RethinkAI™: designing the impact of AI in the future of Work

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Abstract: The future of work is drastically changing due to the adoption of Artificial Intelligence (AI) into smart products and automated industry 4.0 processes. This requires the emergence of new design paradigms and educational approaches that develop our ability to navigate the ethical and social issues that AI brings. This research develops a new participatory method to address this gap in organisations. The paper focuses specifically on how to design the relationship of humans and AIs working together. It brings new ways on how to help organisations to explore this relationship, how to surface human and AI strengths and preferences on how these are combined when working together with AI. The research draws on how cultural differences affect AI development in the UK and Japan, to explore different ways of creating a coevolving, collaborative work relationship between humans and AI.

 The paper describes the design, development and evaluation of rethinkAI™, through a series of workshops, in the context of higher education knowledge transfer and executive business education with global engineering industries. RethinkAI™ was designed, tested and refined through a series of three workshops with business managers and evaluated in a final workshop with 24 multinational Chief Operating Officers (CFOs) in the engineering industry involved in the decisions of integrating AI into their products and processes. The paper analyses the results from its application and explores how this participatory method can be a valuable tool in surfacing the consequences of AI and robotics on work and designing collaborative ways for humans and AIs to work together. The analysis indicates that the use of human strengths and participatory design can help build up organisation's ability in surfacing and mitigating social and ethical issues when designing AI into products and services. The paper concludes with a reflection on current insights and direction of further research. Designing the Relationship of humans and AI at work remains a significant topic of research and the work presented in this paper is a timely investigation and contribution to this topic.

Keywords: future of work, organisational impact of AI, collaborative AI, transdisciplinary design research, participatory methods

1. Introduction

AI is bringing major changes in the nature of work as a result of rapid advances in machine learning and cognitive technologies. It brings strengths that create efficiencies and help solve problems at scale, enhancing cognitive and physical capabilities of humans in the future of work (McKinsey Global Institute, 2017). Though the benefits are clear, there are a multitude of socioeconomic implications and ethical issues in AI design (Huxley, 1957) (Bostrom, 2014) which are rapidly developing the complexity and characteristics of a "wicked problem" (Emmerson and Young, 2017).

These range, from concerns over job losses (Deloitte Review, 2017), the well-being of gig economy workers and dehumanisation of the augmented worker (Bhatnagar *et al.*, 2018) to ethical issues rising from AI autonomy (Stewart, 2018) and dystopian futures from singularity (Medeiros, 2017). Dystopian narratives about AI are compelling and the calls to regulate and create policies that safe guard societal values are justified. This happened throughout human history, as our technologies evolved and changed how we work. During the first industrial revolution, for example, regulation for child labour was put forward through 1833's Factory Act.

1.1 Research Rational and Motivation

The goal of this research is to inform the design of work with Artificial Intelligence (AI) and to navigate forwards, beyond the polarized views and negative publicity of dystopian futures or the current positively over-hyped AI scenarios.

This paper focuses specifically on how to design the relationship of humans and AIs working together. It brings new ways on how to help transdisciplinary teams of designers and business professionals explore this relationship, how to surface human and AI strengths and preferences on how these are combined when

working together with AI. The ultimate aim is to stimulate new thinking into the current design paradigms of humans and AI systems interaction, to inform the design of human work with AI in a coevolving relationship.

As with the IoT and the need for new product development processes (Lee, Cooper and Hands, 2018) there is a need to shift our design paradigm when designing AI in the future of work. As AI evolves, becoming more autonomous, our human-centred design paradigms also need to evolve and extend interaction and experience design into designing the relationship with AI. This is why this paper's design research into methods and tools to explore and design this relationship between human and AI at work is significant.

1.2   Research Questions and Methods

The key research questions therefore addressed in this paper and contributing towards this broader vision are:
How can a design research exploration of the relationship of human and AI at work inform the design of work with AI?
Q1: What are the current issues in the relationship between the human and AI at work?
Q2: How can we research human and AI strengths coming together at work?
Q3: How can this research exploration surface human preference in AI design?
Q4: How can this research exploration inform the design of work with AI?
The research methodology brings together research in design through literature review and AI expert interviews and research through design practice using participatory research methods in workshops with business professionals (Sanders, 2006) (Sanders, 2008). Action research is used in an iterative approach, to plan, action, observe and reflect on the research (Eikeland, 2001), for each of the questions above, with each participatory workshop also informing the design of the next workshop, as shown in Figure 1.
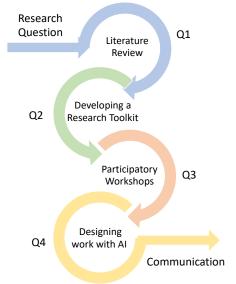

Figure 1: The Research Methodology combines research in design with research through participatory design practice, within an Action Research framework, to explore the four sub-questions, Q1, Q2, Q3 and Q4.

The design practice part of this research develops a research kit, as a glossary of human and AI strengths. The glossary, is designed as a game with 50 cards, developed as an interactive, social way of creating insights in communication between designers and business professionals. The participatory research approach was developed through a series of workshops with business professionals, including business coaches, MBA students and business managers from across different functions and diverse industries. It was informed by extensive literature review on the wide range of challenges and ethical issues around AI and the future of work and a series of interviews with AI experts in the UK and Japan. It was validated in a workshop with 24 Chief Finance Officers (CFOs) from a global steel corporation, in the context of executive education and knowledge transfer. The research in design, through literature review and AI expert interviews, is described in section 2 and the research through design practice is detailed in section 3 of this paper.

2.   Research in Design: AI and the future of Work

What are the current issues in the relationship between the human and AI at work?

2.1 Literature Review

From a technological perspective, AI is a computer program that learns by itself. There are, however, real issues with how AI learns. A key one is, that human biases are being passed on to AI algorithms, through the data sets that are used to train AIs. Google's image search engine categorising black faces as a gorilla is the most often sited example (Simonite, 2018).

Another key issue, is that of transparency of how AI algorithms are reaching their predictions and decisions, often referred to as the issue of "explainability" (a term used in AI research, defined as the ability to explain how AI has reached a decision). This is significant in view also of AI becoming autonomous. The first fatal accidents involving autonomous cars (Stewart, 2018) have surfaced new fears around AI autonomy and the recent Cambridge Analytica scandal has brought out questions on the drivers behind AI use (Tett, 2018). These concerns are also echoed by the broader AI community. For example, Mustafa Suleyman, co-founder and Head of Applied AI at DeepMind, Google's AI company, argues for "up-ending the processes by which technology is developed and deployed, and proposes new ways to ensure it contributes to greater economic and social justice around the world" (Suleyman, 2017).

Journalists posing as gig economy workers are gathering first hand experiences in companies such as Uber and Deliveroo of work conditions and ethical dilemmas (Bloodworth, 2018), raising awareness of the impact on human well-being (Rapacki, 2018). Smart devices, like Amazon's wristband (Olivia Solon, 2018) that facilitate workflows, connecting AI with the human worker, also spark concerns on the de-humanization and control of the worker. These inform the debate and raise questions on the kind of work relationship between human and AI we want to create (Bostrom, 2014)(Harari, 2018).

While regulations and policies for AI are drawn up, there is also a pressing need to build ownership and methods for the decision makers in business, to understand and negotiate the ethics and challenges when integrating AI into human work. This also requires an evolution in our design paradigms. Matt Jones, principal designer for Google AI is advocating for a human-centred approach that designs our relationship with AI, beyond the industry's current design paradigms which stem from human-computer interaction methods and user experience toolkits (Koch, 2017) advocating a collaborative relationship with AI (Jones, 2018) (Google, 2019).

AI continues to learn, becoming more autonomous, with the scope, features and value of digital offerings evolving even after innovations have been launched or implemented. Unlike traditional technologies which have a fixed, discrete set of boundaries and features, AI's distinctive characteristics, as with the IoT, are malleable and evolving (Yoo et al., 2012) and as AI is seen as a black box and distributed across products and services, there is a further dissociation between technology's matter, form and function, an "immaterial/incorporeal ontology of technology" (Kallinikos 2013). Therefore, our human-centred design paradigms also need to evolve, to develop design methods capable of navigating this relatively new kind of ontological complexity, extending interaction and user experience design into designing the relationship with AI. This is why this paper's design research into methods and tools to explore and design the relationship human and AI relationship at work is significant.

2.2 AI Expert interviews

Japan sees AI as the solution to its socioeconomic challenges resulting from its aging demographic. As Japan's prime minister said, "Japan has no fear of AI. Machines will snatch away jobs? Such worries are not known to Japan. Japan aims to be the very first to prove that growth is possible through innovation, even when a population declines" (Kharpal, 2017). Can further insights in designing work with AI, surface from the researching the synergies and differences in UK and Japan?

This was further researched through interviews with four AI experts, that work across Japan and the UK: 1) the Director of Artificial Intelligence Research Centre (AIRC) in Tokyo, Japan, 2) the Director of the National Centre for Text Mining and Natural Language Processing (NaCTeM) and Professor at University of Manchester UK, 3) the Head of Robotics and Manufacturing Theme at Dyson School of Design Engineering, at Imperial College, London and Reader in Design Engineering and Robotics, and 4) the Director of SPiKE.AI and Visiting Lecturer at the Dyson School of Design Engineering, at Imperial College, London, UK. The two most significant parameters that apply to both Japan and the UK, which make the relationship to AI different are:

Intelligence as a Continuum: "Japanese culture sees intelligence as a continuum with the human and AI positioned across that continuum, together with other species. In some tasks AI is ahead, in other humans, or animals are better." This creates a more fluid vision of how we collaborate and work with AI. In contrast there is "a dichotomy in the west and the UK where AI is perceived as good or evil." Popular culture also with comic heroes like astro-boy (Schodt, 2007) has reinforced the "AI as a friend" relationship in Japan.

Relationship with AI strengths: The strengths that AI brings are welcomed in Japan, as a solution to its ageing population which impacts its workforce. Japan has low levels of foreign workforce, hence AI and its robotic materialisations are considered a solution and not a problem. The UK is seen job losses from robotic automation which are hitting the headlines and the well-being of human workers, thus AI strengths are perceived as replacing human strengths and ability.

This different relationship to AI, results in differences in the way AI strengths are designed into work and its acceptance in the society (Ito, 2018). The next section describes the participatory methods used to research through design how human and AI strengths can be designed together in the future of work.

3. Research through design: Our relationship with AI in the future of Work

This research, develops a participatory method using a research through design approach. A participatory method is chosen, as it can stimulate new thinking into our current design paradigms and open up a dialogue between designers and business professionals on how to design work with AI. This is in the form of four workshops with business professionals, involving them as co-creators in the design research process.

The participatory research artefacts, were designed as thinking tools, to help designers and participants research how human and AI strengths can come together at work. These were developed as a glossary of strengths, through the first workshop with business coaches (section 3.1). The participatory research approach was tested through the second workshop with MBA students (section 3.2) and refined in the third workshop with 20 business managers from across functions and industries (section 3.3). The final workshop evaluated the method and explored how it can be used to inform the design of work with AI in a business case workshop with a group of 24 executives from a global steel industry corporation (section 3.4).

3.1 Designing a participatory research toolkit

How can we research the relationship of human and AI strengths coming together at work?

If we are to design the work relationship between human and AI, as a coevolving, collaborative relationship, a good place to start is research into how humans work together. There is a plethora of organisational research tools, to explore and improve the dynamics of how humans work together. One category of these, focuses on individuals' strengths and how these might be brought together more effectively when working in teams. Some of the most researched and well proven ones, used by global corporations and NGOs are Myers-Briggs MBTI® (Myers-Briggs and Myers, 1980) (Jung, 1971) and Belbin® (Belbin, 2010).

Through this research in related organisational tools, an initial glossary of positive traits or strengths was developed. These were translated into a glossary of strengths and designed as a kit of coloured cards, with one word on each card, describing a human strength at work. Alternatives and complementary of this glossary of words, was tested through a one-hour workshop with six business coaches, accredited to work with MBTI® and Belbin® typologies.

Figure 2. Developing a glossary of human strengths, designed as a set of 50 cards.

For this workshop, an initial set of coloured cards were complimented by blank cards, which the participated business coaches used to add words or change existing ones. For example, "bossy" which is used in (Shapiro, 2010), was changed to "assertive" and words such as "detailed" or "rigorous" became part of the glossary, as shown on the left and right images of Figure 2. The choice of brown in the initial colours, which were blue, green, red and brown, changed to yellow and orange hues, as brown was perceived as dull to represent people's strengths, in comparison to the other colours (see central image in Figure 2). This resulted a kit of 50 coloured cards used as a form of participatory artefacts and a thinking tool throughout the research practice.

3.2 Testing the Design Research Kit

These participatory artefacts, were further tested in an hour-long workshop with a group of four, part-time MBA students at Westminster Business School. This group was chosen, as they are working managers and students at the same time and in the point of considering their future careers and work beyond the MBA.

After a short introduction on the future of work and how this might change because of AI, participants were invited to choose from the set of 50 cards the strengths that best describe them. The choice was restricted to 5 cards, as the intention is for participants to narrow down their selection to their most valued strengths. Participants were then asked to look at their cards and think which of these strengths AI could also have in the future. Participants dropped these strengths from their hands to a black board, as shown on lower right image in Figure 3. The black board was chosen because, according to the literature review, AI remains a black box, in terms of our understanding of how it reaches predictions and decisions.
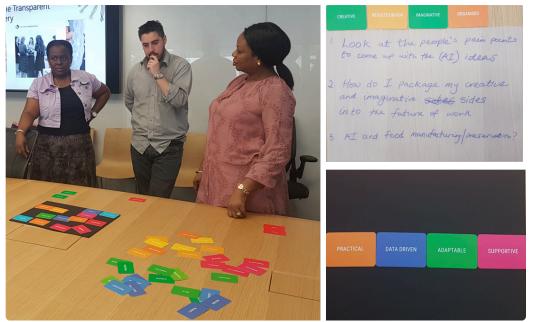

Figure 3. Participants reflect on AI strengths (left and bottom right) and their career options (upper right).
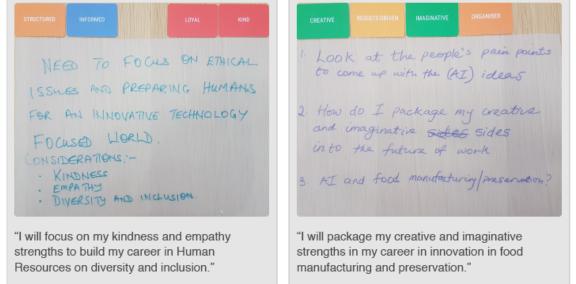

Figure 4. *Participants' reflections on their strengths and how they can best use these in the future of work with AI.*

Participants discussed what it means for them and their own strengths and how they might develop these in the future. Participants were given time to write down how they might grow their strengths in their future careers working with AI, as shown in Figure 4. One participant, for example, decided to focus on their

"kindness" and "empathy" to build their HR career on "diversity and inclusion", while another chose to "package their creative and imaginative strengths" in their career in innovation in "food manufacturing and preservation."

Key findings are: a) it enabled participants to surface their own strengths and which of these are most important to them, b) removing cards from their own strengths reinforced the negative, fear element about AI, c) participants needed a warm up step to familiarise themselves with the words on the cards, as presented all 50 of them was a lot of information to absorb as a first step and d) the reflective and group discussion time allowed rich insights into how participants view their future work with AI.

3.3 Refining the design research approach

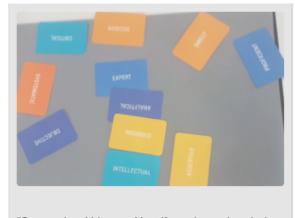How can this research exploration surface human preference in AI design?

The glossary and participatory research methods were further refined in a third workshop of one and a half hours long, with 20 business managers attending an Agile Management Conference.

Based on the key findings from the previous workshop, a warm up game was introduced to familiarise participants with the words on the cards. Participants are split into groups of 5 to 6 people, each dealt with 5 cards. Participants first exchange cards with others in their group, to end up with five cards that best represent their strengths. The remaining cards are spread on the table with the words visible to all. Participants can drop a card from their hands and pick up one from the table, ending up with five cards that represent their most valued strengths.

Participants then choose from their own and the remaining cards on the table, the strengths that they would like AI to have, to work better together with them. These are placed on a black board, as before. Therefore, participants design the AI as "a board of strengths". They are given time to reflect and negotiate their own preferences and those of others in their groups into a final design. Groups present their AI designs, with time to reflect and debate their designs with other groups (see *Figure 5*).

Figure 5. Participants design AI using the rethinkAI™ glossary of strengths and participatory research method.

Figure 6. Reflecting on human strengths in the future of work

AI designs across groups were different, shown in *Figure 6*. For example, one team designed AI as "Loyal, "Friendly, Supportive", because as the group articulated, "AI is supportive to the user, so technology is a friendly access to services offered. AI is playing a supportive role." Another group designed their AI as "Analytical, Objective, Structured" because, "we like to design AI to be friendly and supportive, but as a human if you have a machine that is supportive and empathetic, and you have a friend, where would you go? I would say, we would always go for the human."

Key findings are: a) framing this research as designing the AI they would like to work with, creates positive dynamics and energetic conversations, b) the warm up game helps participants familiarise with the glossary of strengths c) the group conversations and reflections allow participants to surface and debate their preferences and biases towards AI, building up rich insights for designers and d) empowers participants to become designers of their own AI, defining it through a set of strengths and according to what they would like AI to do for them in the future of work.

3.4 Validating with industry - Designing work with AI

How can this research exploration inform the design of work with AI?

The fourth workshop was a half-day workshop with 24 Chief Finance Officers (CFOs) from a global steel corporation. The participants were CFOs of national divisions within the multinational. CFOs are chosen because they are leading important business decisions on how AI is integrated into work, due to the economic drivers for AI use in business. The aim of the fourth workshop was to evaluate the research approach in a business case and test how a participatory approach can create help surface and negotiate the ethical issues of those decisions. It further explores, how business professionals in communication with designers can use this research approach to design their work with AI, as a coevolving relationship.

To frame this in an intelligence continuum and as a co-evolving relationship, the metaphor of the octopus is used for designing work with AI. The octopus's nervous system is distributed, with octopus tentacles so packed with neurons that it is as if there are "thinking" independently and with their bodies (Montgomery, 2015) (Godfrey-Smith, 2017). This distributed, embodied intelligence resembles more closely the way that AIs are integrated into our workflows and business systems, connecting with other AIs and learning from humans and large data sets distributed across businesses. This reframed the design of work with AI, as designing the human and AI strengths working together in a distributed and yet collaborative relationship (see *Figure 7*).

Figure 7.The Octopus metaphor in designing a collaborative and co-evolving relationship

Participants first designed their AI as a black board of strengths, as before, and then redesigned one of their finance functions, involving dynamic pricing for complex combinations of steel materials and products currently done by experienced sales and finance experts, to work with AI. They designed three phases of this integration, based on the capabilities of the AI system in each phase: a) initial, b) learning and c) autonomous. The first phase is the introduction of AI, the second is the learning through humans and data and finally the phase of AI as more autonomous making decisions. Participants used the cards to design the human and AI strengths in each phase and how these would work and evolve together as AI strengths change through these phases.

They further debated ethical issues and reflected on job losses and skill changes, as well as a process for negotiating AI autonomous decision making and human control. Finally, they used the cards to reflect on which skills would be required, that the teams do not currently have and an initial plan to reskill and redeploy people in jobs. Due to commercial confidentiality the full details of the function or the solution cannot be disclosed.

Findings: a) the use of the research kit created again a dynamic, positive energy and produced rich insights for designing work with AI, further validating the contribution of this participative research approach b) it stimulated a dialogue about job changes and reskilling c) it helped participants debate ethical issues when designing work with AI in communication with designers e) the HR Director who also attended the workshop suggested that the kit can also be used as a team building tool.

4. Discussion and further research

Recent studies on the impact of AI in the UK, estimate that AI will automate 7m jobs over the next 20 years, but also create 7.2m (Ernst & Young, 2018). Furthermore, the view that AI revolution will work best when it complements human skills, and future jobs will rely on humans utilising unique strengths, such as creativity and empathy (PwC, 2018) is put forward. However, the socioeconomic theories and perspectives from which these reports originate are not questioned or debated within the businesses and when AI is impacting jobs and human work. RethinkAI™ puts the human in the centre of designing work with AI. It aims to explore our relationship with AI at work and to stimulate new thinking in our design paradigms. The paper describes the development of a participatory method and research kit, to help designers explore how human and AI strengths can be designed together in a coevolving, collaborative relationship.

The paper explores initial findings of the development and use of this participatory method with promising results. However, there are limitations to be addressed by further research along two dimensions: the educational and the cultural. How can design education take advantage of these insights and participatory method to inform current paradigms of human and AI interaction and AI design? This is currently pursued with an ongoing research study within a postgraduate transdisciplinary design research educational context. A further investigation relates to how cultural differences affect AI and design across the globe. This focuses on researching the ontological complexity that AI's evolution brings to the future of work. This line of research is currently explored within the scope of design research and executive education in UK and Japan. Designing the relationship of humans and AI at work remains a significant topic of research and the work presented in this paper is a timely investigation of this research topic.

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