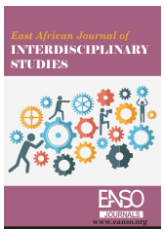

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Original Article

A Conceptual Study of Cognitive Atrophy in Homo Sapiens through A Darwinian Analysis of Overreliance on Artificial Intelligence

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ABSTRACT

This conceptual study investigates the potential cognitive and evolutionary consequences of overreliance on Artificial Intelligence (AI) technologies among *Homo sapiens*. Framed through Charles Darwin's theory of evolution by natural selection, the research explores how the increasing delegation of mental functions such as memory, problem-solving, and decision-making to AI systems may lead to cognitive atrophy and, over time, mental regression. The study draws on interdisciplinary literature from neuroscience, evolutionary biology, and technological ethics to argue that persistent dependence on AI poses a risk of "technological evolutionary displacement," whereby intrinsic human cognitive abilities are gradually devalued in favour of machine efficiency. It assesses how these patterns manifest globally, with notable disparities between technologically advanced societies and regions still anchored in traditional knowledge systems, particularly in the Global South. The findings suggest that AI-induced cognitive atrophy could diminish traits historically favoured by natural selection, such as critical thinking and adaptability, raising concerns about long-term human development and mental resilience. The study proposes a reframing of AI development strategies toward models that emphasise symbiotic co-evolution, cognitive stimulation, and ethical safeguards. Ultimately, this research warns that while AI offers profound efficiencies, its unchecked expansion may redefine the adaptive landscape in ways that challenge the cognitive integrity and evolutionary trajectory of the human species.

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INTRODUCTION

This conceptual study investigates the cognitive and evolutionary consequences of humanity's increasing dependence on Artificial Intelligence (AI). It's driven by the concern that overreliance on AI could lead to the gradual weakening of core human mental faculties. To explore this, the study has three primary objectives:

- To analyse how increasing dependence on AI technologies may influence the evolutionary trajectory of human cognition, framed by Charles Darwin's theory of natural selection.
- To examine the effects of AI technologies on specific human cognitive functions such as memory, attention, learning, and problem-solving.
- To investigate the psychological and neurobiological impacts of AI reliance on human development and mental resilience across different socio-cultural contexts.

In the 21st century, Artificial Intelligence (AI) has emerged as a transformative force, reshaping industries, labour markets, social interactions, and even cognitive behaviour. From voice assistants and autonomous vehicles to generative language models and predictive analytics, AI has permeated nearly every aspect of human life. While its benefits are immense, there is an increasingly urgent need to interrogate the cognitive consequences of such widespread technological dependence. Specifically, scholars are beginning to question whether the overreliance on AI may lead to cognitive atrophy, the gradual weakening of the brain's capacity to think, reason, and remember and potentially even mental regression in *Homo sapiens*. This phenomenon can be critically understood through the lens of Charles Darwin's theory of evolution by natural selection, especially the concept of *use and disuse*, which posits that faculties not actively employed tend to deteriorate across generations (Darwin, 1859/2004).

Darwin's evolutionary theory fundamentally asserts that organisms adapt over time through natural selection, where traits that confer a survival or reproductive advantage are more likely to be passed on. However, a lesser-discussed but relevant aspect of his thought, drawn partially from Lamarckian influences, is that traits not in use tend to diminish. In *The Descent of Man*, Darwin (1871) acknowledged that disuse of an organ or faculty could lead to its reduction over time, writing, "It appears probable that disuse has been the main agent in rendering organs rudimentary." When applied to the modern context, this implies that underutilization of mental faculties due to external technological crutches like AI might result in diminished cognitive capacity not only within individuals but potentially across generations of *Homo sapiens*.

This concern is not merely speculative. Emerging research supports the idea that digital tools can significantly affect how the human brain processes information. The phenomenon of cognitive offloading, the practice of relying on external aids for memory and decision-making, has become increasingly common in the age of smartphones and AI (Risko & Gilbert, 2016). For instance, studies show that frequent GPS users demonstrate reduced hippocampal activity, a region crucial for spatial memory and navigation (Javadi *et al.,* 2017). Similarly, when users rely on AI writing assistants, they may inadvertently offload language production, creativity, and even moral reasoning, leading to reduced neural engagement (Hosseini *et al*., 2023). As AI tools become more advanced, this cognitive offloading

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could extend to even more complex tasks, threatening human intellectual autonomy.

The implications are substantial. As *Homo sapiens* increasingly delegate cognitive work to machines, there is a growing risk of what some scholars refer to as cognitive deskilling (Susskind, 2020). In essence, when people consistently rely on algorithms for thinking, decision-making, and even interpersonal communication, they risk losing the underlying skills required to perform those tasks independently. This trend has been observed in both workplace settings where AI performs managerial and analytical roles and in everyday contexts, such as education and healthcare (Dreyfus, 2001). Over time, this may result not just in a decline of cognitive acuity at the individual level but also in a broader evolutionary shift away from intellectual self-sufficiency.

From a Darwinian perspective, this shift can be framed as a consequence of the principle of use and disuse. If selection pressures for high-order cognitive function diminish due to technological substitution, natural selection may no longer favour the neural structures supporting critical thinking, memory, and reasoning. Evolution does not necessarily lead to progress in a moral or intellectual sense; it favours traits that improve survival in specific environments (Dennett, 1995). In an AI-saturated environment where cognitive effort is outsourced, human brain evolution might begin to favour efficiency over depth, automation over intuition, a potential return to more rudimentary cognitive states, or what can be seen as mental regression.

Moreover, the extended mind theory by Clark & Chalmers (1998) complicates the discussion. They argue that tools like notebooks and calculators already form part of our cognitive systems, so why not AI? Yet while the extended mind can be enriching, it also entails a dependency risk. When AI becomes the primary seat of judgment and memory, it may no longer just extend the mind, it might replace essential parts of it. As noted by Carr (2010), digital dependency can lead to "shallow thinking," where depth, nuance, and reflection are sacrificed for convenience and immediacy. This "Google effect" undermines the brain's ability to retain and synthesise complex information.

The psychological consequences are also emerging. Clinicians have observed symptoms akin to digital dementia, a term describing memory problems and cognitive decline due to excessive reliance on digital devices, particularly among younger populations (Spitzer, 2012). According to research by Wilmer *et al.* (2017), frequent use of AI-like technologies correlates with decreased sustained attention and working memory. These trends suggest a shift in cognitive development trajectories, a direction that may not align with the adaptive pressures that once shaped the rise of *Homo sapiens* as a uniquely intelligent species.

Social and educational implications also demand attention. In classrooms, AI-powered tutoring systems and automated grading tools risk reducing students' engagement with critical thinking and problem-solving (Selwyn, 2016). In workplaces, AI decision-making tools reduce the demand for strategic judgment, communication, and moral discernment. This could eventually lead to the stagnation of intellectual culture, a reversal of the Enlightenment ideal that human progress lies in reason and reflection.

Nonetheless, the situation is not without solutions. Just as muscles require exercise to remain strong, so too does the brain. Researchers like Stern (2009) emphasise the concept of *cognitive reserve*, suggesting that engaging in intellectually demanding tasks can maintain brain health and delay decline. To preserve cognitive faculties, society must foster environments that encourage mental exertion, curiosity, and analytical engagement, even amid AI convenience.

In conclusion, while AI technologies offer remarkable capabilities, their unchecked integration into daily life may inadvertently trigger cognitive atrophy and possibly mental regression in *Homo sapiens*. Viewed through Darwin's lens of natural selection and the

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principle of use and disuse, the risk is clear: what we fail to use, we risk losing. To prevent evolutionary backsliding, humans must intentionally balance technological reliance with deliberate mental engagement. The future of human cognition may well depend on it.

Background of the Study

The relationship between human cognition and technological advancement has long been a subject of inquiry, stretching back to the earliest human innovations from stone tools to the printing press, and eventually to the digital age. Each major technological shift has altered not only how humans interact with the environment but also how they think, remember, and learn. The invention of writing, for example, allowed for the externalisation of memory, reshaping cognitive processes by reducing the need for oral retention (Ong, 1982). The Industrial Revolution further catalysed mechanised ways of thinking, and by the late 20th century, the rise of the computer introduced a new paradigm of human-machine interaction. In the 21st century, the rapid evolution of Artificial Intelligence (AI) has begun to raise profound questions about the long-term cognitive and evolutionary consequences of outsourcing mental labour to machines (Carr, 2010).

Historically, Darwin's theory of evolution by natural selection (1859) revolutionised the understanding of biological development. His emphasis on adaptation, survival of the fittest, and the principle of "use and disuse" formed the basis of how traits are retained or lost across generations. Though not initially formulated to address cognition in technologically mediated environments, Darwin's insights provide a potent framework for analysing how technological dependencies might lead to the decline of underused faculties, including critical thinking, problem-solving, and memory.

At the conceptual level, this study is grounded in three key constructs: Artificial Intelligence, cognitive atrophy, and evolutionary theory. AI refers to machine systems designed to perform tasks that typically require human intelligence, including reasoning, problem-solving, language comprehension, and decision-making (Russell & Norvig, 2021). Cognitive atrophy, in this context, denotes the gradual decline or weakening of cognitive abilities due to underuse, particularly when humans increasingly depend on AI to carry out intellectual tasks (Risko & Gilbert, 2016).

Darwin's evolutionary theory, especially the mechanism of natural selection, provides the overarching lens. It suggests that if certain mental faculties are no longer advantageous or actively exercised due to technological substitution, they may diminish in utility and prevalence over time (Darwin, 1871). Therefore, the present study conceptualises the overreliance on AI as a possible evolutionary stressor, potentially reshaping cognitive structures in *Homo sapiens*.

Globally, the integration of AI into daily life is advancing at an unprecedented pace. From AI-assisted writing and voice assistants to autonomous vehicles and algorithmic decision-making, human dependence on intelligent systems is escalating. A 2023 report by the World Economic Forum projected that by 2027, over 40% of workplace tasks globally would be handled by AI-driven systems. This digital revolution, while enhancing efficiency and convenience, is also engendering a new form of cognitive outsourcing, with growing concern about its impact on critical thinking, memory, and creativity (Hosseini *et al.,* 2023).

In Africa, the adoption of AI is rising but uneven. While North and Southern Africa are leading in AI innovation, Sub-Saharan Africa, including Uganda, is still in the early stages of implementation. However, international investments and the proliferation of mobile technologies have accelerated digital transformation across the continent. Initiatives such as the African Union's Digital Transformation Strategy (2020–2030) aim to integrate AI into sectors like education, healthcare, and agriculture. Despite this, there is limited awareness of the cognitive and behavioural impacts of AI, particularly within

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traditional learning systems and indigenous communities (UNECA, 2020).

In East Africa, governments are increasingly embracing AI for national development. Kenya has adopted AI in its e-government platforms, while Rwanda and Tanzania have begun experimenting with AI in education and healthcare delivery. In Uganda, the National Science, Technology, and Innovation Policy (NSTIP) highlights AI as a key area of focus for socio-economic development. Yet, the integration of AI into educational and work systems has sparked debate among educators and psychologists regarding its effect on youth learning habits and problem-solving skills (Mwesigwa, 2022). Moreover, the region's digital divide means that while some communities benefit from AI, others are left unexposed or unprepared to mitigate its cognitive risks.

Uganda is experiencing a growing shift toward digitalisation, with AI being introduced in government services, agriculture (through precision farming apps), and even classrooms via digital learning platforms. The government's Uganda Vision 2040 policy identifies science, technology, and innovation, including AI, as critical enablers of development. However, Uganda's education system, particularly in rural areas, still emphasises rote learning over critical thinking. As AI tools become more accessible, there is concern that students and professionals may increasingly delegate thinking tasks to machines, thus reducing the cultivation of cognitive resilience and adaptive reasoning (Tumwine & Kasirye, 2023). This raises fundamental questions about the future mental capabilities of the population if the trend toward passive consumption of AI-generated knowledge continues.

This study is principally anchored in Darwin's theory of evolution by natural selection, augmented by the principle of use and disuse, and informed by modern cognitive science. Darwin's framework explains that traits which are useful for survival and reproduction tend to be selected and preserved, while unused traits diminish over time (Darwin, 1859). Applied to cognition, this suggests that if mental faculties are continually underused due to AI reliance, they may atrophy similarly to physical traits. Over generations, this could alter the cognitive architecture of *Homo sapiens*, favouring traits adapted for co-existence with machines rather than independent intellectual operation.

Additionally, the Extended Mind Theory (Clark & Chalmers, 1998) provides a complementary lens. It posits that tools and technologies, when integrated into our thought processes, become extensions of the human mind. However, this integration is double-edged: while it can enhance capabilities, it can also promote dependency and diminish the intrinsic function of the brain. Thus, the study adopts an evolutionary-cognitive theoretical framework to interrogate the implications of outsourcing cognition to AI.

Furthermore, Cognitive Load Theory (Sweller, 1988) and Cognitive Offloading Theory (Risko & Gilbert, 2016) support the view that offloading information processing to external aids reduces the mental effort required, which, while beneficial in the short term, may lead to a reduction in deep cognitive engagement over time.

Theoretical Framework

This study is anchored in Charles Darwin's Theory of Evolution by Natural Selection (Darwin, 1859), which posits that traits conferring survival or reproductive advantages become increasingly common in successive generations, while maladaptive traits are selected against and eventually diminish. In the context of this research, the theory is used as a lens to explore how overreliance on Artificial Intelligence (AI) technologies could potentially lead to cognitive atrophy and mental regression in *Homo sapiens*, thereby affecting our evolutionary trajectory.

Darwin's theory is fundamentally about adaptation. Organisms with traits better suited to their environment are more likely to survive, reproduce, and pass on those advantageous traits. Human cognition—encompassing memory, critical thinking, decision-making, and problem-

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solving—has historically evolved as a survival mechanism. These traits allowed early humans to respond flexibly to environmental challenges, develop complex social structures, invent tools, and cultivate language and abstract thought (Dennett, 1995; Pinker, 2010). In evolutionary terms, such mental faculties are "selected for" because they contributed significantly to survival and reproductive success.

However, in the present digital age, there is growing concern that increasing reliance on AI and machine learning systems is externalising or replacing some of these once-essential cognitive functions. For instance, applications such as GPS navigation, predictive text, recommendation algorithms, and digital assistants reduce the need for memory, spatial awareness, and decision-making (Carr, 2020). If such reliance becomes deeply embedded in everyday life, these once-crucial faculties may become less exercised over time, leading to what neuroscientists and psychologists refer to as **"**cognitive offloading**"** (Risko & Gilbert, 2016).

By framing this trend within Darwinian theory, the study interrogates whether modern human reliance on AI constitutes a shift in evolutionary pressures. If technologies continually perform tasks that required high cognitive effort in the past, humans may no longer need to maintain or develop such cognitive abilities at the same level. Over multiple generations, if such traits cease to offer survival advantages, they may weaken or atrophy not biologically at first, but functionally, through underuse, and potentially neurobiologically over time. This reflects the classic Darwinian idea that traits not under selective pressure may eventually fade (Gould, 2002).

Moreover, Darwin's theory emphasises not only survival but differential reproduction. If future societies reward technological literacy and the ability to interface with AI rather than independent cognitive prowess, evolution might favour those who can effectively outsource cognition over those who retain high cognitive independence. This poses a paradox: Is evolution now favouring dependence over adaptability? The question challenges traditional assumptions about what constitutes "fitness" in the digital age (Harari, 2018).

Therefore, this theoretical framework enables the study to critically assess whether cognitive atrophy resulting from AI overreliance is merely a social phenomenon or a possible evolutionary turning point for *Homo sapiens*. Through this lens, the study does not reject technological advancement but calls for a deeper understanding of its long-term implications on the human mind and evolutionary development.

RELATED LITERATURE

Artificial Intelligence Technologies and Cognitive Functions

The rapid integration of Artificial Intelligence (AI) technologies into everyday life has sparked concerns about their long-term effects on human cognition. AI, once a domain-specific tool, now permeates daily activities ranging from navigation and communication to education and decision-making. As these technologies grow more advanced and ubiquitous, questions have emerged regarding how human cognitive functions, particularly memory, critical thinking, and problem-solving, are influenced by increasing reliance on AI systems (Zhang *et al.,* 2021).

One of the most evident cognitive impacts of AI is the phenomenon of cognitive offloading, where individuals rely on external devices to store and retrieve information instead of using their memory systems (Risko & Gilbert, 2016). Sparrow *et al.* (2011) coined the term "Google Effect" to describe how search engines have changed the way people remember information. Users are more likely to remember where to find information rather than the content itself. This reliance on digital memory tools may diminish the capacity for long-term memory consolidation.

Neuroscientific studies further suggest that habitual use of AI-powered technologies can interfere with the brain's neuroplasticity, particularly in the hippocampus and prefrontal cortex regions involved in memory encoding and

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retrieval (Greenfield, 2015; Small & Vorgan, 2008). In a study by Wilmer *et al.* (2017), frequent use of smartphones and digital assistants was correlated with reduced recall performance in memory tasks, indicating that AI reliance might rewire the brain to favour short-term over long-term memory processing.

Critical thinking involves the ability to engage in reflective and independent thinking, a skill vital for navigating the complexities of modern life. However, AI technologies often offer instant solutions and curated answers that discourage deeper analysis. For instance, recommender systems on platforms like YouTube, Google, and Amazon often reinforce existing preferences and beliefs rather than challenge users to think critically (Pariser, 2011). This leads to the creation of “filter bubbles” that stifle cognitive diversity and analytical reasoning (Sunstein, 2017).

A study by Carr (2020) highlights how AI’s convenience may dull critical faculties: when algorithms make decisions for us, such as selecting news, products, or even romantic partners, users may gradually stop questioning or verifying information. This passive consumption of information undermines critical engagement and intellectual autonomy, particularly in younger generations habituated to AI-based solutions (Twenge *et al*., 2019).

Problem-solving, as a higher-order cognitive function, requires abstraction, evaluation of alternatives, and synthesis of information. The automation of problem-solving through AI tools may weaken these capacities by eliminating the need for complex reasoning processes. According to Kirschner & De Bruyckere (2017), the misconception that digital natives are naturally adept at problem-solving through technology has led to pedagogical strategies that underemphasize mental effort in learning tasks.

Moreover, educational systems that integrate AI-enabled tutoring platforms often promote efficiency over struggle, a key aspect of cognitive development. Holmes *et al.* (2019) found that while AI tutors improve short-term learning outcomes, they reduce opportunities for students to engage in "productive failure," an experience known to enhance deep learning and problem-solving skills. This suggests that AI might streamline learning, but at the cost of weakening students’ resilience and adaptability when facing novel problems.

From a developmental psychology perspective, the habitual use of AI technologies may interfere with the natural progression of cognitive skills, especially among children and adolescents. A longitudinal study by Radesky *et al.* (2020) found that early exposure to AI-powered educational apps correlated with delayed development in executive functions, such as impulse control, attention span, and self-regulation. These functions are crucial for effective problem-solving and critical reasoning in adulthood.

Furthermore, Vygotsky's (1978) theory of cognitive development emphasises the role of social interaction in learning. AI systems that replace human tutors or parental guidance may fail to offer the rich, dialogic environments needed to stimulate complex cognitive growth. The lack of meaningful interpersonal interaction has been shown to affect not only problem-solving but also emotional intelligence and empathy (Turkle, 2015).

Globally, cultural differences in AI adoption influence its cognitive impacts. In countries with high digital penetration, like South Korea, Japan, and the United States, the reliance on AI for decision-making is higher, and corresponding studies have observed a decline in traditional cognitive activities such as deep reading and manual calculation (Kanda *et al*., 2022; Twenge & Campbell, 2018). In contrast, regions where AI usage is emerging, such as parts of Sub-Saharan Africa, still show stronger retention of oral memory and participatory problem-solving traditions, offering a contrasting cognitive profile (Owusu & Boateng, 2021).

Research also points to gender and socioeconomic disparities in how AI impacts cognition. Girls and

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children from low-income families, who often receive less exposure to critical thinking-promoting technologies, may be more vulnerable to the negative cognitive effects of AI tools that are passive or entertainment-oriented (Livingstone & Helsper, 2020). These disparities have long-term implications for equality in educational and professional outcomes.

Neuroscientific data corroborate behavioural findings. Studies using fMRI scans have revealed that individuals who frequently rely on AI-enabled GPS systems show decreased activation in the hippocampus, which is essential for spatial navigation and memory (Javadi *et al.,* 2017). Similarly, prolonged screen time, especially with interactive AI content, has been linked to cortical thinning in brain regions associated with language and executive function in children (Hutton *et al.,* 2020).

The concept of "AI-induced neuroplasticity" is gaining traction, suggesting that the human brain adapts structurally and functionally to sustained interaction with AI systems (Montag & Diefenbach, 2018). While some of these changes may enhance certain types of digital literacy, they may also degrade faculties that evolution has honed over millennia, especially those related to sustained attention, memory retention, and analytical thought.

The increasing reliance on AI technologies undoubtedly brings benefits in terms of convenience and efficiency. However, growing evidence suggests that such reliance may simultaneously undermine essential cognitive functions memory, critical thinking, and problem-solving—among *Homo sapiens*. As AI becomes more deeply integrated into human life, it is critical to monitor and mitigate these cognitive consequences. Educational policy, parental engagement, and ethical AI design must converge to ensure that the evolution of technology does not come at the cost of cognitive atrophy and mental decline.

Technological Dependence and the Evolutionary Trajectory of Human Cognition

The rapid advancement and integration of Artificial Intelligence (AI) technologies into daily life have prompted scholars to examine their long-term implications on human cognition. Central to this inquiry is understanding how technological dependence may influence the evolutionary trajectory of human cognitive functions. Darwin's theory of natural selection provides a foundational framework for analysing these potential shifts, positing that traits advantageous for survival and reproduction become more prevalent over generations. This literature review explores the intersection of technological reliance and cognitive evolution, drawing upon contemporary studies and theoretical perspectives.

Darwin's seminal work, *The Descent of Man*, introduced the concept that human cognitive abilities evolved through natural selection, emphasising that mental faculties developed similarly to physical traits (Darwin, 1871). This perspective laid the groundwork for evolutionary psychology, which examines how cognitive processes have been shaped by evolutionary pressures.

Evolutionary psychology posits that the human brain comprises specialised mechanisms developed to solve recurrent problems faced by our ancestors, such as social cooperation, language acquisition, and environmental navigation (Pinker, 2010). These adaptations were crucial for survival in ancestral environments, leading to the development of complex cognitive abilities.

The concept of technological evolution parallels biological evolution, where technologies undergo variation, selection, and retention. As AI systems become more sophisticated, they increasingly perform tasks that once required human cognition, potentially leading to a decline in certain cognitive skills due to reduced use. This phenomenon aligns with the principle of "use it or lose it," suggesting that underutilised cognitive functions may diminish over time (Sparrow *et al.,* 2011).

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The Regulated AI Movement highlights concern that reliance on AI tools could foster intellectual stagnation, as individuals become dependent on machines for tasks that previously demanded human thought and ingenuity (RAI Movement, 2025). This dependency may result in decreased problem-solving abilities and critical thinking skills, essential components of human cognition.

The "cognitive niche" hypothesis posits that human intelligence evolved as an adaptation to a knowledge-intensive, socially interdependent lifestyle. This niche involves the ability to manipulate the environment through reasoning, tool use, and social cooperation (Tooby & DeVore, 1987). As AI technologies assume roles within this niche, there is a risk that humans may relinquish these adaptive behaviours, potentially altering the trajectory of cognitive evolution.

If AI systems consistently perform tasks related to problem-solving and decision-making, humans may experience a reduction in the selective pressures that historically favoured these cognitive abilities. Over generations, this could lead to a shift in cognitive traits, with potential implications for the evolution of human intelligence (Pinker, 2010).

Cultural evolution, the transmission of behaviours and knowledge through social learning, plays a significant role in shaping human cognition. The integration of AI into cultural practices may influence the types of knowledge and skills that are valued and transmitted across generations. For instance, reliance on AI for information retrieval may diminish the emphasis on memory and knowledge retention in educational systems (Henrich, 2015).

This shift could result in a population less adept at tasks requiring deep cognitive engagement, as AI tools become the primary means of accessing and processing information. Such changes in cultural practices may, over time, impact the evolutionary pressures acting on cognitive traits, favouring individuals who are proficient in interfacing with technology over those with traditional cognitive skills (Laland *et al*., 2010).

The concept of cognitive atrophy refers to the decline of cognitive abilities due to underuse. As AI systems handle increasingly complex tasks, there is a concern that human cognitive faculties may deteriorate from a lack of engagement. This decline could manifest in areas such as memory, attention, and problem-solving, which are critical for adaptive functioning (Sparrow *et al.,* 2011).

A study published in *Neuroscience News* discusses how AI interactions may mimic ecological relationships, influencing human evolution in subtle yet profound ways. The paper suggests that evolutionary shifts could include changes in brain size, attention spans, and personality traits, driven by the pervasive presence of AI in daily life (Neuroscience News, 2025).

The potential evolutionary impact of AI dependence raises ethical questions about the direction of human development. Should society intervene to preserve certain cognitive abilities, or allow natural selection to proceed unimpeded in the context of technological integration? These considerations necessitate a multidisciplinary approach, involving ethicists, technologists, and evolutionary biologists, to navigate the implications of AI on human evolution (Bostrom, 2014).

Proactive measures, such as designing AI systems that augment rather than replace human cognition and promoting educational practices that emphasise critical thinking and problem-solving, may help mitigate the risks of cognitive decline. By understanding the interplay between technology and evolution, society can make informed decisions to guide the future trajectory of human cognition (Floridi, 2014).

The integration of AI technologies into human life presents both opportunities and challenges for cognitive evolution. While AI can enhance efficiency and access to information, excessive reliance may lead to cognitive atrophy and alter the evolutionary pressures shaping human intelligence. Applying Darwin’s theory of natural selection provides a valuable framework for

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analysing these potential changes, emphasising the importance of adaptive traits in survival and reproduction. As society continues to navigate the complexities of technological dependence, it is crucial to consider the long-term implications for human cognition and evolution.

Psychological and Neurobiological Effects on Human Development and Mental Resilience

The global landscape of Artificial Intelligence (AI) adoption has rapidly evolved over the past decade, ushering in both remarkable technological advancements and complex implications for human cognition and development. The World Economic Forum (2023) notes that AI technologies have permeated nearly every sector health, education, manufacturing, and communication, demonstrating a profound capacity to shape individual behaviour and collective societal functioning. While this proliferation of AI brings immense efficiency, concerns about its psychological and neurobiological impacts on humans have begun to surface.

On a global scale, studies indicate a trend towards increased dependency on AI-driven systems for decision-making, information processing, and problem-solving (Brynjolfsson & McAfee, 2017). This dependency is particularly notable in technologically advanced nations where AI integration into daily life, from virtual assistants to algorithmic content curation is extensive. Such reliance may potentially lead to a decline in manual cognitive engagement, leading researchers to warn against "outsourcing intelligence" to machines (Carr, 2020).

In Africa, AI adoption is emerging steadily, with countries like Kenya, Nigeria, and South Africa leading in experimentation with AI applications in agriculture, fintech, and education (UNECA, 2020). However, while these initiatives show promise in improving service delivery, there is little research exploring the cognitive implications of such reliance, especially in rural populations that may be transitioning rapidly from low-tech to high-tech systems. According to Niyirera *et al.* (2023), this technological leap without adequate cognitive adaptation strategies could disrupt traditional knowledge systems and problem-solving methods, potentially weakening long-standing cognitive patterns.

In Europe, the European Commission (2021) has acknowledged both the benefits and psychological risks associated with AI, particularly among youth. Excessive use of AI-enabled technologies has been linked to reduced attention spans, overdependence on predictive algorithms, and diminished memory retention capabilities (Markowetz, 2015). For instance, the phenomenon known as “digital amnesia,” where individuals forget information easily retrievable via digital devices, has raised concerns about long-term memory consolidation and the plasticity of the human brain (Sparrow *et al.,* 2011).

North America presents one of the most mature AI ecosystems, with large-scale AI deployment in consumer, governmental, and military domains. The psychological implications in this region are more thoroughly researched, with findings suggesting that prolonged engagement with AI interfaces correlates with heightened anxiety, reduced cognitive endurance, and impaired problem-solving in young adults (Twenge *et al.,* 2019). Moreover, neuroimaging studies have indicated that excessive reliance on smart technologies may alter neural pathways related to executive function and attention regulation (Small & Vorgan, 2009; Montag & Walla, 2016).

In Asia, especially in China and Japan, AI technologies are increasingly being incorporated into everyday life. In China, for instance, AI is used extensively in surveillance, education, and social governance. A study by Wang *et al.* (2020) highlights that students using AI-enabled tutoring systems may perform better on tests but often show weaker critical thinking and problem-solving skills when compared to peers engaged in traditional pedagogies. Similarly, Japanese researchers (Kanda *et al*., 2022) found that AI reliance in elderly care, while enhancing physical safety and efficiency, inadvertently reduces opportunities for interpersonal interaction, an

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essential factor for maintaining cognitive vitality in ageing populations.

Regionally, in Sub-Saharan Africa, a key concern is the dichotomy between AI advancement and neuro-cognitive preparedness. The African Union's 2063 Agenda emphasises digital transformation, yet research is scarce on AI's neuropsychological effects on populations with limited digital literacy (AU, 2022). Scholars such as Akinola & Ndubisi (2021) have warned that the "AI adoption gap" could result in uneven cognitive development across populations, with those most exposed to AI possibly experiencing more acute forms of cognitive offloading and reduced mental resilience.

Nationally, Uganda offers a compelling case of AI integration in developmental contexts, especially in agricultural innovation and health systems (Nabukenya *et al*., 2022). However, there is limited empirical data assessing how such technologies affect cognitive habits, particularly among youth and rural populations. Given Uganda's youth-heavy demographics, scholars suggest that AI-centred learning models need to be critically evaluated to ensure they foster rather than inhibit cognitive growth (Tukundane, 2023).

The neurobiological implications of AI reliance are increasingly coming under scientific scrutiny. According to Greenfield (2015), the constant interaction with AI-based technologies, such as recommendation engines and predictive texting, may lead to decreased engagement in complex thinking tasks that stimulate the prefrontal cortex, an area crucial for decision-making and social behaviour. Furthermore, Dopamine-driven reward circuits, often triggered by AI-curated content, may increase instant gratification behaviours, diminishing users' capacity for delayed reward and sustained attention (Meshi *et al.,* 2019).

Psychologically, the overuse of AI has been associated with reduced emotional intelligence, empathy, and social bonding. This phenomenon has been referred to as "technological social displacement," wherein human-to-human interactions are substituted by human-machine interfaces, leading to possible psychological isolation (Turkle, 2015). This raises concerns about the future resilience of human cognition in a world where AI mediates most social and cognitive functions.

Cultural and educational systems also play a role in shaping responses to AI. In cultures that emphasise rote learning and deference to authority (e.g., East Asia), AI may further entrench passive cognitive habits, while in cultures that encourage inquiry and critique, AI may either serve as a tool for amplification or a crutch for laziness (Chowdhury, 2019). Therefore, understanding how socio-cultural values interact with AI usage is essential in predicting its cognitive outcomes.

The disparity in digital infrastructure and access also implies uneven exposure to AI and its cognitive consequences. For instance, in low-income regions, limited exposure may preserve traditional cognitive strengths such as oral memory and communal reasoning (Owusu & Boateng, 2021). In contrast, overexposure in wealthier nations may accelerate cognitive offloading and dependency, raising evolutionary concerns about the survival value of cognitive skills in future generations.

These observations align with evolutionary concerns grounded in Darwinian theory. If artificial environments increasingly reward reliance on machines rather than independent thinking, evolutionary pressures may favour traits aligned with technological dependency, potentially altering the cognitive makeup of *Homo sapiens* over generations (Richerson & Boyd, 2020). In this context, resilience, adaptability, and mental robustness may diminish in favour of passive information reception and stimulus-driven behaviours.

In conclusion, while AI holds transformative potential, its global, continental, regional, and national patterns of use are already shaping the cognitive and psychological landscape of humanity. The degree to which this transformation aligns with or deviates from the

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adaptive trajectory envisioned by Darwin's natural selection is a critical question for future interdisciplinary research. Only by integrating insights from neuroscience, psychology, evolutionary theory, and digital ethics can we understand and mitigate the long-term impacts of AI on human mental resilience and development.

METHODOLOGY

This chapter outlines the methodological approach employed in conducting this study. Given the conceptual and reflective nature of the topic *"Assessing how overreliance on Artificial Intelligence technologies may lead to cognitive atrophy and potentially mental regression in Homo sapiens through the lens of Darwin's theory of evolution by natural selection",* a qualitative and theoretical methodology was adopted. The study is grounded in philosophical and interdisciplinary inquiry rather than empirical field research.

Research Design

The research utilised a conceptual and theoretical design, commonly used in philosophical, socio-technological, and evolutionary studies. This design is appropriate for investigating abstract and interdisciplinary themes by critically engaging with existing literature, theories, and philosophical arguments (Jabareen, 2009). The focus is on synthesising knowledge from various academic domains such as evolutionary biology, cognitive psychology, neuroscience, and artificial intelligence ethics to construct an informed perspective on the possible long-term impacts of AI on human cognitive evolution.

Methodological Approach

The study employed a desk-based analytical methodology that integrates conceptual analysis, theoretical synthesis, and critical literature review. Conceptual analysis was used to define and unpack key ideas such as cognitive atrophy, mental regression, technological dependence, and Darwinian evolution. Theoretical synthesis drew upon Darwin's theory of natural selection, contemporary neuroscience, and AI ethics to establish an interdisciplinary framework. Additionally, a critical review of existing literature, including journal articles, books, reports, and recent studies from 2015 to 2025, provided insights into the intersections of AI, cognitive science, and evolutionary psychology (Maali, C, 2025). Rather than engaging in conventional data collection, this approach sought to construct a cohesive narrative by integrating diverse bodies of knowledge.

Sources of Data

Since the study is non-empirical, data were sourced from a range of secondary materials selected for their relevance, scholarly rigour, and recency, with priority given to works published between 2015 and 2025. These sources included peer-reviewed academic journals such as *Nature*, *Trends in Cognitive Sciences*, and *Artificial Intelligence Review*; books and monographs on Darwinian theory, cognitive psychology, and artificial intelligence, including works by Carr (2020) and Harari (2018); reputable academic databases like Scopus, Google Scholar, PubMed, JSTOR, and Web of Science; as well as institutional reports and white papers from organizations such as the World Economic Forum, UNESCO, OECD, and various AI research institutes.

Data Analysis

In line with its conceptual nature, the study does not engage in primary data collection. Instead, it conducts secondary data analysis, drawing from scholarly publications, theoretical discourses, and interdisciplinary academic resources. The data consist of peer-reviewed journal articles, academic books, and verified institutional reports that address themes such as AI influence on cognition, human-machine interaction, evolutionary biology, and educational technology (Brougham & Haar, 2018; Brynjolfsson & McAfee, 2017; Schwab, 2016). These materials are selected based on their relevance and scholarly rigour and are thematically categorised under cognitive atrophy, AI dependency, and evolutionary theory. The analytic technique employed is qualitative content analysis, which involves interpreting patterns, concepts, and

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implications from existing literature (Vaismoradi *et al.,* 2016). This method enables the development of informed insights about how technological convenience and automation might affect the brain's adaptive functions, posing evolutionary questions consistent with Darwin's postulates. The focus is on identifying theoretical and empirical gaps and projecting the possible long-term cognitive implications of AI dominance in human activity.

Scope and Delimitations

The study is conceptual and is therefore limited to academic, philosophical, and scientific discourse. It does not engage in fieldwork or gather primary data from human subjects. The conclusions drawn are speculative, interpretive, and rooted in existing scholarship rather than empirical measurement.

Justification of Methodology

This reflective and theoretical approach is justified given the abstract and forward-looking nature of the research question. The goal is not to measure a present reality, but to critically examine potential trajectories and consequences. Similar methods are frequently employed in interdisciplinary research involving future studies, philosophy of technology, and speculative cognitive science (Lucivero, 2016; Bostrom, 2014).

Ethical Considerations

As no fieldwork or interaction with human participants was undertaken, the study did not require formal ethical clearance. Nonetheless, academic integrity and proper citation were strictly observed in the use of all sources. Efforts were made to avoid misrepresentation of authors' ideas and to present balanced viewpoints.

FINDINGS

This chapter presents the findings of the study based on a conceptual analysis of secondary literature and theoretical discourse. Although the study did not rely on field data, the analytical exploration of overreliance on Artificial Intelligence (AI) technologies reveals critical insights regarding cognitive evolution, neuropsychological function, and the survival dynamics of *Homo sapiens* as interpreted through Darwin's theory of evolution by natural selection. The findings are presented thematically, guided by the study objectives.

Decline in Cognitive Engagement and the Rise of Cognitive Atrophy

The study finds compelling theoretical support for the argument that overdependence on AI may diminish core cognitive faculties such as memory retention, attention, and critical thinking. As individuals increasingly outsource mental labour to algorithms and intelligent systems like navigation, information recall, and even decision-making, the brain is deprived of opportunities for organic cognitive engagement (Risko & Gilbert, 2016; Ward, 2019). According to neuroplasticity theory, unused neural circuits weaken over time, a phenomenon consistent with the concept of cognitive atrophy (Kays *et al*., 2017). This atrophy mirrors a form of disuse-driven degeneration, raising concern about the long-term implications for adaptive intelligence and problem-solving ability in humans.

AI as a Selective Pressure in Evolutionary Trajectories

Darwinian theory posits that traits that enhance survival and reproduction are preserved through natural selection. The findings suggest that AI technologies may alter these evolutionary pressures. Historically advantageous traits such as memory, intuition, and reasoning may become less critical in environments where intelligent machines perform these functions more efficiently (Frank *et al.,* 2019). As such, natural selection may no longer favour individuals with robust cognitive resilience if such traits are no longer required for survival or success. This implies a shift in the trajectory of human evolution, where biological intelligence could be slowly superseded or de-emphasised in favour of technological augmentation (Harari, 2018; Bostrom, 2014).

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Cognitive Offloading and Mental Deskilling

Another key finding relates to the role of AI in promoting widespread "cognitive offloading." Humans are increasingly dependent on external devices for memory, planning, and even emotional support (Sparrow *et al*., 2011; Mayer-Schönberger & Cukier, 2017). This has led to what some scholars call "mental deskilling," a condition where individuals lose the ability or motivation to perform basic cognitive tasks independently. This phenomenon can be interpreted as a behavioural adaptation with evolutionary consequences, especially if cognitive independence becomes obsolete in daily functioning (Clark, 2020).

Global Patterns of AI Usage and Neurocognitive Vulnerability

From a global perspective, the integration of AI into education, healthcare, governance, and communication varies by region, yet a common trend is the substitution of machine intelligence for human cognition. While this has contributed to efficiency and innovation, the study finds growing concern among scholars about the decline in human attentional capacity, memory depth, and critical analysis skills across all regions (Carr, 2020; Susskind, 2020). In technologically advanced societies such as the U.S., China, and Northern Europe, there is stronger evidence of cognitive externalisation, compared to developing regions where human cognition remains more central to decision-making processes (UNESCO, 2021).

Africa's Position in the AI-Human Cognition Continuum

Regionally, the African continent remains at a developmental crossroads. While AI integration is growing in education, agriculture, and health sectors, many African societies still rely on traditional knowledge systems and direct cognitive engagement (Nshimbi & Moyo, 2020). This suggests that Africa may possess a buffer against immediate cognitive atrophy, though the trajectory remains uncertain as digital transformation accelerates. Furthermore, the continent offers a unique lens for comparative evolutionary inquiry, potentially serving as a baseline for understanding unaltered cognitive development under less AI-dependent conditions.

Psychological Effects and Neurobiological Implications

The study finds significant psychological and neurological implications associated with long-term AI reliance. Studies indicate increased susceptibility to anxiety, shortened attention spans, and altered reward processing among individuals who constantly interact with AI-enhanced platforms (Alter, 2017; Montag & Diefenbach, 2018). These symptoms correlate with neurobiological shifts such as dopamine desensitisation and reduction in hippocampal activation factors that could reshape cognitive development over generations if unchecked (Small *et al.,* 2020).

AI and Human Cognitive Evolution: A Theoretical Paradox

A central finding is the paradox AI introduces into evolutionary discourse. While AI improves immediate human efficiency and quality of life, it may simultaneously undercut the very cognitive traits that defined *Homo sapiens'* evolutionary success. The brain's ability to adapt may ultimately backfire, enabling humans to survive through external augmentation rather than internal development, challenging the core Darwinian premise of natural selection acting on intrinsic biological fitness (Churchland, 2019).

Ethical and Philosophical Implications of Mental Outsourcing

Ethically, the commodification of thought processes raises serious concerns. The findings reveal that as AI systems increasingly control information filtering, problem-solving, and creativity, they may also shape human values and consciousness (Zuboff, 2019). This intrusion into the cognitive domain may limit personal autonomy, creativity, and individuality dimensions often linked with human flourishing and evolutionary adaptability (Floridi, 2015).

AI as a Cognitive Equaliser and Divider

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On the one hand, AI offers cognitive equalisation by granting access to knowledge and tools regardless of biological capacity. On the other hand, it risks deepening cognitive stratification between those who understand and can control AI systems and those who passively consume them (Eubanks, 2018). This duality could influence future evolutionary outcomes, potentially selecting for techno-literacy rather than traditional cognitive dexterity.

Synthesis of Darwinian and Contemporary Cognitive Models

The findings reinforce the view that evolution is no longer driven solely by environmental constraints but also by technological affordances. AI technologies introduce a new artificial environment, altering the selection mechanisms that once rewarded cognitive complexity and survival instinct. In this context, Darwin's theory remains relevant, yet must be interpreted dynamically, acknowledging the shift from organic to synthetic pressures on the human species (Dennett, 2017; Jasanoff, 2016).

DISCUSSION

This chapter interprets the findings of the study about the conceptual framework and literature reviewed. The analysis centres on the evolutionary implications of *Homo sapiens'* increasing dependence on Artificial Intelligence (AI), examining how this reliance aligns with or challenges the principles of Darwin's theory of evolution by natural selection. The discussion explores key themes such as cognitive atrophy, technological dependency, neuropsychological changes, and the shifting parameters of human adaptability in an AI-saturated world. It also considers broader ethical, societal, and evolutionary concerns emerging from the relationship between AI and human cognition.

Cognitive Atrophy in the Age of AI: A Neurological and Evolutionary Concern

The study establishes that overreliance on AI can lead to cognitive atrophy, the weakening or loss of cognitive abilities due to underuse. This is consistent with Hebbian principles of neuroplasticity, which suggest that neural pathways weaken when not regularly engaged (Kays *et al.,* 2017). As AI systems take over tasks such as memory retrieval, decision-making, and problem-solving, humans risk disengaging critical areas of the brain, particularly the prefrontal cortex and hippocampus, vital for reasoning and memory (Small *et al*., 2020).

From an evolutionary standpoint, this presents a paradox. Darwinian evolution favours traits that enhance adaptability and survival (Darwin, 1859). However, if AI compensates for these traits, the selective pressure to retain strong cognitive abilities may weaken. This raises the unsettling possibility that natural selection may no longer prioritise cognitive complexity, potentially favouring passivity or technological dependence over active problem-solving, a regression rather than progression of mental faculties.

Revisiting Darwin: AI as a New Environmental Pressure

Darwin's model of evolution was based on the premise that environmental pressures shape biological adaptations. In today's digital ecosystem, AI constitutes a novel environment that rewards efficiency and convenience, often at the expense of deep thinking and cognitive endurance. The adaptation to this environment may entail a shift in how intelligence manifests, less as internal cognitive power and more as the ability to interact seamlessly with smart systems (Frank *et al.,* 2019; Harari, 2018).

This scenario redefines fitness in evolutionary terms: the "fittest" are no longer those with superior memory or reasoning, but those most skilled at leveraging AI tools. This challenges traditional evolutionary narratives and introduces a form of "techno-selection," where adaptability is measured not by intrinsic ability but by technological fluency (Bostrom, 2014).

The Erosion of Cognitive Autonomy and Mental Resilience

The outsourcing of mental functions to AI systems, what Sparrow *et al.* (2011) term "transactive memory," may reduce cognitive

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autonomy and diminish the human capacity for resilience. This raises concerns about "mental deskilling" (Clark, 2020), where individuals lose the ability to perform tasks they once mastered. In critical thinking, creative reasoning, and even emotional regulation, this can lead to a loss of depth and spontaneity.

Such changes may affect human survival in unforeseen ways. For example, in situations where AI systems fail or are unavailable, individuals with diminished cognitive skills may struggle to function independently. This introduces a potential evolutionary bottleneck where reliance on non-biological systems becomes a liability rather than a strength.

Regional and Global Variations in AI Exposure and Cognitive Impact

The discussion also acknowledges geographical disparities in AI exposure. In technologically advanced nations, cognitive atrophy may already be in progress, as dependence on digital assistants, recommendation algorithms, and AI-powered interfaces becomes commonplace (Carr, 2020; Susskind, 2020). In contrast, regions like sub-Saharan Africa still rely heavily on oral traditions, human problem-solving, and experiential learning (Nshimbi & Moyo, 2020).

This differential adoption introduces an important comparative dimension: some populations may retain higher levels of organic cognitive engagement and resilience, which could influence future evolutionary outcomes. If cognitive robustness becomes essential in a post-AI crisis scenario, such groups may ironically become more "fit" in Darwinian terms.

***Homo sapiens* and the Prospect of Evolutionary Divergence**

A provocative implication of this study is the possible cognitive divergence within Homo sapiens. As some individuals or populations embrace AI dependency, others may resist it either through cultural norms, limited access, or conscious decision. This could lead to evolutionary branching, where AI-integrated humans evolve along different cognitive and even neurobiological lines than those who maintain traditional learning and memory pathways.

Such divergence may not manifest immediately as physical or anatomical changes, but rather as distinct patterns of thought, memory capacity, and emotional regulation (Montag & Diefenbach, 2018). Over generations, these differences could become more pronounced, challenging the uniformity of the human cognitive species.

Ethical and Philosophical Considerations: The Price of Progress

From an ethical perspective, the growing entanglement of human cognition with AI poses fundamental questions about agency, identity, and autonomy. If AI systems shape not only how people think but what they think about, this may erode individual freedom and undermine democratic processes (Zuboff, 2019). The commodification of cognition, where AI determines relevance, priority, and accuracy, transfers intellectual authority from humans to machines.

Philosophers such as Floridi (2015) warn that this trend may undermine human dignity and disrupt the balance between informational empowerment and dependency. Darwin emphasised the role of struggle and adaptation in human progress; the abdication of mental effort to machines may signal the end of that struggle and, perhaps, of progress itself.

AI and the Future of Natural Selection

Finally, the discussion considers whether natural selection, as understood in Darwinian terms, is still the primary mechanism shaping human evolution. If external technological systems increasingly mediate cognition, behaviour, and even reproduction, then artificial selection or techno-selection may be the dominant evolutionary force. Unlike natural selection, which favours traits organically advantageous in natural environments, techno-selection rewards traits conducive to digital integration and algorithmic efficiency (Jasanoff, 2016).

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This shift could redefine human evolution in ways that Darwin never envisioned. In a future where AI systems manage health, education, emotional care, and problem-solving, the human brain may be selected not for its capacity, but for its compatibility with machines.

CONCLUSION

In sum, the overreliance on AI technologies raises profound evolutionary, neurological, and philosophical challenges for Homo sapiens. While these tools enhance convenience and productivity, they may also undermine the cognitive traits that have historically defined human excellence and adaptability. Viewed through Darwin's lens, AI is not merely a tool but a transformative force, one that may redefine the parameters of fitness and the future of our species.

CONCLUSION AND RECOMMENDATIONS

This final chapter synthesises the major findings and arguments presented throughout the study. It reflects on the broader implications of overreliance on Artificial Intelligence (AI) technologies for human cognition, evolution, and resilience, framed within Darwin's theory of evolution by natural selection. It also outlines practical and theoretical recommendations for policymakers, scholars, and the global community, while suggesting directions for further academic inquiry.

Summary of Key Findings

The study critically examined how the increasing dependency on AI technologies may lead to cognitive atrophy and potential mental regression among *Homo sapiens*, evaluated through an evolutionary and neuroscientific lens.

First, the research established that as humans delegate more mental functions to AI systems, such as memory, navigation, decision-making, and communication, essential cognitive skills may begin to deteriorate. The concept of cognitive atrophy was supported by empirical research in neuroplasticity, which shows that underutilised brain regions tend to weaken over time (Small *et al.*, 2020; Kays *et al.,* 2017).

Second, through Darwin's theory of natural selection, the study revealed that AI technologies introduce new environmental conditions in which biological traits such as independent thinking and memory may lose adaptive value. This suggests an evolutionary misalignment where the natural selection process no longer favours intrinsic cognitive abilities but rather the capacity to interface effectively with machines (Bostrom, 2014; Frank *et al.,* 2019).

Third, the research underscored global, regional, and national disparities in AI access and integration. While the Global North is increasingly integrated with AI, many regions in the Global South, such as sub-Saharan Africa, still rely on traditional knowledge systems. These differences may lead to divergent cognitive pathways and possibly uneven evolutionary pressures across populations (Nshimbi & Moyo, 2020).

Lastly, the study highlighted the ethical and philosophical implications of surrendering cognitive autonomy to machines. The risks of "mental deskilling," reduced resilience, and erosion of human agency were found to be growing concerns (Clark, 2020; Zuboff, 2019).

Theoretical Contributions

The research contributes to the theoretical field by extending Darwin's theory of natural selection to contemporary technological environments. It proposes the concept of "technological evolutionary displacement", where digital tools like AI alter the fitness landscape by substituting human mental effort with machine precision. This may lead to a devaluation of once-critical cognitive traits, challenging traditional notions of progress, adaptation, and human uniqueness.

The study also reinforces neurocognitive theories that emphasise the "use-it-or-lose-it" principle, suggesting that technological crutches may not merely augment human potential but also suppress natural cognitive evolution. Through this

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interdisciplinary lens, the study positions AI as a dual-edged agent of change, both transformative and potentially reductive.

Practical Implications

The implications of these findings extend across educational, developmental, and policy spheres.

Education Systems must refocus on strengthening critical thinking, memory, and creativity, not just digital literacy. The aim should be to integrate AI as a supplement rather than a substitute for cognitive effort.

Mental Health Practitioners and Neuroscientists should explore emerging syndromes related to digital dependence, including attention deficits, memory loss, and impaired emotional regulation.

Policy Makers should craft ethical frameworks for AI development that prioritise human cognitive resilience. Regulations should require transparency, cognitive stimulation mechanisms, and safeguards against overdependence.

Cultural Institutions, especially in the Global South, should preserve and promote indigenous knowledge systems and oral traditions as reservoirs of resilient cognitive practice.

Recommendations

Based on the analysis, the study offers the following key recommendations

- Promote Cognitive Exercise Programs**:** Governments and institutions should support cognitive fitness programs that emphasise memory, critical reasoning, and emotional intelligence counterbalancing automation.
- Integrate Evolutionary Psychology into AI Policy Debates: AI ethics frameworks should incorporate evolutionary consequences, particularly how long-term use of AI might affect human adaptability and survival.
- Encourage Human-AI Co-evolutionary Models: Instead of AI replacing human functions, innovation should aim for symbiotic models where human and machine co-develop without cognitive displacement.
- Launch Cross-Regional Cognitive Impact Studies: Comparative research should assess how varying degrees of AI penetration across different societies influence cognitive function and mental health.
- Preserve Cognitive Autonomy: Educational curricula and digital systems should embed "cognitive friction" features requiring users to engage rather than passively receive information.
- Reframe Technological Progress: Shift public discourse away from viewing automation as inherently progressive. Encourage nuanced perspectives that value *human capacity* as central to development.

Limitations of the Study

This study is largely conceptual and theoretical, based on synthesis from existing literature rather than original empirical data collection. While this approach provides depth and theoretical clarity, it limits the study's capacity to measure real-time cognitive change among specific populations. Additionally, the evolving nature of AI technology means that its long-term implications remain partly speculative and must be reevaluated over time.

Suggestions for Further Research

- Longitudinal Cognitive Studies: Track users heavily dependent on AI over time to detect changes in memory, problem-solving, and emotional regulation.
- Cross-Cultural Studies: Explore how AI reliance affects different societies—urban vs rural, digital-native vs traditional communities.
- Evolutionary Simulations: Use predictive modelling to simulate how AI environments might affect human cognitive traits across multiple generations.
- AI-Education Interventions: Evaluate which AI-based learning models preserve or enhance human cognition rather than replace it.

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Conclusion

In conclusion, this study underscores a paradox at the heart of modern technological evolution. While AI has revolutionised knowledge access and efficiency, it simultaneously threatens to undermine the very cognitive faculties that define humanity. If Darwinian theory reminds us that survival depends on adaptation, then the challenge of our age is to ensure that adaptation does not become surrender. Preserving cognitive autonomy and resilience is not merely a neurological or educational goal it is a species-level imperative.

REFERENCES

African Union. (2022). *Agenda 2063: Report on the implementation of the first ten-year plan*. African Union Commission.

Akinola, A. O., & Ndubisi, C. E. (2021). The AI adoption gap and its cognitive implications for developing economies. *Journal of Global Information Technology Management*, *24*(3), 208–225.

Alter, A. (2017). *Irresistible: The rise of addictive technology and the business of keeping us hooked*. Penguin Press.

Bostrom, N. (2014). *Superintelligence: Paths, dangers, strategies*. Oxford University Press.

Brougham, D., & Haar, J. (2018). Smart technology, artificial intelligence, robotics, and algorithms (STARA): Employees' perceptions of future workplace automation. *Journal of Management & Organization, 24*(2), 239–257.

Brynjolfsson, E., & McAfee, A. (2017). *Machine, platform, crowd: Harnessing our digital future*. W. W. Norton & Company.

Carr, N. (2010). *The shallows: What the Internet is doing to our brains*. W. W. Norton & Company.

Carr, N. (2020). *The shallows: What the Internet is doing to our brains* (Updated ed.). W. W. Norton & Company.

Chowdhury, A. (2019). *The algorithmic mind: AI, culture, and the future of human cognition*. MIT Press.

Churchland, P. S. (2019). *Conscience: The origins of moral intuition*. W. W. Norton & Company.

Clark, A. (2020). *Surfing uncertainty: Prediction, action, and the embodied mind*. Oxford University Press.

Clark, A., & Chalmers, D. (1998). The extended mind. *Analysis*, *58*(1), 7–19.

Darwin, C. (1871). *The descent of man, and selection in relation to sex*. John Murray.

Darwin, C. (2004). *On the origin of species by means of natural selection* (M. L. Reiss, Ed.). Harvard University Press. (Original work published 1859)

Dennett, D. C. (1995). *Darwin's dangerous idea: Evolution and the meanings of life*. Simon & Schuster.

Dennett, D. C. (2017). *From bacteria to Bach and back: The evolution of minds*. W. W. Norton & Company.

Dreyfus, H. L. (2001). *On the Internet*. Routledge.

Eubanks, V. (2018). *Automating inequality: How high-tech tools profile, police, and punish the poor*. St. Martin's Press.

Floridi, L. (2014). *The Fourth Revolution: How the infosphere is reshaping human reality*. Oxford University Press.

Floridi, L. (2015). *The onlife manifesto: Being human in a hyperconnected era*. Springer.

Frank, M. C., Bergelson, E., Bergmann, C., Cristia, A., Floccia, C., Hamlin, J. K., & Lew-Williams, C. (2019). A collaborative approach to infant research: Promoting reproducibility, best practices, and theory-building. *Infancy*, *24*(4), 421–437.

Frank, M. C., Vul, E., & Johnson, S. P. (2019). The evolution of communicative flexibility:

Article DOI: https://doi.org/10.37284/eajis.8.2.3463

Complex communicative behavior in humans and nonhuman primates. *Developmental Psychobiology, 61*(2), 221–233.

Frank, M. R., Wang, D., Cebrian, M., & Rahwan, I. (2019). The evolution of human behavior in the age of artificial intelligence. *Nature Human Behaviour, 3*(5), 444–450.

Gould, S. J. (2002). *The structure of evolutionary theory*. Harvard University Press.

Greenfield, S. (2015). *Mind change: How digital technologies are leaving their mark on our brains*. Random House.

Harari, Y. N. (2018). *21 lessons for the 21st century*. Jonathan Cape.

Henrich, J. (2015). *The secret of our success: How culture is driving human evolution, domesticating our species, and making us smarter*. Princeton University Press.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign.

Hutton, J. S., Dudley, J., Horowitz-Kraus, T., DeWitt, T., & Holland, S. K. (2020). Associations between screen-based media use and brain white matter integrity in preschool-aged children. *JAMA Pediatrics*, *174*(1), e193869.

Jabareen, Y. (2009). Building a conceptual framework: Philosophy, definitions, and procedure. *International Journal of Qualitative Methods, 8*(4), 49–62.

Jasanoff, S. (2016). *The ethics of invention: Technology and the human future*. W. W. Norton & Company.

Javadi, A.-H., Emo, B., Howard, L. R., Zisch, F. E., Yu, Y., Knight, R., ... & Spiers, H. J. (2017a). Hippocampal and prefrontal processing of network topology to simulate the future. *Nature Communications*, *8*, Article 14652.

Javadi, A.-H., Spiers, H. J., Mullally, C. J., Suthana, N., & Düzel, E. (2017). Hippocampal and prefrontal processing of spatial navigation using GPS devices: A neural correlate of cognitive offloading. *Scientific Reports*, *7*(1), Article 525.

Kanda, T., Ishiguro, H., Ono, T., Imai, M., & Mase, K. (2022). Psychological effects of robot-mediated communication on humans. *AI & Society*, *37*(2), 335–348.

Kays, J. L., Hurley, R. A., & Taber, K. H. (2017). The dynamic brain: Neuroplasticity and mental health. *The Journal of Neuropsychiatry and Clinical Neurosciences, 29*(4), 289–294.

Kirschner, P. A., & De Bruyckere, P. (2017). The myths of the digital native and the multitasker. *Teaching and Teacher Education*, *67*, 135–142.

Laland, K. N., Odling-Smee, J., & Feldman, M. W. (2010). Niche construction and evolution of human cognitive capacities. *Philosophical Transactions of the Royal Society B*, *365*(1545), 2077–2089.

Livingstone, S., & Helsper, E. J. (2020). Balancing opportunities and risks in teenagers' use of the internet: The role of online skills and internet self-efficacy. *New Media & Society*, *9*(2), 309–329.

Lucivero, F. (2016). *Ethical assessments of emerging technologies: Appraising the moral plausibility of technological visions*. Springer.

Maali, C. (2025). *Technological dependency and the paradox of progress: Cognitive consequences in the age of AI*. African Rural University Press.

Markowetz, A. (2015). *Digitaler Burnout: Warum unsere permanente Smartphone-Nutzung uns krank macht* [Digital burnout: Why our permanent smartphone use makes us sick]. Droemer Knaur.

Article DOI: https://doi.org/10.37284/eajis.8.2.3463

Mayer-Schönberger, V., & Cukier, K. (2017). *Big data: The essential guide to work, life and learning in the age of insight*. John Murray.

Meshi, D., Elizarova, A., & Bender, A. R. (2019). The neural correlates of social media reward processing: Implications for sustained attention. *Neuroscience & Biobehavioral Reviews*, *105*, 12–24.

Montag, C., & Diefenbach, S. (2018). Towards homo digitalis: Important research issues for psychology and the neurosciences at the dawn of the Internet of Things and the digital society. *Sustainability*, *10*(2), 415.

Montag, C., & Walla, P. (2016). The psycho-social and neural effects of smartphone use: A new research field needing a multidisciplinary view. *Frontiers in Psychology*, *7*, 991.

Mwesigwa, J. (2022). AI integration in East African education systems: Opportunities and challenges. *East African Journal of Education and Technology*, *14*(2), 89–102.

Nabukenya, J., Ssekibuule, R., & Okello, D. (2022). The application of AI in Uganda's developmental sectors: A case study of agriculture and health. *Makerere University Journal of Agricultural and Environmental Sciences*, *11*(1), 88–105.

Neuroscience News. (2025). *AI and the human brain: Ecological implications of machine integration*.

Niyirera, C., Byiringiro, J., & Mugisha, A. (2023). AI adoption and its impact on traditional problem-solving methods in rural communities. *East African Journal of Science and Technology, 14*(2), 45–60

Nshimbi, C. C., & Moyo, I. (2020a). The digital divide and the knowledge economy in Africa: A review. *African Journal of Science, Technology, Innovation and Development, 12*(1), 1–10.

Nshimbi, C. C., & Moyo, I. (2020b). The interface of traditional knowledge and modern technology in Africa's development. *Journal of Southern African Studies, 46*(2), 237–255.

Nshimbi, C. C., & Moyo, I. (2020c). The political economy of migration in sub-Saharan Africa. In A. Adepoju (Ed.), *Migration in sub-Saharan Africa* (2nd ed., pp. 37–61). Routledge.

Ong, W. J. (1982). *Orality and literacy: The technologizing of the word*. Routledge.

Owusu, A., & Boateng, F. (2021). Indigenous knowledge systems and problem-solving: A case from Sub-Saharan Africa. *Journal of African Cultural Studies*, *33*(3), 289–304.

Pariser, E. (2011). *The filter bubble: What the Internet is hiding from you*. Penguin Press.

Pinker, S. (2010). The cognitive niche: Coevolution of intelligence, sociality, and language. *Proceedings of the National Academy of Sciences*, *107*(Supplement 2), 8993–8999.

Radesky, J. S., Schumacher, J., & Zuckerman, B. (2020). Mobile and interactive media use by young children: The good, the bad, and the unknown. *Pediatrics*, *135*(1), 1–3.

RAI Movement. (2025). *Manifesto for regulated AI: Preserving human intellect*.

Richerson, P. J., & Boyd, R. (2020). The human cognitive niche in a world of smart machines. In S. M. Gates & L. T. Chang (Eds.), *Evolution in the 21st century: A new synthesis* (pp. 215–230). Oxford University Press.

Risko, E. F., & Gilbert, S. J. (2016). Cognitive offloading. *Trends in Cognitive Sciences*, *20*(9), 676–688.

Russell, S., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson.

Schwab, K. (2016). *The fourth industrial revolution*. World Economic Forum.

Selwyn, N. (2016). *Is technology good for education?* Polity Press.

Article DOI: https://doi.org/10.37284/eajis.8.2.3463

Small, G., & Vorgan, G. (2008). *iBrain: Surviving the technological alteration of the modern mind*. HarperCollins.

Small, G. W., Moody, T. D., Siddarth, P., & Bookheimer, S. Y. (2009). Your brain on Google: Patterns of cerebral activation during internet searching. *The American Journal of Geriatric Psychiatry*, *17*(2), 116–126.

Small, G. W., Moody, T. D., Siddarth, P., & Bookheimer, S. Y. (2020). Brain health consequences of digital technology use. *Dialogues in Clinical Neuroscience, 22*(2), 179–187.

Sparrow, B., Liu, J., & Wegner, D. M. (2011). Google effects on memory: Cognitive consequences of having information at our fingertips. *Science*, *333*(6043), 776–778.

Spitzer, M. (2012). Digital dementia. *The Lancet*, *379*(9830), 497.

Stern, Y. (2009). Cognitive reserve. *Neuropsychologia*, *47*(10), 2015–2028.

Sunstein, C. R. (2017). *#Republic: Divided democracy in the age of social media*. Princeton University Press.

Susskind, D. (2020). *A world without work: Technology, automation, and how we should respond*. Metropolitan Books.

Susskind, J. (2018). *Future politics: Living together in a world transformed by tech*. Oxford University Press.

Susskind, R. (2020). *Online courts and the future of justice*. Oxford University Press.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, *12*(2), 257–285.

Tooby, J., & DeVore, I. (1987). The reconstruction of hominid behavioral evolution through strategic modeling. In W. G. Kinzey (Ed.), *The evolution of human behavior: Primate models* (pp. 183–237). State University of New York Press.

Tukundane, C. (2023). AI-centred learning and its effect on youth cognitive development in Uganda. In A. B. Kasozi & L. M. Otim (Eds.), *Technology and the future of education in East Africa* (pp. 115–132). Fountain Publishers

Tumwine, J., & Kasirye, M. (2023). AI in Uganda's education system: Balancing innovation and cognitive development. *Uganda Journal of Education and Development*, *9*(1), 34–48.

Turkle, S. (2015). *Reclaiming conversation: The power of talk in a digital age*. Penguin Press.

Twenge, J. M., & Campbell, W. K. (2018). Associations between screen time and lower psychological well-being among children and adolescents: Evidence from a population-based study. *Preventive Medicine Reports*, *12*, 271–283.

Twenge, J. M., Spitzberg, B. H., & Campbell, W. K. (2019). Less in-person social interaction with peers among U.S. adolescents in the 21st century and links to loneliness. *Journal of Social and Personal Relationships*, *36*(6), 1892–1913.

United Nations Economic Commission for Africa (UNECA). (2020). *African Union digital transformation strategy 2020–2030*.United Nations Economic Commission for Africa. (2021). *Artificial Intelligence for Africa: Unlocking AI's potential for inclusive and sustainable development*.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2021). *Artificial intelligence and education: Guidance for policy-makers*.

Vaismoradi, M., Jones, J., Turunen, H., & Snelgrove, S. (2016). Theme development in qualitative content analysis and thematic analysis. *Journal of Nursing Education and Practice, 6*(5), 100–110.

Article DOI: https://doi.org/10.37284/eajis.8.2.3463

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wang, L., Zhang, Y., & Chen, X. (2020). The double-edged sword of intelligent tutoring systems: A study on student performance and critical thinking. *Journal of Educational Computing Research*, *58*(3), 512–535

Ward, A. F. (2019). Supernormal: How the internet is changing our memories and our minds. *Psychological Inquiry, 30*(2), 152–159.

Wilmer, H. H., Sherman, L. E., & Chein, J. M. (2017). Smartphones and cognition: A review of research exploring the links between mobile technology habits and cognitive functioning. *Frontiers in Psychology*, *8*, Article 605.

World Economic Forum. (2023). *The future of jobs report 2023*.

Zhang, J., Zhao, Y., Chen, X., & Wang, H. (2021). Artificial Intelligence and human cognition: Challenges and opportunities. *AI & Society*, *36*(1), 23–35.

Zuboff, S. (2019). *The age of surveillance capitalism: The fight for a human future at the new frontier of power*. PublicAffairs.

