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ARTICLE

Intuitive Psychology in an AI Age: The Evolving Landscape of Child Development in the Presence of Artificial Intelligence

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Abstract

This article examines intuitive psychology, the subconscious ability to infer others' emotions and beliefs, its development in children, and the impact of AI. As AI becomes an "external other," children encounter new social dynamics, influencing their understanding of mental states, social cognition, and critical thinking. AI systems like chatbots and robots mimic human responses, raising concerns about distinguishing real from artificial interactions. While AI offers developmental opportunities, it also presents challenges related to empathy, digital literacy, and over-reliance. The paper proposes a comparative study of children in North Yorkshire, UK, and South East Queensland, Australia, to explore AI's effects. It highlights ethical issues, such as AI bias and evolving human-AI relationships, emphasising the importance of responsible AI integration to support children's social and emotional growth.

Keywords: Intuitive Psychology; AI; Child Development; Theory of Mind; Comparative Study; North Yorkshire; South East Queensland

1. INTRODUCTION

"Even before we know the world, we know about the world" [1].

Humans seem to possess an intuitive understanding of how the world works from birth. Decades of research involving infants, children, and adults confirm that these intuitions are not trivial; they are key insights that shape our perception and interaction with both the physical and social world [2].

Building on these foundational intuitions, intuitive psychology specifically addresses how we perceive and interpret the internal states, beliefs, desires, and intentions, of those around us [3]. It seeks to explain how we naturally develop mental models of other people's thoughts and emotions, even without formal training or explicit instruction. Many intuitive psychology concepts in preschool years align with Wellman's [4] belief-desire model, which explains that human behaviour is driven by both beliefs (perceptions and knowledge) and desires (wishes, wants, and needs) [5].

1.1. Importance of Intuitive Psychology in Social Interactions and Relationships

Human beings are inherently social creatures. Understanding intuitive psychology is essential for navigating complex social environments [6]. This ability can help humans to predict, understand, and respond appropriately to another person's emotions or behaviour which underpin everyday interactions, from smooth cooperation at work to deeper connections in personal relationships. Unlike formal psychological theories developed through explicit reasoning, intuitive psychology operates largely at a subconscious level, allowing individuals to navigate social environments with minimal cognitive effort [7].

1.2. Intuitive Psychology in Child Development

The development of intuitive psychology begins in early infancy, with newborns displaying a preference for human faces and responding to emotional expressions [8]. By the age of one, infants engage in joint attention, following the gase and gestures of caregivers to infer focus and intention. Around two to three years of age, children start using words related to emotions and desires, demonstrating a growing awareness of the internal states of others. By four to five years old, they typically pass the false-belief task, a key milestone indicating an understanding that others may hold beliefs that differ from reality.

Traditionally, this developmental trajectory has been driven by interactions with caregivers, peers, and teachers, with children refining their intuitive psychology through conversations, play, and observation. However, the introduction of AI into children's daily lives presents a new variable in this equation [9]. Unlike human beings, AI systems process information algorithmically, responding to inputs without possessing subjective experiences or emotions. Yet, advancements in natural language processing and affective computing have made AI systems increasingly capable of mimicking human-like interaction. This raises a critical question: Do children attribute mental states to AI, and if so, how does this shape their cognitive and social development?

1.3. The AI Age

Over the past 15 years, there has been an explosion of new educational technologies (edtech), aimed at enhancing content learning across virtually all subject areas, as well as intra- and interpersonal competencies [10]. However, since the release of OpenAI's ChatGPT in November 2022, the technological landscape dramatically shifted as Large Language Models (LLMs) burst onto the scene.

The uptake has been extraordinary, far exceeding traditional linear models of technological adoption [11]. AI platforms are also increasingly integrating with other technologies and supporting ecosystems in such a manner that it is fast becoming a ubiquitous feature in the tools people (including children) use in everyday life, for example: Google, Microsoft, smartphones, Grammarly or social media applications [12].

As the prevalence and increasingly multimodal capacity of AI tools brings us to an inflection point in society, there has been a significant response in the education sector, with a recent survey also indicating widespread use within education along with other public service sectors [13]. Physical robots and adaptive web-based systems that learn instructor and learner behaviour and adjust accordingly to improve learning outcomes are also becoming more common in early education [14]. Examples of such developments include social robots which can serve as tutors or caretakers [15] or AI integrated toys which can resemble tools, animals or anthropomorphic designs [16]. It is clear that AI is fast becoming an integral part of children's lives, influencing learning environments, daily tasks and social interactions.

2. EXPLORATION OF THE THEORY OF MIND AS A CORNERSTONE OF INTUITIVE PSYCHOLOGY

Intuitive psychology is closely linked to the theory of mind (ToM). ToM, introduced by Premack and Woodruff [17] to describe chimpansees' ability to infer others' mental states, was later adopted by psychologists to study young children's understanding of their own and others' minds [4]. It is the ability to understand that others have their own beliefs, knowledge, and perspectives [18]. The Maxi chocolate task illustrates this concept: when Maxi leaves his chocolate in the cupboard, but his mother moves it to the fridge, he will still look in the cupboard upon returning because he is unaware of the change [19]. This demonstrates that people act based on their beliefs, not objective reality (ibid.).

ToM serves as a cornerstone of intuitive psychology. It enables individuals to be aware that others have distinct perspectives, emotions, and knowledge [19]. It also directly influences social interactions such as friendships [18]. Research indicates that children with advanced ToM exhibit stronger social skills, including strategic thinking in persuasion, argumentation, and game-playing [8]. Additionally, ToM allows individuals to influence others' behaviour by shaping their beliefs, a skill essential for persuasion and cooperation [19]. Beyond its impact on social competence, ToM is linked to cognitive development, influencing metacognitive learning strategies, academic performance in reading and mathematics, and responsiveness to teacher feedback [8].

Besides ToM, empathy, social perception, and predictive ability are fundamental components of intuitive psychology, enabling individuals to interpret, respond to, and influence social interactions. Empathy allows people to understand and share others' emotions, fostering emotional bonds and social cohesion [20]. Through social perception, individuals recognise and interpret facial expressions, body language, and verbal cues, allowing them to navigate social dynamics effectively. Predictive ability further enhances intuitive psychology by enabling individuals to anticipate others' behaviours and reactions based on inferred mental states, allowing for adaptive communication and conflict resolution [21]. Together, these skills shape effective social interaction, emotional intelligence, and cognitive flexibility, making intuitive psychology a crucial mechanism for understanding and engaging with the social world.

3. MILESTONES IN CHILD DEVELOPMENT AND THE DEVELOPMENT OF INTUITIVE PSYCHOLOGY

Child development unfolds in stages, each marked by cognitive, emotional, and social growth. Early signs of development appear in infancy and become increasingly sophisticated through childhood. The development of intuitive psychology, the ability to interpret and infer others' mental states, is closely linked to these milestones [5]. Key areas such as visual recognition, symbolic thinking, and social understanding play a crucial role in this progression.

3.1. Infancy (0-12 Months): Visual Recognition and Early Social Awareness

During infancy, children develop foundational abilities in visual recognition, imitation, and social engagement, forming the basis for intuitive psychology [8]. These early milestones shape later cognitive and social development by helping infants interpret facial expressions, follow social cues, and distinguish between animate and inanimate objects.

Newborns show an innate preference for face-like stimuli, even minutes after birth [22]. Within the first hour, they imitate basic facial expressions, such as tongue protrusion [23], suggesting an early ability to recognise and respond to human faces. By three months, they can distinguish smiling from non-smiling faces, demonstrating an early sensitivity to emotional cues [5].

Between six and nine months, infants develop gase following and joint attention, essential skills for understanding others' intentions [24]. By seven months, they can differentiate between male and female faces [25]. By ten months, infants engage in social referencing, using caregiver expressions to guide their behaviour [26]. They avoid toys associated with parental disgust and adjust actions based on caregiver emotions, as demonstrated in visual cliff experiments [27]. This marks a shift toward emotional and social understanding, preparing infants for more complex social interactions.

3.2. Toddlerhood (1-3 Years): Symbolic Thinking and Emerging Mental State Understanding

Between 18 months and three years, toddlers make significant strides in symbolic thinking, understanding desires and intentions, and distinguishing between mental and physical states [8]. Toddlers engage in pretend play, a major milestone in cognitive and social development [28]. Through role-playing, they assign emotions and attributes to objects and people, demonstrating an early ability to take others' perspectives. This symbolic thinking strengthens social interaction skills and helps children distinguish between imagination and reality.

By two years old, toddlers begin differentiating between mental and physical realities [29]. They recognise that thinking about a cookie is not the same as physically possessing one [30]. This realisation is crucial for understanding that thoughts exist independently of reality, a foundational step in developing intuitive psychology.

At this stage, toddlers also recognise that others have different desires and intentions [1]. For example, they may offer food they like to someone else, assuming that person shares their taste (ibid.). This behaviour signals an early awareness that others' internal states may not always match their own, an essential step toward perspective-taking and social understanding.

3.3. Preschool Age (3-5 Years): Advancing Theory of Mind and Social Understanding

During the preschool years, children experience rapid cognitive and social development, particularly in their understanding of mental states, beliefs, and emotions [8]. They begin to appreciate

that seeing leads to knowing and develop the ability to attribute mental states to both themselves and others [28]. A critical milestone in this stage is the emergence of ToM, the ability to understand that others can hold beliefs different from reality.

By three years old, children recognise that beliefs influence behaviour, but they struggle with false beliefs, often assuming that what they know must be known by everyone [31]. Between three and five years old, children undergo a radical shift in their understanding of belief [30,32]. By four years old, they grasp that beliefs can be false, differ between individuals, and change over time, even when reality remains constant [31]. This shift is demonstrated through false-belief tasks, where children predict how someone will act based on incorrect information. Passing these tasks around age four signals a fully functional ToM [8]. As they gain experience interpreting others' actions, they come to recognise when behaviour is driven by mistaken beliefs, strengthening their ability to reason about others' perspectives.

Preschoolers refine their social perception, improving their ability to interpret emotions through facial expressions, body language, and tone of voice [33]. They also develop more sophisticated deception skills, suggesting an advanced understanding of how to manipulate beliefs to influence behaviour [8]. Pretend play and storytelling become more structured, reflecting a growing grasp of social roles and relationships [34]. Through role-playing and narrative construction, children practice perspective-taking and reinforce their intuitive psychology skills, allowing them to navigate social interactions more effectively.

3.4. Early School Age (5-7 Years): Advancing Social and Cognitive Awareness

Between five and seven years old, children develop a more sophisticated understanding of perspectives, emotions, and cognitive processes. They begin to grasp that opinions can differ even when both individuals receive the same information and that personality traits influence behaviour [35]. These developments enhance their ability to engage in complex social interactions, moral reasoning, and self-reflection [5].

A major milestone in this stage is the ability to distinguish thoughts from physical reality. Young children now understand that a thought about an object (e.g., a dog) is different from the actual object itself [8]. This deeper comprehension of mental representations allows them to differentiate between imagination, beliefs, and objective reality. As children develop empathy and moral reasoning, they become more adept at perspective-taking, gaining a nuanced sense of fairness and justice [36]. They recognise that emotions can be managed and that people may hide their true feelings based on social situations. These advancements in emotional intelligence help children form stronger social bonds and adapt their behaviour to different contexts. Additionally, school-age children refine their social strategies, learning to cooperate, negotiate, and resolve conflicts. Their ability to predict and influence social interactions improves, enabling them to navigate more complex group dynamics.

Another key development in this period is metacognition and self-reflection [37]. Children gain an increasing awareness of their own thought processes, allowing them to analyse experiences, regulate emotions, and adjust learning strategies (ibid.). This contributes to a more sophisticated understanding of intuitive psychology, as they recognise not only others' mental states but also their own cognitive growth. The progression from visual recognition in infancy to symbolic thinking in toddlerhood and advanced social cognition in early childhood highlights the interconnected nature of cognitive and social development. Together, these milestones shape the development of intuitive psychology, enabling children to successfully navigate social interactions, interpret emotions, and predict behaviour, forming the basis for lifelong cognitive and emotional development.

4. THE IMPACT OF AI ON INTUITIVE PSYCHOLOGY

4.1. AI as an External Other

In contemporary and philosophical discussions about artificial intelligence (AI) and human cognition, one of the most intriguing paradigms centres around AI as an external other. This conceptualisation draws from psychology, linguistics, and philosophy theories, including Vygotsky's sociocultural theory and Premack and Woodruff's [17] Theory of Mind (ToM). Vygotsky emphasised the importance of social interaction for cognitive development, particularly the role of external mediators or 'more knowledgeable others' such as language and cultural tools or other humans. When AI functions

as an external other it becomes a novel mediator, potentially reshaping how humans develop cognitive and social skills [38].

The ToM, which describes the ability to attribute mental states to oneself and others, now faces the challenge when the other is not human but an artificial and intelligent entity. Traditional ToM assumptions hinge on human minds possessing intentionality, empathy, and complex mental states [39]. However, when interacting with technology, users often attribute intentionality and intelligence to systems that lack genuine consciousness [40]. This process raises philosophical questions about the boundaries of mind recognition. Wolfram's [41] work on computational irreducibility offers insights into how AI systems, while deterministic, often present behaviour so complex that they appear autonomous and unpredictable, further complicating our intuitive psychology.

The rise of digital or technological post- and trans-humanities, which advocate for non-anthropocentric human and non-human agency and the integration of technology into human bodies and minds, respectively, brings another layer to this discourse. Transhumanist perspectives challenge traditional definitions of human agency by positing a continuum between biological and artificial intelligence [42]. The human-AI interaction hereby shifts from a clear distinction to a blended agency, complicating our social, ethical and cognitive frameworks. Continuing this line of thinking, AI can be seen as an additional 'external other' within a child's surroundings. To illustrate this, we created the Expanded Intuitive Psychology Model (Figure 1), which shows how children's intuitive psychology grows in the AI age.

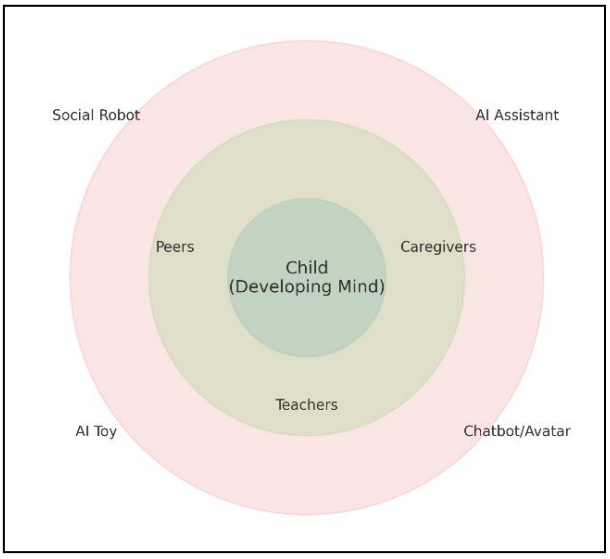

Figure 1. The Expanded Intuitive Psychology Model.

The concentric model shows how children's intuitive psychology expands in the AI age. At its centre is the child's developing mind, surrounded first by traditional human external others, caregivers, peers, and teachers, who historically shaped the growth of Theory of Mind, empathy, and social cognition [8,43]. In line with Vygotsky's [38] sociocultural theory, these human interactions act as mediators through which children internalise social and cognitive skills. The outer concentric layer introduces AI external others, such as conversational agents, social robots, and AI-integrated toys, whose presence increasingly mediates children's social environments [15,44]. This visual framing emphasises how AI has emerged as an additional category of "external other" alongside humans, requiring children not only to attribute mental states in interpersonal contexts but also to discern the simulated intentionality of artificial agents [40,45]. The positioning of developmental skills on the model's periphery reflects the need for both continuity and adaptation: children must still develop empathy, social perception, and Theory of Mind [4,20], while also acquiring new forms of literacy and critical thinking to navigate the limitations and biases of AI systems [46,47]. In this way, the concentric model captures the theoretical argument that children's intuitive psychology is being reshaped by the integration of AI into their social worlds, extending traditional developmental trajectories to encompass both human and artificial forms of otherness.

4.2. Human-to-Human vs. Human-to-AI Interaction or Integration

Encompassing both forms of otherness requires a fundamental distinction between human-to-human and human-to-AI interaction which lies in the recognition of agency and intentionality. In human interactions, empathy and the ability to infer emotions and intentions are critical components. Humans rely on a lifetime of social learning to decode facial expressions, tone of voice, and subtle social cues [48]. Conversely, interactions with AI often lack these natural cues. AI systems like virtual assistants, chatbots, and social robots operate through pre-programmed algorithms and machine learning models [49]. While these systems can simulate empathy and adapt to user preferences, their responses remain fundamentally rooted in computation rather than genuine emotion. This creates a peculiar dynamic wherein humans may project emotions onto AI systems, attributing to them social qualities they do not possess [45]. The English language may not yet have the right terms to describe perceptions of seemingly intelligent non-human entities [50]. Still, recent studies show that children perceive artificial artifacts, such as conversational agents, in ways that go beyond typical categories of inanimate objects or living beings [44,51].

The determinism inherent in AI also shapes these interactions [52]. From a deterministic perspective, AI systems function predictably based on their programming and input data. This predictability contrasts with the unpredictability of human behaviour. However, from the developing human user's perspective, sophisticated AI systems can appear unpredictable, as their decision-making processes often exceed human comprehension [41]. This creates an illusion of autonomous agency, further blurring the lines between human and non-human actors and raising questions about how AI tools might impact the development of genuine skills related to intuitive psychology such as empathy, social perception and predictive capacities.

Although research into the effectiveness of AI-integrated approaches to early childhood education is still emerging [53], there is some empirical support to suggest that using robot-based learning can indeed be useful in fostering the development of computation thinking, sequencing, self-regulation and ToM skills [53]. Additionally, the increasing sophistication of AI tools raises the potential of fostering adaptive or personalised learning scenarios in which cognitive, personality, learning, language and cultural differences are accounted for and even leveraged for improved learning outcomes [54].

Furthermore, certain pedagogical interventions related to ToM can promote children's metacognitive skills and understanding of the relations between mind and emotion [55]. This was achieved through the intentional creation of a zone of proximal development that supported students in exploring how their own minds work while also discussing and sharing different points of view (community of minds).

An emerging challenge to education and pedagogies relating to ToM is the rapidly changing and interconnected nature of social and technological landscapes. The cognitive, social and emotional impact of digital connectedness in the age of AI remains largely unknown at this stage. However, studies have shown that variations in social environments can lead to recognisable differences in the development of ToM skills [56]. Given that language acquisition and the development of theory of mind are clearly paralleled, and that mental state attributions are evolving with the advent of non-human intelligence as an 'external other', there are numerous uncertain implications that require careful attention.

One critical area in the age of AI includes the above described 'gold standard test' in ToM, which involves the comprehension that others can hold false beliefs that are different from one's own (correct) knowledge [57,58]. The interaction between children and AI tools that produce outputs that seem real, true or reliable, but might also be fake, misleading or entirely fabricated (hallucinated) [59] has implications for intuitive psychology that require further exploration. Students need to recognise not only the nature and capacities of AI as an external entity but also its distinct limitations and implications for their interactions with it. One risk in such interactions involves the way in which AI algorithms are based on existing datasets that may exhibit systemic bias and discrimination that could perpetuate issues of marginalisation, racism, sexism or other forms of injustice and inequity, thereby adversely influencing the development of young minds [58,60].

A second area of concern is the potential impact of AI on brain development. From a neurobiological perspective, it has been argued that AI information processing systems more closely resemble left-hemisphere functionality, which, amongst other things, manipulates symbols as abstract aspects of a decontextualised and explicit reality. In contrast, the right hemisphere is more attuned to the implicit

realm of context, emotion and values [61]. Increased exposure to and reliance on AI could shape children's mental attention and cognitive capacities in ways that are not necessarily conducive to holistic views of reality, the pursuit of truth, the development of values, and the cognitive resonance that can only be achieved through authentic interactions and relationships with human external others.

A third area of concern relates to the above-described vision for holistic child development and the implications of a transhumanist agenda and its vision for the continued evolution of humanity. Whilst advocates of transhumanism hold a wide spectrum of views, the core notion is that human limitations (cognitive or otherwise) can be overcome through biological integration with enhancing technologies such as AI [62]. These scenarios extend beyond the aforementioned human-AI-interaction in education and move into the realm of human-AI-integration. According to Bostrom [61,63], a leading transhumanist advocate, humanity is a "half-baked", "work-in-progress" that we can learn to "remould in desirable ways" (p. 495). Proposed enhancement options include the augmentation of human intellectual, physical and emotional capacities, which impact existing notions of intuitive psychology and ToM. For example, cyborg enhancement technologies, currently developing at an accelerating pace, can be integrated into the body to improve biological information processing capabilities and the way the world is experienced [64].

Proponents of transhumanism may argue for comparatively mild interventions, such as non-genetic augmentations, or for more radical changes. Either way, critics argue that biotechnical enhancements (unlike therapeutics) will alter our shared self-understanding. They warn that such self-determined changes to human nature could undermine equal freedoms based on equal birth [64,65]. While tools that focus on human-AI-integrations are not yet mainstream in educational technology, is it important to underscore the need for caution, clarity and further research on how AI technology might impact conceptions of what it means to be human.

It is clear that the advent of AI has created various challenges and opportunities within education. For this reason, AI literacy for both students and early childhood educators is widely considered essential [53]. However, the task is ever-evolving as technological change significantly outpaces research. This delays the timely development of relevant, evidence-based, and age-appropriate curricula and pedagogical adaptions. Whilst short-term studies have demonstrated considerable positive potential in using AI tools on the market for a wide range of learning outcomes, there is ongoing speculation about the vast promise of personalised learning or insights into students' behaviours through facial recognition software and predictive analytics [55,58]. Further, no longitudinal studies exist to verify the long-term impact of such pedagogical interventions and there are immediate ethical issues that need to be resolved. These include, but are not limited to, the protection of student and teacher privacy, the boundaries of surveillance, and the impact on teaching and learning autonomy, transparency and accountability [58]. It does, however, seem reasonable to suggest at this stage that the evident and widespread adoption of AI into everyday life necessitates the development of new cognitive and social skills, particularly for children growing up in AI-mediated environments. Therefore, at minimum, these skills include digital literacy, critical thinking, and social-emotional competencies which can be understood through our Human-AI Developmental Pathways Model (Figure 2).

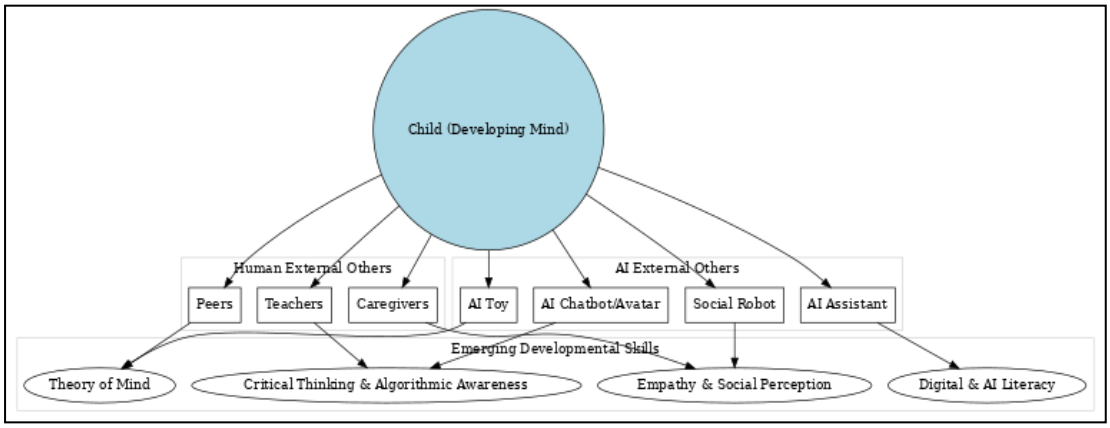

Figure 2. Human-AI Developmental Pathways Model.

5. NEW SUBCONSCIOUS SKILLS FOR AN AI AGE

The Human–AI Developmental Pathways Model illustrates how both human external others and AI external others shape the emergence of new subconscious skills required in the AI age. While caregivers, peers, and teachers traditionally nurture empathy, Theory of Mind, and social cognition, the increasing presence of AI introduces distinct developmental demands.

• Digital Literacy and AI Literacy:

AI literacy will become as essential as traditional literacy in navigating the digital landscape. Children must develop a nuanced understanding of how AI systems work, including their limitations and biases. This includes learning to question their outputs and understanding the data-driven nature of AI decision-making [44].

• Critical Thinking and Algorithmic Awareness:

As AI increasingly mediates information access and decision-making, children need to cultivate critical thinking skills to evaluate AI-generated content. This includes the ability to discern between human-authored and AI-generated information and to recognise the potential biases embedded in algorithms [47].

• Empathy and Social Perception:

One of the most complex challenges posed by AI is the potential erosion of empathy and social perception skills. Traditional human socialisation involves nuanced emotional exchanges and the ability to infer mental states from non-verbal cues. AI interactions, which lack genuine emotional reciprocity, may hinder the development of these skills [45]. To mitigate this risk, educational systems must emphasise posthuman-centric social interactions and teach children to distinguish between authentic human relationships and simulated AI interactions. Empathy training, role-playing exercises, and collaborative activities can help reinforce these skills [48].

6. THE NEED FOR ACTIVE RESEARCH

6.1. Current Research Landscape

Existing studies on intuitive psychology primarily examine how children develop social cognition and theory of mind through interactions with their peers [67]. With the growing presence of AI technologies like social robots and virtual assistants in children's lives [68,69], it becomes essential to explore how these entities might influence the development of intuitive psychology [70,71].

Current investigations focus on how children interact with AI and the implications of these interactions for their psychological development. Children often attribute emotional states to social robots, suggesting that even artificial agents can elicit social responses typically reserved for human interaction [72]. Nonetheless, much of the literature remains in its infancy, lacking direct examination of how these interactions affect children's cognitive and emotional development, particularly concerning their understanding of human social cues and empathetic responses [73,74].

While the growing discourse on screen time and digital engagement highlights various impacts on child development, studies specifically analysing AI's role in shaping intuitive psychology are limited. Much of the current dialogue revolves around potential negative effects of screen use, such as reduced face-to-face interactions and the consequent deficits in emotional intelligence [75]. It is equally important to consider how AI systems, designed to engage and respond to children in increasingly sophisticated ways, might either mitigate or exacerbate these issues [76,77]. Although a foundation of literature exists exploring intuitive psychology alongside the burgeoning role of AI, significant gaps remain. Key areas requiring further exploration include the longitudinal effects of AI interactions on children’s social cognition, the nuanced influences of different AI modalities (e.g., voice-activated assistants versus humanoid robots) on child development [78,79], and the varying impacts across diverse demographic groups [80].

6.2. Rationale for Research

Understanding AI's influence on the development of intuitive psychology is essential for several reasons. As AI becomes more integrated into children's daily lives, grasping the potential cognitive and emotional implications of these interactions is imperative. Children naturally tend to anthropomorphise

technology, attributing human-like qualities to AI systems [81]. This inclination could shape their understanding of social dynamics, empathy, and moral reasoning [82]. Research focusing on these dynamics can offer valuable insights into how children's perceptions of relationships are altered when engaging with non-human agents. Comprehending AI's effects on intuitive psychology can inform the development of educational programme and parenting strategies. Educators and parents require guidance on effectively leveraging AI tools while ensuring that these tools do not hinder the development of critical social skills [83,84]. For instance, while AI can provide personalised learning experiences, reliance on such systems might reduce opportunities for children to engage in collaborative activities that foster empathy and understanding of social cues [85,86].

The implications of this research extend to policymakers as well. As AI technologies evolve, they will inevitably shape the regulatory landscape governing children's interactions with technology. Policymakers will need evidence-based guidelines to establish frameworks that ensure the ethical use of AI in educational settings and homes [87]. Understanding how AI affects child development will be crucial for developing policies prioritising children's emotional and cognitive well-being while embracing the benefits of technological advancements. The ethical considerations surrounding AI and child development cannot be overlooked. As AI systems increasingly take on roles traditionally filled by caregivers or educators, examining the ethical ramifications of these shifts becomes essential [88,89]. Questions arise regarding whether AI systems are designed with children's best interests in mind and whether they provide adequate emotional support or risk normalising transactional relationships devoid of genuine human connection. Research can help unpack these complex questions, providing a foundation for ethical guidelines in AI development and deployment [85].

7. PROPOSED COMPARATIVE STUDY

Considering the ideas presented in this paper, we propose a comparative study which aims to explore the development of intuitive psychology among children aged 5 to 11 years in North Yorkshire, UK, and South East Queensland, Australia, specifically focusing on their ability to distinguish between human-made and AI-generated media. As artificial intelligence increasingly permeates creative domains, understanding how children interpret these forms of media is essential for grasping their cognitive and emotional development in an AI-enhanced world.

7.1. Objectives of the Study

The primary objective of the study is to assess children's discernment abilities, providing insights into their cognitive processes, including reasoning and critical thinking skills concerning technology and creativity. Research indicates that children often attribute emotional states to social robots and AI systems, suggesting that interactions with these technologies can elicit social responses typically reserved for human interaction [72]. By examining their perceptions, the study seeks to promote well-being as children navigate an environment increasingly influenced by AI, ensuring they develop healthy views on technology's societal role.

7.2. Research Paradigm and Methodology

Adopting a constructivist research paradigm, the study emphasises understanding how children construct meaning through their experiences and interactions. This approach allows researchers to explore subjective interpretations of media and technology by children from diverse cultural and developmental backgrounds [8]. The study will collect quantitative data, in the form of structured assessments where children evaluate a series of images, half human-made and half AI-generated. The participant selection criteria focus on a representative sample of children aged 5 to 11 from North Yorkshire and South East Queensland, aiming for 120 participants divided into three age groups of age 5, age 7, and age 11. This distribution will allow for a thorough examination of developmental differences in intuitive psychology while capturing a range of experiences [5].

7.3. Data Collection Methods

Data collection will consist of participants being shown images and asked to identify which are human-made and which are AI-generated, providing quantitative data on their discernment abilities at

the ages of 5 to 11. The participants will be shown a mix of human created images (e.g. a photo taken by a human of a real object like a horse), an AI-generated image of the same or similar object (e.g. a horse generated in Adobe Firefly), and an AI-generated image of an unreal object (i.e. something that cannot exist in reality) such as subtle changes in an animal's form. A representative sample of 40 participants in each age group will be chosen across 4 settings in both North Yorkshire, UK and South East Queensland, Australia to capture a mix of geographical and socioeconomic disparities in both regions.

7.4. Limitations and Ethical Considerations

The proposed study, while aiming to provide valuable insights into children's development of intuitive psychology and their interactions with AI, has several limitations and ethical considerations. First, despite efforts to include diverse samples from North Yorkshire (UK) and Southeast Queensland (Australia), the study may not fully capture the cultural, socioeconomic, and educational factors that influence children's technology interactions [5,91], limiting the generalisability of the findings. Additionally, the cross-sectional design cannot assess the longitudinal effects of AI exposure on children's cognitive and emotional development [32,67], necessitating further longitudinal research. Uncontrolled variables, such as prior experiences with technology and individual cognitive differences, may also affect responses [58]. Media selection bias is another concern, as the complexity and cultural context of AI-generated and human-made images may impact children's ability to interpret them. Finally, ethical issues related to privacy, consent, and the potential influence of AI on children's social and emotional development must be addressed, particularly regarding the reinforcement of stereotypes or biases in AI-generated content [90].

7.5. Expected Outcomes

The study hypothesises that children at different developmental stages will show varying discernment abilities that will impact their media interpretation skills [67]. The emotional engagement with AI-generated content is also anticipated to reflect broader societal attitudes toward artificial intelligence, highlighting the significance of empathy and social perception in these interactions [45]. Based on the findings, policy recommendations will be proposed for both the UK and Australia with a focus on the development and integration of AI literacy programmes into school curricula for children aged 5-12. These programmes should aim to help children understand AI technology, including its capabilities, limitations, and ethical considerations. The responsibility for implementing these initiatives will fall to the Department for Education (DfE) in the UK and the Australian Curriculum, Assessment and Reporting Authority (ACARA) in Australia. Pilot programmes should be launched in select primary schools within 12-18 months, with a goal of nationwide integration within 3-5 years, contingent on feedback and effectiveness. To ensure the success of these programmes, continuous monitoring will be essential, through longitudinal studies and regular surveys of teachers, students, and parents. Additionally, external evaluations should be conducted every two years by independent research bodies such as the Education Endowment Foundation in the UK or the Australian Council for Educational Research (ACER).

Ultimately, the findings are expected to have significant implications for educational practices, including curriculum development, parental involvement, and mental health initiatives. By fostering critical thinking about media consumption and production, the study aims to help children navigate an AI-driven world more confidently and healthily, aligning with emerging educational goals that emphasise digital literacy and critical awareness in the face of rapidly evolving technologies [53]. In essence, the study aims to explore new subconscious skills for an AI age of 'digital literacy' and 'AI literacy' which will become as essential as traditional literacy in navigating the digital landscape. Children must develop a nuanced understanding of how AI systems work, including their limitations and biases. This includes learning to question their outputs and understanding the data-driven nature of AI decision-making [44].

8. CONCLUSION

In conclusion, the intersection of intuitive psychology and artificial intelligence (AI) presents a dynamic and evolving field of inquiry, particularly concerning child development. The understanding of mental states, as articulated through the lens of intuitive psychology, is foundational for social

interactions and relationships [6]. Traditional pathways of developing these skills have been heavily reliant on human interactions, with children learning to navigate social environments through engagement with caregivers and peers [8]. However, the emergence of AI as a prevalent entity in children's lives poses unique challenges and opportunities for cognitive and emotional development.

As noted, the presence of AI systems, ranging from conversational agents to social robots—has the potential to alter how children perceive and engage with social cues and mental states [72]. While AI can facilitate certain cognitive skills, such as computational thinking and adaptive learning [53], it simultaneously raises concerns about empathy and social perception, essential components of intuitive psychology [45]. The possibility that children may attribute human-like qualities to AI systems complicates their understanding of agency and intentionality, potentially blurring the lines between authentic human interactions and artificial engagements [40,48].

The deterministic nature of AI systems contrasts sharply with the unpredictability inherent in human behaviour, which could lead to a misattribution of mental states and emotional responses in interactions with non-human agents [41]. This raises philosophical questions about the development of children's theory of mind (ToM) in an era increasingly influenced by technology [17]. The traditional benchmarks of ToM, such as understanding false beliefs, may be challenged as children interact with AI that can convincingly simulate human-like interaction without genuine emotional reciprocity [73].

The implications of these dynamics necessitate urgent and focused research efforts to explore how these AI interactions impact children's intuitive psychology. Current literature suggests that while there is a burgeoning interest in understanding these effects, substantial gaps remain regarding the longitudinal impacts of AI engagement on social cognition and emotional development [58]. Additionally, the need for critical research that considers demographic variations and the diverse modalities of AI—such as voice-activated assistants versus humanoid robots, further emphasises the complexity of this inquiry [67]. In light of these considerations, we propose a comparative study examining the development of intuitive psychology among children aged 5 to 11 in North Yorkshire, UK, and South East Queensland, Australia. Ultimately, this study serves as a crucial next step in understanding the complex interplay between AI, child development, and intuitive psychology, setting the stage for informed educational practices and policy implications in an increasingly AI-mediated world.

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