful to see the different types of AI, and to go through them in the brainstorming" (Workshop 3). However, one group of participants found that the focus during brainstorming became very solution-focused "too early", "with the AI cards representing solutions" (Workshop 4). Instead, this group would have preferred "more guidance in developing the problem formulation" (Workshop 4). Finally, the AI cards also addressed concerns and wicked problems, which supported participants in the adoption of critical perspectives against their generated opportunities (see example in Section 7.2).

The method structure contributed to engaging participants in a flow of activities that built upon each other, and helped them to iterate, describe the contextual aspects of AI opportunities and hypothesise alternative ways to conceptualise their opportunities. Concerning these aspects, the participants appreciated the overall organisation in steps: "the structure of the workshop was very well thought through and the activities" (Workshop 3) with "five clear steps" (Workshop 3); and the five activities: "were very pedagogically explained and divided" (Workshop 3). However, some participants found that the activity instructions lacked clarity, specifically when it came to using the collaborative software: "when we moved on to the workshop part, there was a lack of rigour and clarity in the information and instructions" (Workshop 4).

We observed that participants were engaged in discussions, building on each other's ideas. During the reflective sessions, some participants expressed an interest in developing their ideas further in future workshops (in Workshops 1, 3 and 4). However, some participants pointed out potential improvements that could be made in future workshops. For example, some mentioned the challenge of combining AI cards into one solution, saying that it's "difficult to show that the green cards can be combined to solve a problem" (Workshop 3). Other feedback concerned expectations about the discussion with the facilitators: "we would have liked more large group discussions and reflections from the workshop leaders" (Workshop 4).

7.1. Results from Each Workshop

In Workshop 1 (see Table 1), the industrial master's students proposed more than fifty (50) ideas for how AI could help in manufacturing settings. Some ideas were generic, such as "prevent accidents"; however, other ideas were more specific, like the detection of "vibrations in bearings", the use of a vision camera to "identify quality press deviations", the possibility to "recognise the quality of the weld seam and give an alert", "tuning machines by recognising the sound of the machine", and many others.

Workshop 2 differed from the other workshops because the participants (AI bachelor's students) were knowledgeable about AI to some extent. The participants approached brainstorming quite broadly, focusing their attention on their hobbies and interests and proposing conceptual solutions that described potential opportunities and how they would solve them with the AI cards. The participants suggested more than eighty (80) ideas with topics such as "meal planning", "interpretation of laws and rules", "removing fake news", and a baby radio that could analyse sound and detect crying, among others. In this workshop, two participants suggested that the method could help with the initial stages of

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brainstorming to find out what to develop with programming. However, other participants mentioned that it was more interesting to focus on the technical aspects of AI rather than in brainstorming.
In Workshop 4, the experts (Agency for Accessible Media) brainstormed more than twenty (20) ideas and documented specific challenges they faced in their everyday work activities. For example, one group described the challenges people with dyslexia face when formulating search queries and analysing query results. The experts explored how AI could help through "intuitive searches", comparing "specific search patterns of different user groups with different reading difficulties". The experts also explored some challenges faced by people with visual impairments and intellectual disabilities.

7.2. Workshop 3 - Librarian Students' Narrative

Workshop 3 is presented as a narrative to illustrate the method and use of the cards in a more in-depth manner. This workshop was selected because the empirical material provides different uses of AI cards and captures contextual aspects of what the librarians find meaningful at work.
The warm-up (Activity 1, see Figure 2) consisted of discussing the meaningful and irritating aspects of being a librarian. Some of the meaningful themes that participants discussed were to "engage citizens in cultural activities that they enjoy", "event planning", "literature promotion (right book to the right person)", "reading circles", and "collection management". As irritation aspects, the discussion covered topics like the use of "outdated systems and work practices" and "the handling of incoming books".
During brainstorming (Activity 2), participants read each card aloud then wrote down ideas silently. At the end of the activity, participants explained their ideas to each other (see results in Table 2).

Table 2. Participant results from generating ideas using the AI cards.

AI Card name	Ideas written in sticky notes by participants
Anomaly Detection	"Lost books"; "In manual handling of books, the system can read if you have entered incorrect info or insufficient info, etc."
Learning through trial and error	"Catalogizing and indexing"; "Optimizing through trial and error"
Computer vision/image recognition	"Book recommendations based on art (e.g., renaissance painting after scanning Mona Lisa)"
Expert system	"Increase reading level"; "Chatbot"
Relation Finder	"Recommend book by theme, author, genre, etc."; "Personalized recommendation of new books to read"
Sound recognition	"Play a song and the system can recognize if it is in the stock"; "Asking where a book or section is, the system can answer"
Number prediction	"Can help with the purchase of books, can predict what will be popular in the coming year"
Text Analysis	(No ideas for text analysis)

Because there is a particular joy in recommending books, participants prioritised (Activity 3) "personalised recommendations of new books to read" as an idea to explore further. During the idea description session (Activity 4), the participants' discussion initially focused on the challenges librarians face when recommending a book: librarians are not experts of specific genres; they do not have access to the history of books that someone has read (this information is not allowed to be registered); they don't know the person's genre and reading level preferences; recommendations are pretty subjective and take time; and it is hard to know what books are currently on the library's shelves without checking the library system or shelves. The participants used sticky notes, arrows and other graphic forms, and Google Search (to retrieve pictures) to document and discuss these challenges in a diagram that included a picture of a librarian, sticky notes with difficulties identified, and photographs of various people who could request a recommendation.
In the conceptual solution (Activity 5), participants explored how AI could contribute to better-personalised recommendations for citizens (library users). The participant's discussion started with recommendation systems often found in popular music and movie apps like Spotify and Netflix. However, participants discussed how such an app could have shortcomings when it comes to

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providing personalised recommendations and cultural aspects typically incentivised in libraries. Then, the participants discussed that it would be nice for librarians to receive a list of suggestions based on the citizen's preferences, which was their final conceptualisation (see Figure 3).
In this concept, the citizen can use the library machines to answer a few questions ("Text analysis" AI card) in exchange for a list of books and other potential media recommendations ("Categoriser", "Relation finder" and "Expert system" AI cards). The library machine would print out a paper with a list of recommendations that the librarian and the citizen could use to discuss potential book choices. Such a list could prevent shortcomings in specific genres not so well-known by the librarian. It would also account for books present in the library (not lent out to other readers), and it could suggest books liked by similar readers' profiles instead of basing suggestions on the experience of one librarian (less subjective to one person). During the discussion, the participants recognised some potential shortcomings of the AI system. Including the need to comply with the current GDPR and what data to collect ("no-privacy" AI card), and to inform the users about it ("transparency" card); as well as the shortcoming that some people might have challenges using the system, especially the elderly and kids ("inclusivity" and "inequality" AI cards).

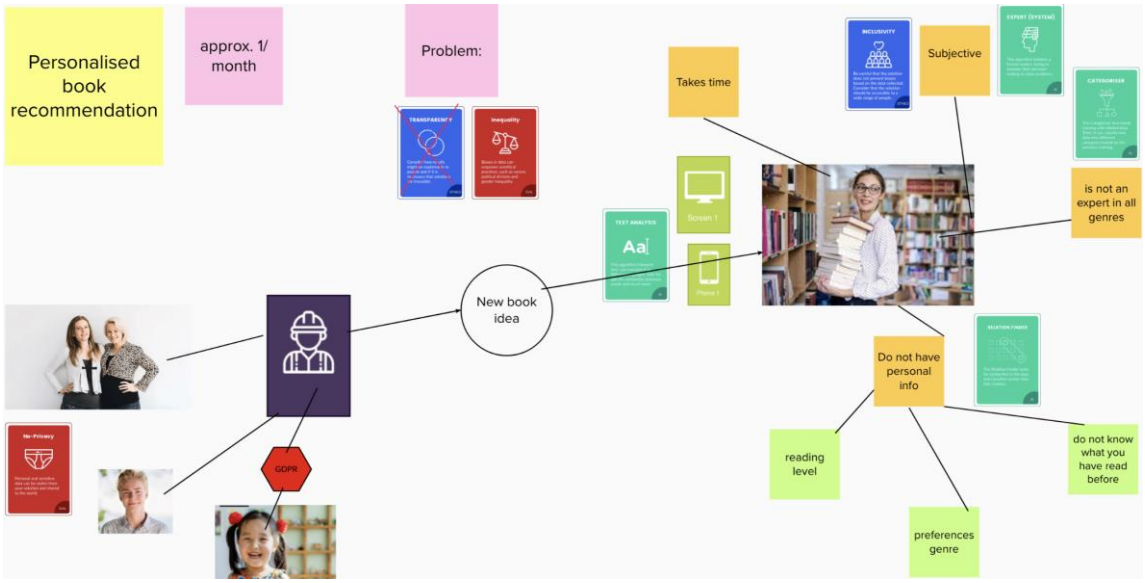

Figure 3. The conceptual solution presented by student-librarians (translated to English).

8. Discussion and Future Work

The research question that guided this pilot study was: How can people be supported in the AI idea generation process? To answer this question, we presented a collaborative method and a specially designed deck of AI cards (tool) that have been utilised in four workshops in different domains. In such workshops, we observed that the method and AI cards framed discussions that addressed AI opportunities in the respective domains without dialogues about technological implementations. The participants could generate ideas with AI, discussing broader perspectives concerning data, privacy issues, ethical dimensions and other aspects described in the cards. As a limitation, we see that the duration of the workshops can limit participants from gaining a deeper understanding of AI. Longer perspectives of time for understanding the effect of the use of the method and AI cards were not considered for this pilot; yet, we see the value in conducting follow-up studies to comprehend the effect the method has on participants' understanding of AI. Furthermore, we observed that some participants needed more time to understand and be able to use the digital tool. We will address both aspects in future iterations of the method.
We reflect that, despite the AI cards conveying different AI capabilities to participants, it might be challenging for participants to perceive and understand the AI capabilities in depth if they have not experienced them before. As future work, we find inspiration in the vision tool presented by Malsattar et al. (2019) which helps participants experience AI vision, and in the "AI explorables" developed by

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Google (PAIR, 2019). We view it as a compelling option that AI collaborative practices incorporate prototypes which allow participants to experience different AI capabilities. Furthermore, we highlight the need for a more systematic process in order to identify AI and machine learning capabilities for people who lack computational skills and studies of how such capabilities can be conveyed to people.

We see that this collaborative method, combined with the AI cards presented in this paper, can facilitate early discussions of AI integration that attend to participants' context (domain), instead of the concerns and challenges that deploying AI can cause in work environments.

An example is that the student librarians conceived a solution in the form of AI support to help librarians overcome challenges instead of automating the recommendations. A plausible explanation comes from the workshop's warm-up, where participants stated that it is meaningful for them to "engage citizens in cultural activities that they enjoy" and "literature promotion". Attending to this narrative, we see that the early involvement of participants in the design process can help preserve what is meaningful to people in their workplaces while still innovating new technological solutions with AI. In this respect, we see that the first step of the method that we present is vital to later driving the ideation of AI opportunities, as it frames the generation of AI solutions from the perspective of what is meaningful at work (what can be supported) and what causes irritation (what can be automated). Otherwise, the risk is that AI opportunities end in struggles, with deployments that do not attend to the context of people, just like the cashiers and farmers' struggles with AI discussed by Mateescu and Elish (2019).

9. Conclusion

In this pilot study, we introduced a collaborative method, including a deck of AI cards, to involve people in the process of generating ideas for AI solutions, attending to what people consider meaningful and discouraging at work. Such cards abstracted engineering aspects of AI and, instead, presented the capabilities that AI systems would be able to perform through the "assistant" metaphor. To observe the combination of the collaborative method and the AI cards, we conducted four workshops with 58 participants and presented a narrative that describes the AI cards and method in use in detail. As a contribution to the design field, the results suggest that the method combined with the AI cards supported participants in the process of ideating and reaching conceptual solutions based on AI capabilities. Specifically, the cards framed discussions on a high level, and served as a repository of AI capabilities and as mediators in discussions that covered broader topics of AI without addressing technological implementations; such as ethical aspects, potential shortcomings and broader contextual aspects. Such contextual elements include what people would desire to automate and augment with AI. The results suggest to designers the viability of including the AI cards following the method presented in this pilot study as a way to lower the threshold of involving people in the early stages of design. From an industrial perspective, this involvement of people in co-design activities with AI can help preserve meaningful work aspects and potentially help integrate AI solutions more inclusively in work environments.

References

Albinsson, L. and Forsgren, P.O. (2005), "Co-Design Metaphors and Scenarios – Two Elements in a Design Language for Co-Design", Proceedings of LAP 2005, presented at the Proceedings of LAP 2005.

Amershi, S., Weld, D., Vorvoreanu, M., Fourney, A., Nushi, B., Collisson, P., Suh, J., et al. (2019), "Guidelines for Human-AI Interaction", Proceedings of 2019 CHI, ACM, New York, NY, USA, Glasgow, Scotland UK.

Aranda-Muñoz, Á., Eriksson, Y., Yamamoto, Y., Florin, U. and Sandström, K. (2021), "To support IoT collaborative expressiveness on the shop floor", Proceedings of the Design Society, Vol. 1, pp. 3149–3158. DOI: https://doi.org/10.1017/pds.2021.576

Auernhammer, J. (2020), "Human-centered AI: The role of Human-centered Design Research in the development of AI", Synergy - DRS International Conference. DOI: 10.21606/drs.2020.282.

Bozic-Yams, N. and Aranda-Muñoz, Á. (2021), "Poetics of Future Work: Blending Speculative Design with Artistic Methodology", CHI' 21 Extended Abstracts, ACM, NY, USA. DOI: 10.1145/3411763.3443451

Brandt, E., Binder, T. and Sanders, E. (2012), "Tools and techniques: Ways to engage telling, making and enacting", in Simonsen, J. and Robertson, T. (Eds.), Routledge International Handbook of Participatory Design, Routledge, pp. 145–181.

https://doi.org/10.1017/pds.2022.11 Published online by Cambridge University Press

Bratteteig, T. and Verne, G. (2018), “Does AI Make PD Obsolete? Exploring Challenges from Artificial Intelligence to Participatory Design”, Proceedings of PDC 2018, ACM. DOI: 10.1145/3210604.3210646.
Browne, J.T. (2019), “Wizard of Oz Prototyping for Machine Learning Experiences”, CHI’19 Extended Abstracts, ACM, Glasgow, Scotland, UK, pp. 1–6. DOI: https://doi.org/10.1145/3290607.3312877
Clarke, M.F., Gonzales, J., Harper, R., Randall, D., Ludwig, T. and Ikeya, N. (2019), “Better Supporting Workers in ML Workplaces”, CSCW’19 Companion, ACM, Austin, TX, USA, pp. 443–448.
Dalsgaard, P. (2017), “Instruments of Inquiry: Understanding the Nature and Role of Tools in Design”, International Journal of Design, Vol. 1 No. 11, pp. 21–33.
d.school, S. (2018), “I Love Algorithms”, available at: https://dschool.stanford.edu/resources/i-love-algorithms (accessed 14 October 2021).
Florin, U. (2015). Konstnärskap i samspel : om skapande arbetsprocesser i myndighetsledda samverkansprojekt. PhD dissertation, Mälardalen University.
Florin, U., and Eriksson, Y. 2020. "Visual Awareness Aiding Communication." The International Journal of Visual Design 14 (2): 21-33. DOI:10.18848/2325-1581/CGP/v14i02/21-33.
Futurice-Oy. (2020), “The Intelligence Augmentation Design Toolkit”, available at: http://iadesignkit.com (accessed 14 October 2021).
Hanington, B. and Martin, B. (2019), Universal Methods of Design Expanded and Revised : 125 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions, Rockport Publishers Inc.
Harper, R.H.R. (2019), “The Role of HCI in the Age of AI”, International Journal of Human–Computer Interaction, Vol. 35 No. 15, pp. 1331–1344. DOI: https://doi.org/10.1080/10447318.2019.1631527
JSAI, the J.S. for A.I. (2020), “AI Map beta 2.0”, AI Map Beta 2.0, available at: https://www.ai-gakkai.or.jp/en/resource/aimap/ (accessed 30 October 2021).
Littman, M.L., Ajunwa, I., Berger, G., Boutilier, C., Currie, M., Doshi-Velez, F., Hadfield, G., et al. (2021), The One Hundred Year Study on Artificial Intelligence (AI100) 2021 Study Panel Report, available at: http://ai100.stanford.edu/2021-report.
Loi, D., Lodato, T., Wolf, C.T., Arar, R. and Blomberg, J. (2018), “PD Manifesto for AI Futures”, PDC ’18: Short Papers, Situated Actions, Workshops and Tutorial, ACM, NY, USA. DOI: 10.1145/3210604.3210614.
Malsattar, N., Kihara, T. and Giaccardi, E. (2019), “Designing and Prototyping from the Perspective of AI in the Wild”, DIS ’19, ACM, New York, NY, USA, pp. 1083–1088. DOI: 10.1145/3322276.3322351
Mateescu, A. and Elish, M.C. (2019), AI in Context: The Labor of Integrating New Technologies, New York: Data & Society Research Institute.
Mucha, H., Mevißen, D., Robert, S., Jacobi, R., Meyer, K., Heusler, W. and Arztmann, D. (2020), “Co-Design Futures for AI and Space: A Workbook Sprint”, CHI ’20 Extended Abstracts, ACM, New York, NY, USA, pp. 1–8. DOI: 10.1145/3334480.3375203
PAIR, G. (2019), People + AI Guidebook, available at: https://pair.withgoogle.com/guidebook (accessed 14 October 2021).
Peters, D., Loke, L. and Ahmadpour, N. (2020), “Toolkits, cards and games – a review of analogue tools for collaborative ideation”, CoDesign, DOI: 10.1080/15710882.2020.1715444
Piet, N. (2020), “AI meets design toolkit”, available at: http://aimeets.design/toolkit/ (accessed 14 October 2021).
Sanders, E. and Stappers, P. (2012), Convivial Toolbox: Generative Research for the Front End of Design. Amsterdam, BIS Publishers.
Schön, D.A. (1992), “Designing as reflective conversation with the materials of a design situation”, Artificial Intelligence in Design Conference 1991 Special Issue , Vol. 5 No. 1, pp. 3–14.
Schön, D.A. (1993), “Generative metaphor: A perspective on problem-setting in social policy”, Cambridge University Press, Cambridge, pp. 137–163. DOI: 10.1017/CBO9781139173865.011
Shneiderman, B. (2020), “Human-Centered Artificial Intelligence: Three Fresh Ideas”, AIS Transactions on Human-Computer Interaction, Vol. 12 No. 3, pp. 109–124. DOI: 10.17705/1thci.00131
Smith, R.G. and Eckroth, J. (2017), “Building AI Applications: Yesterday, Today, and Tomorrow”, AI Magazine, Vol. 38 No. 1, pp. 6–22. DOI: 10.1609/aimag.v38i1.2709
Triggers and Butler, C. (2020), “Machine Learning Deck”, available at: https://www.trytriggers.com/shop-our-tools/ideation-cards-for-artificial-intelligence (accessed 14 October 2021).
Wolf, C.T. (2020), “Democratizing AI? Experience and Accessibility in the Age of Artificial Intelligence”, XRDS, Vol. 26 No. 4, pp. 12–15. DOI: 10.1145/3398370
Wölfel, C. and Merritt, T. (2013), “Method Card Design Dimensions: A Survey of Card-Based Design Tools”, in Kotzé, P., Marsden, G., Lindgaard, G., Wesson, J. and Winckler, M. (Eds.), Human-Computer Interaction–INTERACT 2013, Vol. 8117, Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 479-486. DOI: 10.1007/978-3-642-40483-2_34
Zoltán, S. (2021), The Application of Artificial Intelligence, Springer International Publishing. Doi: DOI: 10.1007/978-3-030-60032-7.

https://doi.org/10.1017/pds.2022.11 Published online by Cambridge University Press