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Human - Centric AI: Real Time interaction and Analysis in Public Spaces

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ABSTRACT :

Artificial Intelligence (AI) is a technology that has touched industries through its operational advances, increased efficiency and its working through computational problems. Nevertheless, these advancements of usage of AI technologies invoke some issues related to ethical decision making, user access, and social processes. HCAI has been developed to respond outweighing these challenges by considering human values, needs and capabilities incorporated in designing and developing AI systems. Underlying the remainder of this paper, this section defines HCAI, compares it to preexisting AI methods, and discusses its ethical, societal, and technological factors.

The research systematically reviews the existing literature, and selected case studies and derives a classification scheme for HCAI approaches and the proposed taxonomy of AI systems, along with fundamentals of developing dependable, safe, and trustworthy AI systems. These results underscore the values of understanding customers, open communication as well as involving them in the AI development. Examples of HCAI use in healthcare, education, workforce management, and customer service demonstrate the application of that technology.

Keywords: Human-Centered; Artificial Intelligence; Design Research; Principles of HCAI

INTRODUCTION

This's that field of computer science that's related to researching and creating algorithms with behaviors or capable of completing tasks that only a person, in real senses, would understand how to get done in a way to be referred to as intelligence. The principles and approaches applied in current computer systems range from Siri to Alexa, among many more. Recently, several AI perspectives have suggested that AI technology would replace human labor in many industries, making all the human resources currently in place irrelevant to workers.

For many philosophical schools, the possibility of autonomous AI systems has long been alerted and debated. The risk also includes biased decision-making due to wrong data input or lack of it. This led to the formation of several human-centered AI research labs, which are supposedly meant to find how this more human-centered approach can be integrated into existing AI systems.

Human-centric AI is a sub-classification of AI and ML, that is vastly more evolved within the modern world. There needs to be an understanding developed at every point about the intelligent systems being developed which are part of a more vast system. In this context, human stakeholders such as the users, customers, and operators, among thousands of others, play pivotal roles. To date, two of the primary methods used in the practice of artificial intelligence happen to be machine learning and deep learning. They contain data, and people use them, and companies along with governmental organizations use to develop predictive models. Now, the techniques of automated learning are developed and can also handle the complexity and unpredictability of information in the industrial sectors, food sectors, biomedical sectors, and aerospace sectors. The inclusion of the principles of ML and DL, together with some advanced optimization techniques into the industrial processes helps the practitioner steer through the current problems better with higher accuracy and efficiency.

Modeling in the use of data in building up predictive models for individuals, organizations to governmental agencies. In the designs under current methods of automatic learning, it is designed such that it can handle complexity and uncertainty in a data item from the different industrial fields on food, biomedical, to aerospace. This will make practitioners go out pretty well equipped to meet the current challenges at high efficiency in accuracy by the infusion of principles of ML and DL with principles of modern optimization into different industrial operations.

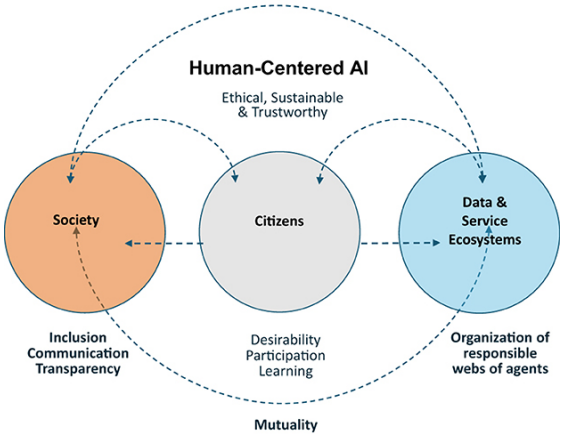

Figure 1.1: Human-centricity in AI

This has led to advanced approaches in cognitive computing and deep learning for automated applications, such as visual inspection, fault detection, and maintenance in manufacturing systems at the industrial level. Deep learning approaches are very actively used in production systems-from supply chain to manufacturing programs-and guarantee the highest quality and safety in multiple sectors, including public policy and public administration.

What is Human-Centered AI (HCAI)?

Human-centered AI, simply put, is the development of AI technologies in such a way that human needs, values, and capacities are placed at the core and center design and operation of the created technology. Teams ensure that they develop AI systems that improve human capacity and well-being and not replace or weaken human positions. It considers the ethical, social, and cultural implications of AI and provides systems that are accessible to and usable by all parts of society as a benefit. HCAI is related to a discipline called Human-AI interaction that explores communication and collaboration between humans and AI.

Human-Centric AI promotes an interdiscipline design and development process quite often involving psychologists, ethicists, and domain specialists in designing open, explainable, and accountable AI. It actually finds a place in broader directions for ethical AI usage because of its focus on the recognition and observance of human rights by use of AI systems.

This paper explores the two philosophies relating to AI: Winograd's rationalistic and design approach in 1996. It explains the philosophies used, and subsequently the related perspectives and how they operate in forming the developments and use of human-centered AI. It then leads further into explaining in detail humanistic design perspective, while further explaining some approaches relating to Human-centered Design approaches applied in AI development.

HCD research is the general term which covers all that research approaches which place persons at the heart of a design process. The paper pays attention to humanistic design perspective, since the rationalistic approach is overvalued, which occurred from the mid-20th century advance in pure science and technology (Winograd, 1996). In general words, design, development, and innovation of HCAI needs an approach which spans all disciplines and integrates them as one whole or pan-disciplinary design approach.

Why Is Human-Centered AI Important?

The involvement of users actively in the process of development makes it possible to have human-centered design in AI. Therefore, human-centered AI is important because it guarantees that the AI systems are focused on human needs and values. This leads to more effective and ethical solutions because diverse perspectives and expertise are harnessed in the process. That might even be when the groups can figure out and at times ameliorate the biases inherent in AI algorithms and would therefore lead to more equitable results.

Human-centered AI builds acceptance and confidence in the minds of users. People tend to accept and support them when they understand and realize the potential of AI. Thus, that trust is an imperative prerequisite for the smooth amalgamation of AI into daily life.

Human-Centered AI vs. Traditional AI: What's the Difference?

Traditional AI Focus on automating a job for efficiency. A human-centered AI, however, focuses on the needs, values, and capabilities of a person. Unlike most traditional AI, human-centered AI aims to augment human capabilities rather than replace or eliminate them. Thus, this design philosophy accommodates and respects the needs of a human while building accessible user-friendly AI systems that will be well-aligned with ethical standards.

In HCAI, the involvement of users is taken actively to the design process so that it creates solutions finely tuned to the needs of the real world. The ethical considerations in HCAI are privacy, fairness and transparency, the prevention of biases, accountable and explainable AI decisions. HCAI is an adaptive and learning system aware of contexts. HCAI has integration with psychology, sociology, and design for better understanding of human-AI interaction. Some examples are discussed below to illustrate the comparison between HCAI and traditional AI:

- Personalized learning systems: Traditional AI may be more inclined toward automating grading or any general educational content. In that case, HCAI designs an adaptive learning platform in a manner so as to modify content and teaching style according to an individual's learning pattern, preference, and requirements.
- Health care: Traditionally AI may tend toward efficiency to process the data as well as to follow the procedures in diagnostics. Meanwhile, HCAI should contribute to finding the treatment and toward the patient comfort along with their confidentiality and psychoemotional well-being as well. Thus, gentle-like AI therapy tools can be issued that are friendly concerning their processing of the psycho-state of a person.
- Automobile industry: In this case, old AI may have targeted fully autonomous vehicles. HCAI approaches it differently and will try to build ADAS systems that improve the safety and comfort of the driver. Technology is serving the driver and not replacing him. The ADAS system can easily adjust to the personal style of the driver and provide intuitive support in a harmonious human-machine interface.
- Smart home devices: Again, the classical AI would probably focus most of its energy on the automation and regulation of household appliances. HCAI designs a smart home system in learning with and adapting to its users' habits and likings. It produces not just an environment that is just efficient but also comfortable and even amenable to the comfort of those it houses.

Artificial intelligence holds unprecedented transformative power for industries and societies. Such a degree of transformative power stimulates a person to think seriously as to what this could probably mean for people, their ethics, and well-being. The European Commission, Massachusetts Institute of Technology, Stanford University, and others have each dedicated themselves fully in designing and developing artificial intelligence with applications for good use. A High-Level Expert Group of the EC suggested ethics guidelines for trustworthy AI (EC, 2019). Article develops humanistic perspective in design and number of Human-centered design approaches and their role in the creation of AI; HCD research as superseding term encompasses all the range of research approach centering people in designing. The article dwells on the humanistic design perspective mainly because of the over valuing of the rationalistic approach that grew up around advances in pure science and technology of the mid-20th century (Winograd, 1996). It concludes the article by stating that the required approach to design, develop, and advance human-centered AI is either comprehensive or pan-disciplinary. The paper includes the following objectives:

Literature in Human Centered AI:

- Classify Human Centered AI from Literature Review
- Tabulate and graphically report the classification results
- Present future directions of Human Centered AI

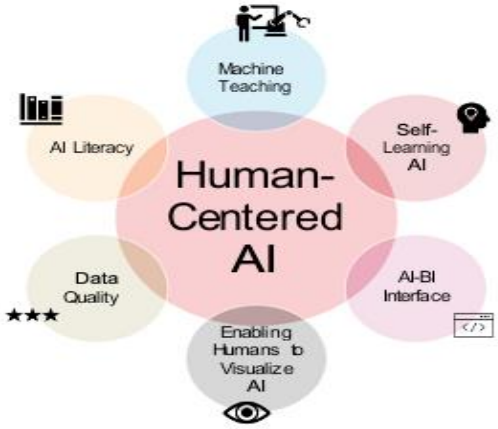

Figure 1.3: Human Centered AI

Background

The Artificial Intelligence systems and technologies including machine learning, natural language processing, expert systems, and robotics have evolved and changed over the past 80 years since Alan Turing put forward his Turing-Test in 1950, Crevier, (1993), Grudin, (2009). Over time, two clear philosophical standpoints have emerged on this question of whether humans and computers should interact on what grounds. These two standpoints are the "rationalistic" and "design" outlooks, Winograd, (1996); Grudin, (2009); Lieberman, (2009); Winograd, (2006). Actually, this controversy between these two philosophical positions or scientific and humanities cultures has gone on for many years since AI was invented, (Snow, 1993). Actually, this is a duality of approaches that have been there since the very beginning when AI was first developed. On one side, there was John McCarthy ("rationalistic"), and on the other side, Douglas Engelbart ("design") (Markoff, 2005; Winograd, 2006). Rationalists speak AI in summary as theory and development of computer systems that simulate human abilities such that these systems can perform jobs requiring human intelligence.

This mainly focuses on advances within the fields of mathematical and technological aspects. What human is, according to Winograd, 2006; Winograd & Flores, 1986; "The cognitive machine." A point made on this view having roles so far in AI research involves its involvement in the construction and

developing methods on how statistical language, neural networks, and learning machines work in terms of how an adaptive mechanism of AI has its mechanisms, Winograd, 1996.

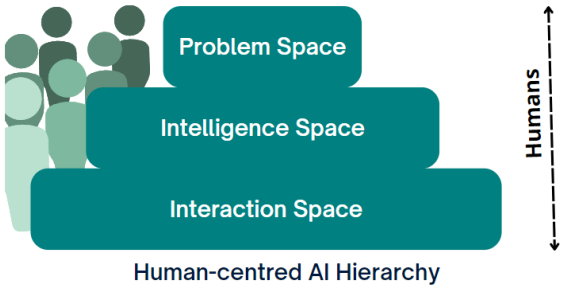

Figure 2.1: HCAI Hierarchy

AI helps monitor and manage production processes comprehensively and not only replace dangerous operations but also helps people so that they put at the core of the process using a specific approach known as human-centered.

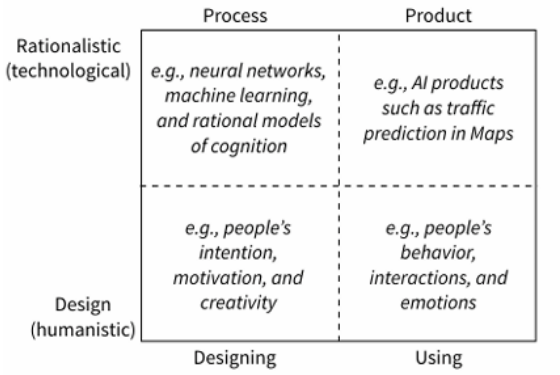

Figure 2.2: illustrates the spectrum of the rationalistic view and design perspectives.

There are many such examples, like how Apple, Google, and Microsoft companies consider human-centered approaches to create artificial intelligence software. The company has replaced standard robots with AI-based collaborative robots, or cobots, which allows for more efficient production of customized cars. IBM Watson has come up with a system that can suggest treatments for cancer according to the most commonly recommended treatments by the doctor. AI and sensors provide real-time technological progress that enables the shipping industry to enhance safety, cut costs, hence enhance productivity in international trade, embracing a more intelligent and sustainable future.

HUMAN-CENTERED AI DEVELOPMENT

Human-centeredness and AI are mentioned in many related concepts in scientific literature that focus on various dimensions of taking into account the needs, values, and capacities of humans in relation to AI-based technologies.

Although the idea of what human-centered AI is may vary in detail, the argument about human-centered AI is, in essence a theoretical one and characterized by negotiating the balance between humans and technology, which is balanced or is not.

Human-centered AI development focuses on the consideration and embedding of the needs of humans and the human perspective in the AI development process and beyond (Auernhammer 2020). By doing so, human-centeredness cannot be overlooked after the deployment and training of an AI-based technology but on the full AI cycle that ensures it meets and complies with set principles regarding human-centered AI among other explanations of transparency standards on the ethics of non-discrimination concerning fairness mechanisms, trust, and accountability as well as its sustainability (Hartikainen et al. 2022).

While building AI, discussion around human-centeredness calls for considerations of perspectives. More critical than a view toward the needs of its eventual users is a view over a possible result of AI decision-making while building tools associated with AI. There are different conceptions of differentiation in regard to the needs of different stakeholder groups and how reflection of their roles manifests while moving toward adoption of AI. Langer and Landers 2021, suggest that within the complex network of parties involved, there should be distinction between the parties regarding handling automation and AI.

First party, second party and third parties. The First party uses the system. They make decisions, decisions that then affect other persons. In that regard, affected persons may be considered as a second party. Very often, no consent nor even knowledge of this party to be affected by AI systems exists. They may feel like a second party but are not directly affected. They understand and perhaps fear the effect that AI-based systems might have upon them and their own work. In most cases, in an AI-based technology company, it is not very clear which entities belong to which party. Such classification according to three parties is interesting in reflecting over the problem of how one could meet human needs and requirements.

What these best practice approaches thus show is that stakeholder groups and individuals are in no way tied to this classical user/non-user distinction during the development of AI and its implementation. All those who are going to be or have to live with effects of it will have to be addressed through an integrated, human-centered approach. Therefore, a strict methodological procedure the change from the conceptual basis to practice of human-centeredness will involve, and it is subject for the section that follows.

3.1 Research design for the analysis of human-centeredness in DSR

Based on our parallel work on ten parallel pilot projects, we defined the research objectives and converged into one formulated research question. Then three examples of use cases were developed, implementations including their status and ways of comparing some of the action-steps conducted, their diversity in terms of companies, their size, and the level of digitalization. All documents prepared and collected in each of the three pilot projects made up detailed step-by-step analysis for each of the process steps, the first four of DSR. Input into the systems of AI and connection they pose to work systems, which - cutting from company structures once more to subordinate classes after the suggestion of Niehues et al. (2023). The results of the analysis were syntactically summarized, and the best practice guidelines for the actionable human-centric DSR approach were distilled.
It reflects on the approach to the design and under which the overview was conceived to acquire best practices or guidelines in action by the practitioners, with systems-based and interdisciplinary approaches to each of the three pilot projects.
Each of the remaining pilot partners had researchers-a pool of "Ergonomics", "Data Science", "Factory Planning and Intralogistics", and "Service Engineering"-all with the thought of holistic view or design combining the methods from all the represented disciplines though for the leading idea of human-centered AI development and implementation. According to the definition set in DSR, development of the AI continued further with applying the HCI-DSR standard guidelines following the problem identification on four phases.
This would design procedures that take response from the structure of an environmental problem, thereby making it apply systematic ways to approach such understanding that would make the researchers take the information as a basis to which the DSR practice can be viable for designing real-life scenarios. The DSR Methodology defined six steps in the process of generating design knowledge:

1. Problem Identification and Motivation: The first step is on problem formation; it creates the fundamental precondition and reasoning behind developing a solution.
2. Goal definitions in the way to a solution: It is the problem statement that, with the demands, further helps define some goals as well as some logistics toward an artefact-development possible solution.
3. Design and development: This third step refers to the work done on the artifact, which means both conceptual design and development/construction.
4. Demonstration: The developed artifact is demonstrated on how it supports the solution of the problem in question, for example "in experimentation, simulation, case study, proof, or any appropriate activity" (Peffers et al. 2007).
5. Communication Communication is the final step that ties together all the process of iterative designing and development of an artefact and forms a scientific publication representing all phases of design and development process.

3.2 HCAI framework for Reliable, Safe and Trustworthy Systems

This is the idea for Reliable, Safe, and Trustworthy systems that was intended to enforce AI systems whose guarantees assured both effective computer automation as well as effective control from computers.
One of the major concerns behind RST systems is performance. RST systems have three pillars that support them:

1. Establishing an adequate technical basis on which system dependability can be anchored.
2. Governmental policies or methods to inspire and promote a safety culture.
3. Mechanisms of independent oversight that will instill trust.

Dependability is measured by the observed history of past system behaviour. Safety is primarily led by management policies and practices. Reliable organizations such as government and professional bodies recognized must be independent and known. Practitioners working with AI systems almost always desire to be in control of the systems with as little effort as possible.
The human element in interaction has to be developed and defined. This could potentially be a gigantic indulgence for AI developers to have, especially while building or inventing AI systems. Not being fixed on targeting such a one-dimensional conceptualization of autonomy, there are still a number of arguments for more stances to be taken into consideration on the very subject. Shneiderman 2020 offers an analogy of a 2D perspective on autonomy relevant in many AI systems. These may either be recommenders, consequential or critical to life.

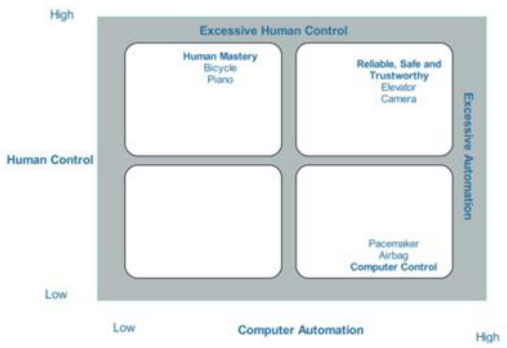

Fig 3.2.1: The 2-dimensional perspective of autonomy

As shown in the picture above, there was so much human control or interaction at this point and almost no computerization. For instance, this would include a bicycle because without human input, all motion of the vehicle is impossible to occur. Devices with high computer control are those that feature more computers.

PRINCIPLES OF HUMAN-CENTERED AI DESIGN

Key principles of human-centered design for AI follow from

• Empathy and understanding for users

It is important to consider the needs, challenges, and contexts of users. Designers should be empathetic to the users in order to develop AI solutions which give tangible feedback to problems and improve human beings' lives for the betterment. For example, an HCAI application in healthcare is developed based on deep interviews with the patients and doctors.

• Ethical Consideration and Minimizing Bias

Three ethics are involved with human-centered AI: privacy, transparency, and fairness. Such transparency and willingness to go out actively in search for bias in the algorithms incorporated within the AI must reflect the commitment of a designer to achieve an appropriate and just outcome for every user.

• User in the design process

Involvement refers to all the stakeholders of where the AI system produces a real-user benefit whose designing perspectives had been articulated while designing and getting involved with the whole process.

•Accessibility and Inclusivity

AI systems shall be made usable and accessible to everyone regardless of age, size, ability, or disability. Equitable sharing of benefits accruing from AI. Text-to-speech-an example of which might appear in an AI-enabled learning platform.

•Transparency and Explainability

Users should know how an AI system makes its decision. The banking AI system is transparent to the user about what kind of analysis is being done on data while giving investment advice. Hence, transparency helps in building trust and awareness of recommendations released by the AI.

Balance between Automation and Human Control

AI can substitute so many things provided there is a balance between the human beings who are in control; so long as such very critical decisions are done by humans. The balance ensures the human is not replaced but rather an amplification of human capabilities by the AI system. For example, a human is assigned the role of takeover manually and an autonomous car provides the navigation. It assures the security and ensures a human element is in charge at those crucial junctures.

The above portrays the critical need for a multi-disciplinary approach in which different sectors and roles can communicate with each other, showing pros and cons and varying perspectives AI use offers. Then I developed the following for these forms the guiding framework of my study: research questions (RQs).

- What can the human-centric AI approach in general expect to bring about for the industrial sector, and what does that mean for manufacture?
- Which literature can be referred to as related to the human-centric such that it enables the realization of the vision of Industry 5.0, and what matters for focus?
- Deciding Authority role in the adoption and implementation of HCAI: Industry 5.0 and the circular economy
- How to work together and take advantage of the synergy arising from mutual activities collaboration in the HCAI field of industry?

Apart from identifying the challenges, recommendations may be proposed as future research directions and priority areas of focus for the industry as well as for the HCAI development. More than anything, though, it's a call for a multisectoral approach that will facilitate interaction among the various sectors and agents and highlight the pros and cons of adopting AI. The paper will derive from the significant theoretical issues relevant to the human-centric artificial intelligence concept of Industry 5.0 and a circular economy, which will make it determine the possible role a decision-maker may play. By so doing, a methodology approach will combine with the methodological approach with rich content, by qualitatively exploring the impacts.

and implementations of HCAI in these domains. This, along with the thorough literature review targeted toward the scrutiny of key practice challenges of smart manufacturing and the importance of decision-makers and focusing attention on the directions and needs of future research.

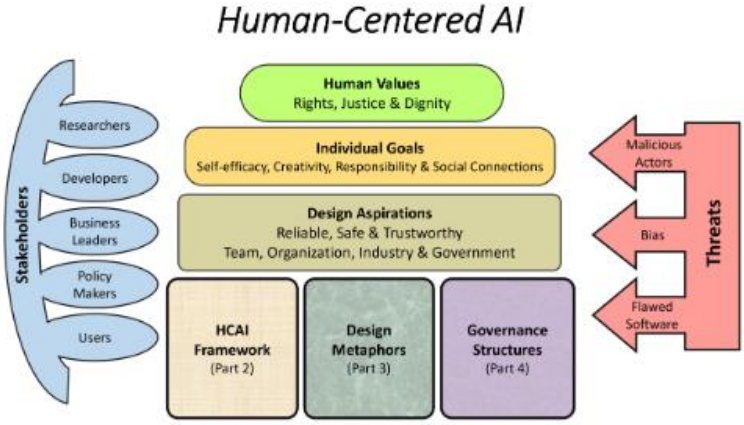

Figure 4.1: Human-cenetred introduction lab

Artificial intelligence [AI] thus strives to achieve proper development in terms of efficiency, sustainability, and competitiveness within the industrial and manufacturing sector. The human-centered approach of AI will ensure that engineering technologies and systems are safe, ethical, and beneficial for people involved in the industry.

Therefore, the industrial-manufacturing industry requires a more integrated view of its current state. The first step would be understanding how AI was designed within the engineering, computer science, and statistics contexts; they were fundamentally associated with data management and handling as ways to better the manufacturing process. There is much unstructured data coming from multiple sources, including sensors on the machines, production lines, production execution systems, and enterprise resource planning systems.

PRINCIPLES OF HUMAN-CENTERED AI DESIGN

Artificial intelligence [AI] hence hopes to see an appropriate improvement in terms of efficiency, sustainability and competitiveness in the industrial-manufacturing industries. A human-centered approach toward AI provides engineering technologies, along with systems, in being safe, ethical and beneficial for people engaged with the industrial sectors. For that reason, the industrial manufacturing industries seek a wide-angle perspective over the entire matter as well. At the very initial stage, how AI was deployed in the disciplines of engineering, computer science, and statistics has largely covered the issues of data processing and handling for optimization of the manufacturing process. In any manufacturing company, huge unstructured data is coming from machines, production lines, production execution systems, and enterprise resource planning systems.

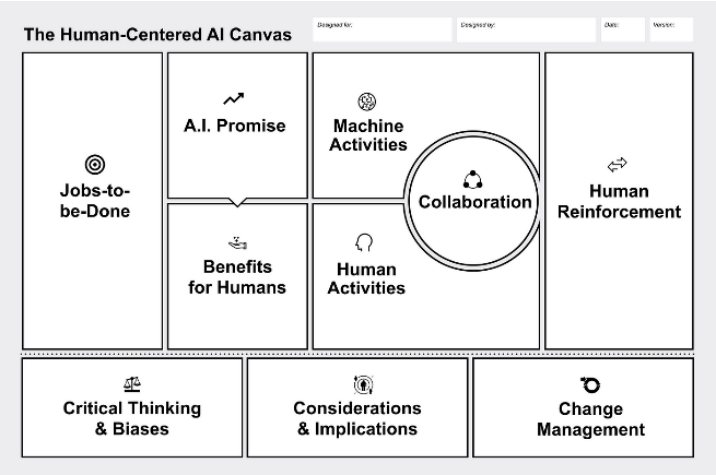

Figure 5.1: Human-centred AI Canvas

Consequently, exploiting HI and AI should refer to using the knowledge of the human, his/her experience, and cognitive processes but pairing them up with AI analytics capabilities.

This means that we designed DSS to support the possibility of both humans and AI responding to crucial statements concerning return management. The empirical analysis indicated that HI and AI responses to statements could correspond to or contradict one another.

The combination of possible HI and AI responses is complex and therefore requires an example. Supposing an organization would want to know whether there exists an age group prone to return products more often than others. The response to HI and AI, relying upon human knowledge and experiences, will be either positive-full or mostly agree-or negative-but partly agree or disagree.

The AI response can also be positive or negative. Room in the DSS is provided for more detailed responses, but such details are not pertinent in exemplifying the complexity of combined responses.

Possible answers from humans, as well as from the AI, give us four possible combinations, all important to design a DSS when decision-making needs to be amplified:

1. If both HI and AI responded positively, then both will have the same content hence the chances of making a correct decision are very high.
2. As if both HI and AI returned with negative results. Well, their answers are similar; they bear the same message thus the likelihood of taking a right choice will remain so also. However, the kind of choice reached this way will differ from the choice taken above.
3. If HI is positive while AI is negative, then the two responses are opposed to each other as well. The decision upon that basis then remains inconclusive thus requiring more time and energy to find out what happened that resulted in such an outcome.
4. That HI comes back negative while AI is positive also means the response is opposing each other, and so one needs to dig deeper to find answers.

The empirical evidence depicted that designing for enhanced decision-making integrates both HI and AI. A firm quoted as follows: "I like that HI brings contextual information and experience while AI brings facts; the two different types of intelligence come together to make superior decision findings compared to either intelligence by itself".

Design Principle 2 – Design for unbiased decision-making

If you are to design a digital DSS for the purpose of HCAI in the context of return management, you are advised to provide procedural support to the DSS for the participation of several roles and the consensus basis for decision-making, since multiple perspectives can help reduce unbiases, uncertainties, and vagueness in human judgment. The empirical analysis revealed that the functional roles at different organizational units that were involved in the process of return management included managing the reverse logistics, customer services, warehouses, and sales.

This led us to devise the DSS with multi-perspective approach so as to minimize biases against response to statements.

During the sessions, it was not strange for participants to disagree on how responses should be formulated to the statements. However, we discovered that most of the discussions were characterized by knowledge and experiences sharing among participants, and the response to the statements was made based on a consensus. It has a collaborative process in which every opinion is represented by different roles, which eventually leads to an agreed-upon decision by all the roles; these are called consensus-based processes (DeGroot, 1974). Similarly, in statements we added AI responses before also. The reason that prompted to build a prototype DSS AI response was based on simulated data.

Generally, it was concluded by the participants that simulated AI and data visualization would help in reducing biases in decision-making.

CONCLUSION

Hence, human-centered AI shall not be viewed as merely a technical extension but also as a bond of morality between the well-being of society and the commitment of fair and moral powering to the human spirit through the use of AI. Instead, it is a strategic and integrating effort in turning AI potential into action for human well-being, cooperation, and ethics. It will give way to the foundation of technological innovation in a society that attempts to set up one with empathy, diversity, and sustainability coming to be quite intrinsically the paramount value.

At this juncture of the AI-led era, principles of human-centeredness must propel our guiding journey as one. In that manner, we optimize the impact of AI so that it will be a continuous benefit for humanity because of our innovation with a commitment towards our future.

This article combines different Human-centered Designs, and how it contributes to Human-centered AI development. The HCD approaches here are beyond that the human-centered AI approaches are very much linked with people namely designers, users, and other stakeholders, their ideologies, practices, activities, interactions, and needs. A true human-centered AI approach is required for the multi/interdisciplinary research consisting of psychology, cognitive science, computer science, engineering, business management, law, and design in order to develop.

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