Beyond the Turing Test Through the Replication of Human Experience

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Abstract

This paper explores the intersection between Artificial Intelligence (AI) and Cognitive Science, analyzing the limits of the human mind and the potential of machines. It examines fundamental theoretical principles such as knowledge, cognition, and reality, drawing comparisons between biological and artificial minds. Furthermore, it discusses the nature of the creative process and the feasibility of replicating human learning in machines, proposing the hypothetical "Marcelo's Test" to evaluate deep artificial intelligence. Finally, the paper reflects on the existential and ethical implications of these advancements for humanity.

1 Introduction

The intersection between Artificial Intelligence (AI) and Cognitive Science has been the subject of intense research and debate, standing out as a crucial area for understanding the limits of the human mind and the potential of machines. The last few years can be described as an era of rapid and continuous technological advances; consequently, the interaction between humans and artificial intelligences has become increasingly common. Such interactions raise fundamental questions about the nature of intelligence, creativity, and the perception of reality.

1.1 Brief History of AI and Cognitive Science

From a historical perspective, as developed by Forbus (2010) [1], although this intersection was more common during their inception, involving, for example, coordination between conferences in Cognitive Science and AI, over time these fields have partially diverged. This separation can be attributed to three main reasons: the diversified scientific direction of AI, financial temptations outside the scientific scope, and the attitude of certain segments of society regarding AI.

According to the same author, the computational hypothesis marks a revolution in scientific understanding, introducing computation as a formal language for modeling minds. The idea that computation can be used as a formal language to express scientific theories is a central point, establishing the foundation for fields such as AI and Cognitive Science. AI, founded in 1956, was the first to adopt this idea, followed by Cognitive Science in 1978.

> "The fundamental hypothesis of Artificial Intelligence is that computation is a useful way to model minds." (Forbus, 2010)

Changes in AI over time can be attributed to various factors, including advances in computing power, representational resources, algorithmic/software resources, and data resources. The increased availability and capacity of these resources have driven progress in AI and opened new opportunities for research and development.

> "Computing power, representational resources, algorithmic/software resources, and data resources." (Forbus, 2010)

The future of AI is promising, with predictions that the next 30 years will see significant advances toward human-level artificial intelligence. This perspective includes the creation of intelligent systems that operate flexibly in the real world, interacting and learning continuously with human beings and the environment. These advances will be driven by insights from Cognitive Science, especially through large-scale cognitive simulations.

> "The next 30 years are going to be extremely exciting for AI researchers." (Forbus, 2010)

1.2 Motivation

As discussed by Dwivedi, Hughes, Ismagilova, *et al.* (2019) [2], artificial intelligence has the potential to revolutionize industries and society, but challenges and research agendas must be addressed to ensure the success of its application and its future impact.

Among various challenges that AI has brought over time, the exercise of conceptually understanding its meaning is highlighted, considering how something so fundamental can have such an unclear and shifting definition across diverse areas. This gap was addressed by Silveira and Lopes (2023) [3], where they refer to the lack of consensus on the definition of the concept of intelligencea definition relevant to beginning a discussion about artificial intelligences, artificial minds, and biological minds.

Therefore, the motivation to explore this frontier of intelligence is evident when we consider the social, ethical, and philosophical implications of AI, as well as the gaps that still exist in the definitions and deliberations of certain concepts. Given the increasing capacity of computers to perform ever more complex tasks, the need arises to understand the limits and possibilities of these technologies. From the capacity of machines to understand and respond to human emotions to the prospect of developing consciousness, advances in AI challenge our traditional conceptions of what it means to be human.

In this report, a critical analysis of the implications of AI for human cognition and our perception of reality will be conducted, traversing fundamental concepts and questions such as the concept of intelligence and comparative analyses. By examining such questions, it is expected that the present work may contribute to a broader debate regarding artificial minds versus human minds.

2 Theoretical Principles

According to the work of Silveira and Lopes (2023), intelligence is the capacity of an agent to process external and internal information to adapt to the environment and decode this information into output actions, despite divergent definitions in the domains of computational intelligence and psychology.

Although this definition seems complete, in order to generate more discussion about this critical concept, fundamental concepts underpinning intelligenceboth human and artificialwill be explored: knowledge, cognition, and reality. In particular, their definition and critical analysis will be addressed, examining different perspectives and the complex relationships between them.

2.1 Definition and Critical Analysis

2.1.1 Knowledge

In this section, the concept of "Knowledge" will be explored in light of the reflections presented by Segundo (2002) [4]. This article highlights significant changes in the understanding of knowledge, especially as new forms of information technology emerge and influence our traditional view.

One of the relevant points in his work is the emphasis on the concept of knowledge as something rooted in our cultural history, especially in the development of writing and language systems. That is, writing not only reflects accumulated knowledge but also shapes our cognitive and social structures.

The transition to a digital information society has brought new challenges and opportunities to redefine knowledge.

It is certain that the nature of knowledge and its relationship with reality has been a subject of attempted understanding by various thinkers and philosophers throughout history. From ancient philosophers to modern thinkers like Descartes and Kant, knowledge has been the object of deep investigation and debate. Evidently, technological and scientific evolutions have brought new forms of practical and theoretical knowledge, challenging traditional conceptions.

> "In ancient Greece, the problem about what knowledge is was confronted in close relation with the issue of what reality is, so the terms wisdom, science and epistome were used on the one hand and knowledge and logos on the other." (Segundo, 2002)

Although it may be difficult to distinguish information from knowledge, Segundo presents a possible definition.

> "For many authors, it is extremely difficult to distinguish between information and knowledge. It can be said that knowledge consists of ordered and structured information." (Segundo, 2002)

In other words, while information can be seen as isolated data or facts, knowledge involves the ordering and association of this data within a pre-existing scope of human understanding. Such a distinction is relevant, as it suggests that knowledge is a more complex and integrated process than the simple accumulation of information. It emphasizes that knowledge is not just a static product, but a dynamic process of interaction between the individual and their environment.

While complex, the author notes that information can now be processed and accessed in unprecedented ways, leading to the emergence of new forms of productive knowledge. That is, the rise of electronic information technologies has fundamentally transformed the nature of knowledge, with knowledge no longer being exclusively human, but also something that can be derived from artificial information systems.

> "Given that information technologies, as such, are the material basis for the storage and processing of information, they constitute the foundations of knowledge that would be created if human specialists played the same role." (Segundo, 2002)

Although not related to the concept itself, but rather to the social perception of it, Segundo concludes by observing that knowledge is now valued not only for its accuracy or depth but also for its productivity and utility.

> "The pillars of the new society of knowledge are settling on the basis of productivity and utility, and this has turned knowledge into nothing more than productive information." (Segundo, 2002)

Therefore, in summary, this rich analysis brings interesting thoughts to be developed regarding the comparison between artificial and biological minds.

Being diverse and having historical and cultural roots, knowledge can be seen as difficult to represent faithfully from a computational point of view. That is, how can something with such human characteristics be encoded for artificial minds? In other words, a hypothesis that would make this question simple to answer would be to define knowledge effectively as something as complex as a set of objects, these being information. Something that Segundo criticizes in his article and that other authors have also addressed in their works. According to Hyman (1999) [5], knowledge can be defined as the ability to do, refrain from, believe, or doubt things for reasons that are facts, rather than their origin or form of acquisition; that is, something whose nature is more dynamic and contextual than a pure collection of information. This perspective, together with the social notion of knowledge as nothing more than productive information, leads to questioning whether intelligent systems truly exist today or if such intelligence is merely perceived as such because it is useful.

2.1.2 Cognition

As discussed by Zautra (2015) [6], the conception of cognition is undergoing a significant shift, evidenced by the increasingly common distinction between two distinct notions of cognition. A more refined form of cognition, sometimes called 'higher cognition', is roughly synonymous with 'rational thought' and is generally contrasted with phenomena such as perception and affect. On the other hand, cognition in the more inclusive sense encompasses a broader category of phenomena, such as perception, affect, motivation, and motor control. Ciftcioglu and Bittermann [7], in particular, addressed a definition from a computational standpoint.

> "Thus, from the computational counterpart viewpoint, cognition is to possess the knowledge of relations among entities in any context and manifesting it by a best action in the same context." (Ciftcioglu and Bittermann, 2015)

In other words, cognition is not limited only to the possession of knowledge, but also by the actions manifested by it; being described by other authors as a complex neural process ranging from sensory-motor tasks to decision-making [8].

Such definitions help characterize cognition as something complex and with diverse aspects. Knowledge is built upon prior information, but cognition also gives it meaning; involving the creative application and contextualization of knowledge to solve problems and take decisions, as well as the generation of new knowledgethat is, cognitive processes use existing knowledge and also create new knowledge.

Beyond the complexity involved in cognition, it is certain that human cognition, in particular, stands out from others. MacLean (2016) [9] suggests that human cognition is unique because it is influenced by a combination of representational and motivational factors, similar to what Zautra (2015) described. More concretely, representational factors refer to how humans perceive and interpret the world around them, while motivational factors relate to the emotions, impulses, and goals that drive human behavior. Furthermore, human cognition is shaped by selective pressures and proximate mechanisms. That is, evolution and adaptation play an important role in how human beings think and behave. In summary, the statement highlights the complexity and singularity of human cognition, which is influenced by a complex interaction between representational, motivational, evolutionary, and biological factors.

Therefore, based on the studies above, relevant notions about cognition were presented, namely its composition. The fact that it has diverse layers, from rational layers (termed by Zautra as 'higher cognition'), emotional layers, physical layers (motor control), and the representation layer, becomes relevant for directly comparing the possibility of having artificial minds similar to human minds, should it be possible to concretize such layers.

2.1.3 Reality

In this section, the concept of 'Reality' will be explored in light of the reflections presented by Brandt and Metzger (1969) [10]. This article investigates the complexities surrounding the concept of 'reality' in Psychology, aiming to elucidate four distinct meanings and their implications, based on the work of Wolfgang Metzger and offering a comprehensive analysis of each dimension.

Understanding the dimensions of reality, as explored in the article, is crucial when contemplating eventual differences between artificial and biological minds, particularly regarding how each perceives reality. The four dimensions of reality, indicated in the article as r_1, r_2, r_3, and r_4, were defined as:

- **Realität** (r_1): Refers to a hypothetical world beyond our experiences, which we infer exists based on scientific knowledge and assumptions.
- **Wirklichkeit** (r_2): This encompasses the totality of a person's experiences, including thoughts, feelings, dreams, and perceptions of the outside world.
- **Wirklichkeit vs. Unwirklichkeit** (r_3): This distinction separates things directly experienced (encountered) from things imagined, remembered, or planned (represented).

- **Realheitsgrad** (r_4): This explores degrees of reality versus illusions, emphasizing the subjective interpretation of objects, events, and qualities.

Starting from the definitions of each reality, and considering the comparison between artificial and biological minds, the following questions arise:

- **Realität**: Humans strive to understand the world beyond our experiences (Realität) through science. This thirst for knowledge and explanation is a central aspect of human intelligence. Would artificial minds be programmed with a similar motivation to understand a hypothetical reality beyond their *input*?
- **Wirklichkeit**: Our entire experience of the world (Wirklichkeit) shapes our thoughts, emotions, and behavior, including memories, dreams, and subjective interpretations. Would artificial minds be programmed to dynamically receive these different types of data sources? That is, to develop a broader Wirklichkeit, incorporating a wider range of experiences beyond data processing?
- **Wirklichkeit vs. Unwirklichkeit**: The distinction between directly encountered experiences and mental representations is crucial for human cognition. We can learn from both, but they carry different weights. Would artificial minds be developed to incorporate a concept of "encountered reality" through interaction with the physical world via sensors/tools?
- **Realheitsgrad**: Our experiences have different degrees of reality (Realheitsgrad). Memories can fade, dreams feel less real than waking life, and emotions can influence how real something seems. Would artificial minds be designed to assign "reality" to their experiences, potentially influencing their decision-making or learning?

3 Discussion

In this section, more concrete questions promoting the comparison between artificial and biological minds will be addressed, such as the classification of creative thought and the possibility of a human mind being replaced by an artificial mind.

3.1 Creative Process

The creative process is one of the fundamental aspects of human intelligence, allowing us to generate new ideas, solve problems innovatively, and express ourselves in unique ways.

A study conducted by Marrone, Taddeo, and Hill (2022) [11] focusing on understanding how students view AI and creativity concluded that the majority of students indicated that AI could never match human creativity. In contrast, Gobet and Sala (2019) [12] suggest that AI has demonstrated that computers can be highly creative, opening new possibilities for studying human creativity in the domain of psychology.

> "Developments of AI have been impressive. (...) These developments raise profound issues about human identity; they also pose difficult but exciting questions about the very nature of human creativity and indeed rationality. But they also present novel opportunities for studying human creativity." (Gobet and Sala, 2019)

Therefore, with the advancement of technology, it becomes relevant to explore the following question: can an artificial mind be creative? This section will explore the intersection between the creative process and machine learning, examining whether AI could replicate a creative process.

3.1.1 Reduction of the Creative Process

As seen in 2.1.2, cognition can be given as the process responsible for manifesting the best action for a given context. Thus, the creative process can be seen as a specific cognitive process whose resulting action is something new, unseen, or an action considered improbable for the provided context. And such a definition makes the idea of an existing creative artificial mind more confusing: How could an AI, which tends to replicate existing patterns in its training data, lead to the production of original and innovative content?

On the other hand, the question arises: do humans not also tend to replicate existing patterns in everything they have had as experience (Wirklichkeit)? That is, if we assume that the artificial mind's Wirklichkeit is as vast and diverse as the human one, would the artificial mind not be capable of replicating a creative process?

In other words, do creative processes really exist? Or are all processes deemed creative nothing more than a search through past experiences that in some way resemble the current problem?

Starting from the idea that the creative process can be reduced to an algorithm, this function would be computable and therefore could be executed by the artificial mind. The point of questioning is effectively whether a more significant Wirklichkeit would be sufficient for the functioning of the creative process or not.

3.2 Machine Learning and the Replication of Human Learning Processes

The idea of teaching an AI everything a human being knows, replicating the natural learning process of children, opens a field of intriguing possibilities and raises profound philosophical questions. We can think, for example, how we discover that objects fall to the ground if we stop holding them; how many glass cups we broke until we realized they are fragile? How many times did we feel pain and learn to avoid it? In what way do we learn the rules of our society?

It is indeed interesting to think about how we learn things. How thousands of rules, knowledge, and experiences solidified to form the knowledge base for our rich decision-making. The question that arises is: if we transfer all of an individual's life experiences to an artificial mind, how would that AI behave in different situations? Would it have the same reactions and thoughts as the original human? This perspective challenges how we understand intelligence, consciousness, and the very nature of the human mind.

3.2.1 Marcelo's Test

The Turing Test, proposed by Alan Turing in 1950, is a landmark in the evaluation of artificial intelligence. The test consists of a human interrogator who converses with a human and a machine, both hidden. If the interrogator cannot distinguish the machine from the human based on the conversations, the machine is considered intelligent.

The prospect of replicating the human learning process in AIs raises the possibility of a new version of the Turing Test, "Marcelo's Test". In this test I propose, the AI would receive all of a human's life experiences (Wirklichkeit) and would be subjected to different situations and questions. If the AI responded in a way indistinguishable from the original human, this would mean that the AI not only mimics human intelligence but has reached it at a deep and fundamental level.

3.2.2 The Possibility of Marcelo's Test and the Human Existential Crisis

As discussed in the previous section, the replication of the human learning process in AIs, if successful, would lead to a new milestone in the history of artificial intelligence. A positive result in Marcelo's Test would have a profound impact on humanity's self-perception. If a machine can perfectly replicate the human mind, this raises fundamental questions about the nature of consciousness, intelligence, and human existence itself.

1. If machines can reach a level of intelligence equivalent to humans, does this mean our cognitive capacity is not unique? Is consciousness merely a product of biological complexity, replicable in artificial systems? What could invalidate the idea that we humans are artificial beings?

2. What does it mean to be human? If machines can replicate our mind, what makes us distinctly human? Would it be our morality, our creativity, or our capacity to love that differentiates us from AIs?

4 Conclusion

In summary, the present article explored the fascinating frontier between AI and human cognition, bringing reflections on the limits of the mind, the potential of machines, and the future of humanity. By analyzing concepts such as knowledge, cognition, and reality, thoughts were developed regarding the complex nature of intelligence and the possibilities that AI presents.

Some relevant questions were also developed, such as the question of creativity in AI, pondering whether machines can truly replicate the human creative process. Machine learning and the idea of replicating human learning paved the way for the fascinating "Marcelo's Test", a hypothetical scenario where an AI perfectly replicates the human mind.

The existential implications of such a feat invite us to question our own humanity, which is evidently a rich exercise to undertake.

With the conclusion of this analysis, it becomes clear that the intersection between AI and human cognition is a fertile field for exploration and debate. The questions raised in this article do not possess easy answers, but they invite us to a deep reflection on humanity in the era of AI.

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