

ChatGPT and the entangled evolution of society, education, and technology: a systems theory perspective

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Abstract

This paper presents a novel contribution to the discourse surrounding Large Language Models (LLMs) like ChatGPT in relation to education and society by using systems theory. We argue that ChatGPT can be understood not just as an ‘artificial’ intelligence but that it is entangled in the evolution of society and therefore education. ChatGPT is a subsystem of the autopoietic system of technology, which in modern society mediates between individual thinking, the physical world, and between thought and society. It is an *instrumental* tool and a *semantic communication medium*. With this bimodal framing, we consider ChatGPT and its role in society and education and consider the uses and implications of the technology. In this we respond to the need to introduce a scientific understanding of ChatGPT. We consider its emerging role in promoting educational inclusion, while also reflecting on challenges and limitations. We conclude by identifying the critical multi-dimensional skill sets required for individuals in a ChatGPT-integrated society and calls for strategic educational policies to facilitate this integration responsibly. Overall, this study paves the way for further research by providing a foundational understanding of LLMs through systems theory, thereby informing their ethical and effective incorporation into education.

Introduction

There is a pressing need for a scientific understanding of the nature and impact of ChatGPT, occurring against a backdrop of global public discourse dominated by its perceived threat to the integrity of education and society, expressing alarm about the potential replacement of human beings by machines. In this, the technology is often reduced to a simplistic binary of being either very good or very bad for society and for education and learning (see, for example, Bell, 2023; Cairns, 2023; Nast, 2023; Seddon, 2022; Swift, 2022; Williams, 2023). The utopian view presents, for example, a ‘fully automated luxury communism/liberalism’ (e.g. Bastani, 2019), where artificial intelligence (AI) solves all our problems and creates a society of abundance and leisure. On the other hand, the dystopian view presents a dark, apocalyptic world in which AI like ChatGPT becomes *Skynet* (*The Terminator*, 1984), a self-aware and self-replicating system that destroys humanity.

The paper employs systems theory to analyse ChatGPT and other large language models (LLMs). Key systems theory concepts, such as autopoiesis, structural coupling, and functional differentiation, are utilized to demonstrate how LLMs are not merely external agents but are deeply interconnected with societal and educational systems. The paper suggests a dual framework: technology as both a tool and a semantic medium. This elucidates how ChatGPT not only performs tasks but also mediates thought, action, and communication, maintaining a recursive relationship with the societal structure. Through this lens, the paper also uncovers paradoxes concerning inclusion and exclusion in both educational and broader social contexts. This approach mitigates extreme utopian or dystopian perspectives, guiding a more nuanced discourse around the responsible integration of LLMs into educational and social systems.

ChatGPT, a Large Language Model (LLM) AI, developed by a US company OpenAI, uses deep learning—a subset of machine learning—to produce human-like responses to human prompts. Although it does not understand language like humans, it identifies patterns in extensive training data to generate statistically probable responses. While the underlying technology has been evolving for several decades, it is the use of Natural Language Processing (NLP) that makes ChatGPT especially appealing to diverse user groups. Specifically, ChatGPT excels in coherent, context-sensitive dialogue that mimics human interaction, and which sparked considerable interest since its release in November 2022.

In this paper we consider technology generally, but specifically ChatGPT here, as a self-referentially operationally closed system, as an *autopoietic* system. Within the environment of the autopoietic system of technology are self-referential systems of consciousness, communication and physicality. In other words, we locate humanity, society and the material world as external to technology but at the same time integral to it. This is a somewhat abstract, counterintuitive and paradoxical starting point. However, by using the concept of

autopoiesis within social systems theory, we can cogently conceptualize ChatGPT to better understand the challenges and opportunities it presents, and how it might be ethically integrated into educational contexts and beyond.

We consider technology, in its broadest sense, extending beyond machines or software to include a variety of processes aimed at simplifying or automating tasks, functions or processes. This expansive definition not only captures traditional forms of technology like the stone axe, robotics and algorithms but also less obvious ones like language, social norms or policy. What unifies these diverse elements is the principle of simplification and its repeated application. For instance, language simplifies complex thoughts into communicable units, just as cultural heuristics provide social shortcuts for decision-making. Once a method of simplification proves effective—be it a computer algorithm, a linguistic structure or a social norm—it is used repeatedly while it remains useful thereby elevating it to the status of ‘technology’.

A central tenet of what we put forward here is the entanglement of technology, thought and society and specifically education. Historically, as technologies developed, from the emergence of spoken language, to writing to the printing press and to the internet, so did society and the education system. In the 15th century, Gutenberg’s printing press revolutionized education by making books accessible, leading to increased literacy and the dissemination of knowledge, playing a role in the Renaissance and the Protestant Reformation. The late 20th century saw another paradigm shift with the advent of the internet, whereas previously, education was limited to physical classrooms, the internet facilitated online learning platforms, virtual classes and Massive Open Online Courses (MOOCs), extending education beyond institutions (Vanden Broeck, 2021). While, at the same time, internet technology has been associated with fake news and populism both of which have become a feature of the political, media and public discourse landscape. The way we think, communicate and act and the way in which societies’ structures change and develop are all entwined with technological innovation.

Orthodox understandings of technology often consider its *instrumentality*, as a tool, and the way in which it mediates between thought and action. For example, social media platforms like Facebook and Twitter, are tools for individual or group communication and information sharing. However, it is apparent that social media platforms have an impact on politics, media and culture, and are reciprocally influenced. Instrumentality provides a linear and somewhat static perspective, ignoring the evolving nature of technology and specifically AI. It leans towards ontological anthropocentrism, the nature of being is constructed in relation to the being of the individual. This human-centric view however neglects how technology influences society and how society influences it but considers a linear cause-effect model in relation to what individuals or groups do with technology. This prioritizes human intentions, desires and actions, inadvertently neglecting or undervaluing the autonomous influences and transformative powers of technological systems like ChatGPT. When we place undue emphasis on the individual, we risk overlooking the broader systemic interactions, interdependencies and co-evolutions that shape and are shaped by technology.

While thinkers such as Heidegger (2013) have critiqued the instrumental view of technology, this instrumental interpretation has persisted in media, education, policymaking and ethical debates (see Mitcham, 1994). This is understood here in terms of traditions of European ontology and the centralisation of the notion of the autonomous individual within modern liberal society. This necessitates a conceptual approach capable of observing the individual, as opposed to the critical tradition that is restricted to the observations through the lived experiences of the individual (Latour, 2005).

There are several theoretical approaches that feature an ontological shift from the human subject. These include, for example, object-oriented ontology, speculative realism, posthumanism, new materialism, cybernetics, social systems theory, Actor Network Theory (ANT) and process philosophy. Our approach is intended to articulate a holistic macro-level account of ChatGPT, education and society, while maintaining respect for the individual. ANT associated with Bruno Latour (2005) and social systems theory associated with Niklas Luhmann (2013b, 2013c) both recognise the agency of human and non-human entities and provide frameworks for analysis that is consistent with this ontological perspective. Social systems theory, developed from earlier studies of biological systems, however, offers a holistic, phenomenological perspective on the co-evolution of technology, society, individuals and education (Luhmann, 2021; Mangez and Vanden Broeck, 2021; Vanden Broeck, 2021). ANT, on the other hand, emphasises the micro-level, examining specific interactions within a network.

Drawing on systems theory permits a more general *bimodal* interpretation of technology, one that acknowledges the *instrumental role of technology* as a mediator between thought and action but also in the *semantic role of technology* as a mediator between thought and society. In this, ChatGPT emerges not merely as a technological artifact but as an autopoietic system that is influenced by and influences individual thought, action, communication and society.

In terms of educational and societal inclusion, we argue that technology, understood broadly to include everything from physical tools to social norms and semantic structures, functions as both an enabler and a

barrier. It has the potential to foster inclusion by representing individuals within various functional systems such as education, economics, and healthcare. Yet, it can simultaneously exclude those who cannot make use of it.

This paper is structured to facilitate an in-depth understanding of the intricate relationships between ChatGPT, education and society from a systems theory perspective. Recognizing that systems theory is complex and multi-layered, we first lay down its foundational concepts, contextualizing them within the broader spectrum of modern European philosophy and the rise of liberal society. We then consider the historical evolution of education as a functional system of modern society and to examine the complexities of education and the tension between systemic logic and individual judgment, especially concerning inclusion and exclusion. Next, we examine technology as an autopoietic system and its bimodality, that is as an instrument and as a semantic medium, and then we look in more detail at ChatGPT as a subsystem of technology. With this we outline an approach to comprehending the role of ChatGPT in society and in education using systems theory that can inform further research and development. We employ this to consider the opportunities, challenges and implications of the technology in education.

Systems theory

In the following section, we outline the systems theory approach. We initiate this historically, with the emergence of ontology in Early Modern Europe, extricating human rationality from religious authority. Ontology, the nature of being, in its modern form makes a universal distinction between being and not being, capturing the full range of existential possibilities and uncertainties within a rational, comprehensible model that can be used to predict and control. In other words, ontology rationalises experience and existence. However, there is a self-evident and often ignored contradiction in this and that is that any attempt to rationalise or ‘observe’ the world we exist in is always accompanied by uncertainty, complexity, ambiguity and unknowability. Thus, an observation is always framed by the observer—reality is conditioned by the person (or entity) making the observation. An observation is an actualisation in a realm of possibility as we shall explain, in what follows. Where we outline the following systems theory concepts, autopoiesis, meaning, double contingency, structural coupling and functional differentiation as a basis for conceptualising this framing or conditioning. This prepares the ground for the second part of the paper which considers education and technology, specifically ChatGPT.

From European ontology to autopoiesis: a theoretical progression

The theoretical underpinnings of our argument here are contextualised in the emergence of an approach to conceptualising ‘being’ in modern Europe. The Enlightenment shifted focus from medieval social hierarchies and religious doctrines to the significance of individual consciousness and experience. Descartes (2008) and Kant (2007), for example, observed the individual’s role in constructing knowledge in an emerging modern society. This is encapsulated in Descartes’ phrase *Cogito, ergo sum* (I think, therefore I am). This also led to a binary division between subjective experiences and objective reality. While subjectivity is prone to biases, objective understanding seeks universally accepted truths. Yet, philosophers like Kuhn (2012) and Popper (2010) have shown that objective truth is contentious, as it is always mediated by human interpretation.

Before proceeding it is important to acknowledge the Eurocentrism of our analysis, but it should be noted that systems theory offers a broader framework that offers a robust critique of this European intellectual history. Though this paper does not expand on it, systems theory implicitly critiques modern coloniality, which is underpinned by such modern thought (see, Luhmann, 2002).

Systems theory shifts the focus from the modern individual subject to a holistic view of systems—whether human or otherwise—in relation to their environment. Instead of prioritizing the internal or external, it emphasizes the importance of understanding the boundary or distinction between them. This system-environment differentiation helps to frame complex interactions and is key to understanding how systems function.

To this, Luhmann (1995) introduced the concept of *autopoiesis* as self-referential operational closure by extending the work of Maturana and Varela (1980). Systems maintain their identity through internal processes while simultaneously being influenced by their external environment. We elaborate on these ideas in the following sections, and we conclude this theoretical section with a systems theory account of modern ‘functionally differentiated’ society.

Difference and recursion and the making of meaning

Central to systems theory then is the conceptualisation of difference or distinction. This resonates with linguistic explorations, as posited by thinkers such as Derrida, who emphasized the crucial role of ‘différance’ and the binaries present within language structures (Derrida, 1976). Additionally, Bateson’s observation that it is the

“difference which makes a difference” (Bateson, 1972: 321) echoes Shannon’s information theory, distinguishing between signal and noise (Shannon, 1948).

To illustrate this let us consider this in relation to thought and external reality. Consciousness, or the *psychic system*, is an autopoietic system that continuously regenerates through its own operations (i.e., cognition) in relation to itself in the medium of meaning (Luhmann, 2013a). This dynamic process of internal generation is not isolated but is in perpetual interaction with external stimuli. Thought thus evolves continuously, constructing complex structures through hierarchical frameworks of distinction. The autopoiesis of psychic systems create patterns through recursive distinction, maintaining stability through recursion without relying on intrinsic essence (Luhmann, 2013a).

For instance, our understanding of the term ‘blue’ is not based on the colour’s inherent essence but on the distinctions we establish within the colour spectrum. It is through repeated references and past experiences that we label and perceive the sky or an object as ‘blue’. This does not imply a denial of the inherent ‘blueness’ of an object but highlights our access to this essence is via recursive distinction.

Luhmann (1995, 2013a, 2013b) extended the concept of autopoiesis from a biological context to encompass consciousness and communication. Here, consciousness generates thoughts as selections against a backdrop of possibilities. Through recursive meaning making stable relationships are established between signs and what they signify, leading to societal and cognitive structures. Luhmann identified these stabilised patterns of meaning as the foundation of social structures and societal expectations. This solidification of meaning results in shared understandings, as seen in societal groups and in shared colour perception.

What gets encapsulated within languages, texts and imagery are lasting patterns or semantic structures, represented in diverse forms such as symbols, syllables, words or even genres. For instance, symbols like ‘☺’ generally signify peace. The word ‘freedom’ broadly translates to the idea of unhindered action or thought. Meaning undergoes evolution, shaped by new experiences and insights. Our perception and understanding today can undergo shifts tomorrow, propelled by new encounters and learnings.

In Luhmann's social systems theory, meaning is a central mechanism that underlies the operation and structure of societal systems. Drawing parallels with Shannon's information theory, Luhmann identifies that meaning is context-specific, akin to the differentiation between signal and noise. He employs the concept of autopoiesis to explain that meaning is dynamically and recursively generated within systems, allowing for stability but also perpetuating biases and limiting adaptability. The autopoietic nature of psychic and social systems also emphasizes that meaning is an active construct influenced by both internal operations and external stimuli. According to Luhmann, these stabilized patterns of meaning become the scaffolding for societal structures, implicating issues of individual agency within socially constructed frameworks. Given its recursive and dynamic nature, the meaning in social systems is non-linear and subject to change, further complicated when encapsulated in various languages and symbols. Therefore, in Luhmann's theory, meaning is not an auxiliary element but a fundamental, complex system that shapes and is shaped by social structures.

Society as a system of communication

In systems theory, society is viewed as communication rather than an aggregation of individual human beings or their actions. According to this perspective, it is not individuals who communicate but communication that communicates, functioning as an autopoietic system. This concept radically reframes how we understand politics, family structures or even populist movements. These are all autopoietic entities that maintain an identity through distinction and recursion in the making of meaning (Baraldi et al., 2021; Luhmann, 1990, 1995, 2013b, 2013c). It should be noted here that the implication here is that the individual is inherently excluded from society. We shall return to this point as we examine the nature of educational and societal inclusion and exclusion.

Double contingency elucidates how communication and consciousness are interconnected and co-evolve (Luhmann, 1995). This concept emphasizes that our conscious thought systems differentiate between the internal world of ideas and the external world of reality. Imagine a conversation between two people. Each person not only conveys their own ideas but also interprets the utterances of the other. This dynamic interaction is an example of double contingency, as both individuals are mutually aware of each other’s conscious presence and assign meaning to each other’s words and actions. The implication of double contingency is that mutual understanding or the sharing of meaning are not certain but probable. It is enduring meaning and semantic structures that emerge through the contingency of experience and the interplay of thought and communication that make mutual understanding more probable.

Structural coupling (Luhmann, 1995) denotes the dynamic structural relationships between systems. Structural coupling allows a structural relationship between autopoietic systems that influences but does not constrain the

process of autopoiesis. For example, the human eye has evolved as a structural coupling between psychic systems and the external world, simplifying our understanding of reality through visual perception. This autopoietic system is structurally coupled with other bodily systems like the endocrine, immune, cardiovascular, muscular and skeletal systems. This demonstrates a deep, mutual dependence that allows each to function and evolve.

In social systems, structural couplings manifest as dynamic structural arrangements between different communication and psychic systems. Language, for example, is a structural coupling between individual consciousness and collective communication. Language is a medium of thought and communication, put more straightforwardly, it simplifies and facilitates the transfer of meaning, making communication more probable. In institutional settings like politics and education, policy frameworks and inspection regimes serve similar functions, enabling communication between different systems through shared sets of meanings that are themselves dynamic autopoietic systems responding to their environments.

Language evolves through variation, selection and stabilization within this systemic context (Luhmann, 2013b). To illustrate this and the process of difference and recursion at play in societal evolution, consider a prehistoric community naming a common fruit. Initially, a sound or gesture might symbolize it—a variation that is selected and is stabilised while it remains useful. As this symbol is repeatedly associated with the fruit, it gains acceptance as the fruit's name, passing down through generations and possibly spreading to neighbouring areas. For example, the word 'water', essential in ancient societies, has an etymology that includes Old English 'wæter' and Proto-Germanic 'watōr'. Over time, common symbols, syntax, and semantics evolved, enhancing communication of complex ideas. Language is not just a tool but became integral to human cognition and interaction.

In early societies, language took the form of spoken and oral communication, allowing individuals to interact and share meaning through direct verbal exchanges. However, as societies evolved and became more complex, written language emerged to address the limitations and uncertainties of spoken language. Written language provides a way to record and transmit information over time and space, enabling the development of bureaucratic, political, legal, economic and religious systems. It introduced a level of stability, permanence, and standardization to communication, particularly in the context of institutional structures, in a way that is both contingent and dynamic.

Overall, these concepts—autopoiesis, double contingency and structural coupling—collectively offer a nuanced understanding of the intricate relationships between individual consciousness, communication systems and society. They provide a means through which we can understand how meaning is constructed, communicated and continually redefined, serving as the bedrock upon which societal structures and expectations emerge in a socially ecological way rather than deterministically. This perspective also allows for a more holistic understanding of the dynamics and complexities of modern society. The next and final part of this section considers the nature of modern society when considered from a systems theory perspective, where we present society as functionally differentiated (Luhmann, 2013b, 2013c, 2022). This prepares the way for considering specifically education, technology, ChatGPT and inclusion.

Functionally differentiated modern society and the individual

The shift from a hierarchically dominated society to one marked by specialized roles is evident from the late Middle Ages (Burke, 1999; Le Goff, 1991). Guilds appeared in cities, introducing standardized training and quality in industries like metalwork and weaving. The establishment of universities such as Bologna and Oxford signalled a differentiation into specialized academic pursuits in areas such as law and medicine. Similarly, a trading boom underscored the increasing significance of the merchant, while political transformations shifted governance from feudal structures to sophisticated administrative bodies. This evolution further incorporated specialized military roles, nuances in architecture and art, and a distinct legal focus exemplified by the common law system in England.

This resulted in functional distinctions between politics, law, economics, science, media, education and religion etc. Functionally differentiated systems are autonomous, operating on their internal logic in relation to their environment i.e., they are autopoietic systems. Communication systems are operationalised by binary codes (see also Bateson, 1972), which act as its foundation, guiding its functions and distinguishing it from other systems. For instance, the legal system operates on the binary code of legal/illegal, the economic system on the codes of payment/non-payment. These codes provide clarity, consistency and direction for each system, ensuring that it can function efficiently and effectively within its domain. It is essential to understand that while these systems might seem to revolve around human activities, from the systems theory viewpoint, they are purely communicative structures based on meaning and differentiation (Luhmann, 2013b, 2013c).

To visualize this, let's dissect the assertion: 'A student frequently engages in class discussions'. In the functional system of education, this is observed systemically by the binary code improvement/ deterioration, making meaning of the assertion as educational communication. Science interprets this statement with a true/false binary. For the media, the binary of new information versus repetitive news would prevail, assessing the novelty of such student behaviour in current times. In the legal system, attendance and participation might be gauged against legal obligations, generally viewing regular attendance as legally compliant behaviour. We will return to the binary code of the education system later.

The individual as an autopoietic system in modern society is a self-creating entity defined in terms of what it is external to it in the context of functionally differentiated society (cf. Taylor, 1992). This means the individual is ceaselessly distinguishing itself from its community and broader society, a distinction that is re-made through self-reflection in thought and communication of individual behaviours and actions. The necessity of recognizing what sets an individual apart is always in relation to what lies outside of them—other people, cultural norms, and societal expectations. An individual is shaped by personal convictions, life experiences and knowledge, all the while interacting with and reacting to societal standards, anticipations and hurdles. The decisions one makes are reflections of both internal considerations and external factors such as culture and social relations but always from the perspective of the individual. While society might emphasize certain goals or accomplishments, individuals often find and pursue their unique routes, reconciling at times disparate views based on their intrinsic values and the influence of external forces. This illustrates the intricate interplay between self-reliance and communal interconnectedness. Being an individual, therefore, embodies inherent contradictions. On one hand, individuals are self-contained, they continuously define themselves through personal convictions, experiences, and inner values. On the other hand, this self-definition is inevitably shaped and constrained, by external societal norms, expectations and relationships. This dual nature creates a constant tension, where the pursuit of personal autonomy is balanced with societal interdependence. The individual's desire to be unique and to carve a personal path is often at odds with the need to conform to or engage with the broader community and societal structures (Goffman, 1990).

Having outlined the systems theory approach, in what follows we examine more closely education, technology and society, as autopoietic systems, to show education is not merely a reflection of society but rather a key part of a complex, dynamic system that is both influenced by and has an impact on various social and technological factors and vice versa. By understanding education as a system that has evolved in a system of modern society, we can better understand its current state and speculate on its future directions. This prepares for the final part of the paper where we take a closer look at the technology of ChatGPT in education.

Education and society

Systems theory provides a novel understanding of education by not just focusing on the individual but also considering technology and societal systems as having a kind of 'agency'. The modern education system's function is in transforming the psychic environment of society. The programme of education specifies the goals that determine which changes in the psychic states of learners should be generated through communication in the classroom (Baraldi et al., 2021; Baraldi and Corsi, 2017; Luhmann and Schorr, 2000). Our approach here is intended to compliment the ideas presented in the *European Education Research Journal* Special Issue (Mangez and Vanden Broeck, 2021), however, our departure from this is to focus on technology, education and society in a general way.

The systemic agency of education or any other system is not agency in the human sense. This non-human agency uses binary codes along with programmes that 'steer' the system. In education, 'programmes' centre on curricula and teaching methods, while the code distinguishes whether a student is improving or deteriorating. The code operates on a binary distinction between learner improvement or deterioration (Baraldi et al., 2021). This influences decisions about grading, class placements and future educational paths and careers. This reveals an inherent systemic need for education to 'select' individuals based on this binary assessment.

This might initially appear to overly simplify education into a binary system focused on performance metrics, potentially side-lining other critical educational goals like equitable access and holistic development (see also Steiner-Khamsi, 2021). Systemic codes, however, are not the same as the judgment or decision of the educator and the systemic logic can be in tension with individual human judgement. On one hand, assessment might point to the rejection of a learner from a programme; on the other hand, the educator may feel they want to make an exception and include the individual for other reasons.

The systems approach is not deterministic but ecological; it offers a way to understand how the education system functions within the complexity of society (Kurtz, 2021) and that it is constantly influenced by and influencing individual experiences and other functional systems of society (Luhmann and Schorr, 2000). Moreover, it helps us see that educators make decisions based on their judgment in-the-moment, but in reference

to or with a backdrop of systemic logic, whether this is conscious or not. This systemic approach offers both a macro-level understanding of the educational system and an explanation for the day-to-day decisions educators make in the contingency of the moment (Andersen and Pors, 2021; Luhmann, 2021; Steiner-Khamsi, 2021; Vanderstraeten, 2021).

The historical Development of Education

During the Middle Ages education was closely tied to religion, its codes and programmes were aligned with religion, society and its hierarchy. Monasteries served as centres for learning, preserving texts and imparting religious and some secular education to a privileged few. The programme in this context was the religious and moral development of the individual, the code of education was based on age and religious criteria.

During the Renaissance and the Enlightenment, education begins to differentiate from religion as well as reflecting society's specialisation in differentiation of programmes, with, for example the teaching of science, history and languages. The programme broadened to include various skills and knowledge areas, reflecting the societal values of rationalism and individualism as well as increasing specialisation. The binary code of education moves toward merit and academic performance, with the introduction of standard examinations and grading systems. Enlightenment thinkers, for example, Locke (1632-1704) and Rousseau (1712-1778), characterised education as a means of developing individual autonomy and rationality and distinct from religious doctrine. Locke's emphasis on empirical knowledge and Rousseau's ideas about natural education underscored the growing belief in education as a tool for individual and societal improvement. The programme of education began to include concepts like critical thinking, individual inquiry and civic education.

By the 19th and 20th centuries, the education system underwent further differentiation, with national education systems and was influenced by industrialization and globalization. Education was not just for the elite but aimed at mass populations, evident in the rise of public education systems. The programme evolved to cover a broad curriculum, including specialized subjects like sciences, arts and social sciences. The code also became more complex, factoring in age, ability and even financial status through scholarships and loans.

This approach allows us to understand that while the programme of education might change, underlying codes like improvement/deterioration or inclusion/exclusion continue to guide the system, helping to explain both its adaptability and its enduring challenges. The binary code is embedded within the ontology of individualism in functionally differentiated society.

Individual learners are characterised as having a potential that can be met through educational intervention to acquire the knowledge and skills to be autonomous and yet included individuals in modern society. Education prepares individuals to participate (i.e., to be included) in society by developing a range of specialised knowledge and skills. In contrast to hierarchical society where inclusion was by rank or position in society, the modern individual is inherently excluded from functionally differentiated society (Braeckman, 2006; Emmerich, 2021; Luhmann, 2022) as we set out above.

Inclusion and Exclusion

One aspect that often goes unnoticed in discussions about modern education is its intricate relationship with a particular binary code: that of inclusion/exclusion. This binary aspect, integral to the system's functioning, brings with it a paradox. While the education system aims to include by fostering improvement, in contrast this binary code necessarily entails exclusion, often based on metrics like academic performance or other societal criteria. It is a system where the same mechanisms designed to categorize and uplift students based on improvement can also segregate and demote based on deterioration. In this sense, the binary code of improvement/deterioration or inclusion/exclusion is not a neutral tool for sorting; it is a loaded mechanism that carries significant implications for social equity. This highlights the constant tension within the educational system between its overarching systemic logic, guided by this binary code, and the ethical considerations of inclusivity and fairness (Braeckman, 2006; Emmerich, 2021).

This inclusion paradox is also demonstrated in digital educational technology as well as educational programmes. On one hand, Virtual Reality (VR) classrooms are inclusive, breaking down barriers related to ethnicity, race, gender, and physical disability. However, they can introduce new forms of exclusion, such as economic barriers to hardware access or health-related impediments like motion sickness or epilepsy. Similarly, educational frameworks like Universal Design for Learning and policies like Restorative Justice aim for inclusivity but often inadvertently create new divides. They may require additional resources or training that underfunded schools cannot provide or in other circumstances may not address the needs of all students effectively.

Traditional models often differentiate between impairment, disability and 'handicap' aligning these terms with a naive realism that perceives disability as an inherent characteristic of the individual. At the same time, while we

do not deny the experience of the individual living the ‘reality’ of disability, our aim here is to emphasise the paradoxes of inclusion that systemically include and exclude through the attribution of the term disability, for example. Systems theory asserts that these categorizations arise from the specific codes and programmes of the educational system and other functional systems. For example, if an educational system is designed to favour verbal and mathematical intelligence, students with different types of intelligence may be observed to be disabled within that system. They are not inherently disabled but are made so by the narrow codes of success and failure employed by the educational system (Michailakis, 2003). We stress again here that this is a systemic response that may be in tension with the individual educator’s perspective and actions.

We claim, then, that inclusion should be understood differently. Inclusion is dependent on the individual having the knowledge and skills to present themselves in societal communication and to be able to interpret societal communication in relation to who they are. To be included is to contribute to societal communication, as an individual. This reflects Haraway’s conceptualisation of the modern individual as cyborg (Haraway, 1991). It must be understood that this is not inclusion in society per se, as modern society is exclusive to all individuals, but it means that structural coupling between that individual and societal communication. For example, language and literacy can be understood as a technological structural coupling that allows the individual to be represented in other functional systems and for the individual to be able to interpret functional communication, e.g., political, legal, economic, health, religion, art, media communication etc. Similarly, rhetoric or scientific knowledge and skills can be understood as technologies that structurally couple individuals with society and its subsystems of functional communication.

The autopoietic system of technology

While there are scholarly discussions in systems theory that distinguish between analogue and digital technologies (Baecker, 2007, 2020; Esposito, 2017), this study treats technology as an autopoietic system, viewing technology in this way offers a holistic perspective that transcends the digital-analogue divide. This comprehensive approach allows for an in-depth analysis of ChatGPT’s role in education, acknowledging, but not limited by, the nuances of digitalization.

Following Heidegger (2013), Ihde (1990), Haraway (1991), for example, we adopt a general perspective on technology. In its expanded role, technology can be defined as a complex interplay of tools, systems, methods and practices aimed at facilitating, automating, or enhancing tasks, functions or processes in various domains of human activity. This broad understanding of technology transcends mere mechanical or digital artifacts, encompassing not only physical instruments and software but also conceptual frameworks, communication mediums, social norms and institutional policies. Within this paradigm, technology serves as an extension of human capabilities, a mediator in human interactions and a shaper of societal structures, often functioning at the intersection of the tangible and intangible, the material and the abstract.

Following, also, Luhmann (1990) and Reichel (2011), we understand technology as an autopoietic system, a self-referentially operationally closed system, understood meaningfully by human consciousness and societal communication. Technology is a distinction and therefore a meaning made in thought and communication. It is identified by its capability for repeated operations that are observed as causes and effects. From a systems theory perspective the distinction or binary code of technology is work/not working or work/fail which guides autopoiesis based on what effectively accomplishes its purpose. Its programme is ‘operativeness’ (Reichel, 2011) or elements of cause and effect, such as a computational neuron in AI.

We also consider technology as bimodal; it is instrumental in that it structurally couples between thought (the psychic system) and the physical world and has a semantic role in that it becomes a medium for communication and thought and therefore is a structural coupling between thought and society (the system of communication).

To illustrate this the simple technology of a table exemplifies a subsystem of the autopoietic system of technology. This operationally closed system sustains its identity through cause-and-effect mechanisms that make it an instrumentally and semantically a meaningful entity. Structurally, its design, shape and materials are not just arbitrary or solely functional; they are a product of mental conceptualization as meaning and societal meaning, reflecting both psychic and social systems. The table’s various attributes like utility, durability and aesthetics are thereby guided by the binary code of ‘work/fail’ evolving within specific contexts. A table, like technology more generally is bimodal; it serves as a structural coupling between human thought and the physical world as an instrument, mediating between thought and action. At the same time, it mediates between thought and society as a feature of social relations and social practices, it is thus a shared medium for thought and communication. It can be the domestic focal point for family meals, the hub of professional dialogues in business settings, or a community bulletin board. In each of these roles, the table transcends mere utility to become a medium for thought and social interaction. It shapes and is shaped by the ideas, emotions, and norms

circulating around it, framing the way we interact both with the material world and within our social environments.

From a systems theory perspective, technology operates as a mediator that both simplifies and structures communication, as well as thought (Luhmann, 1990). Rather than simply standardizing or automating the exchange of information, it serves to guide the system-environment interactions through a work/fail binary code. By narrowing the infinite possibilities of environmental indeterminacy to more manageable, structured formats, technology assists in making interactions more predictable. Take digital platforms as an example; they do more than provide a template for emails or social media posts. They act as a framework that filters and channels our ways of engaging with one another, thereby fitting into the autopoietic system where technology is not just an instrument but also a semantic entity. Importantly, while technology may constrain and guide communication, it cannot entirely subsume the indeterminate nature of the environment. Human consciousness and societal communication have their own recursive ways of meaning-making that adapt to and evolve with this complexity. In sum, technology does not just simplify; it functions as part of a dynamic semantic ecosystem, structurally coupling thought with action and society, much like our previous example of a table, which serves as a focal point for various forms of interaction and meaning making.

The system of ChatGPT

ChatGPT is a sophisticated chatbot developed by OpenAI released in November 2022 using a deep learning model GPT-3 (Generative Pretrained Transformer) which was later superseded by GPT-3.5 and GPT-4 (released in March 2023) (OpenAI, 2023b) which is currently available as ChatGPT Plus by subscription for \$20 (US) per month. GPT means that it *generates* text based on *pretraining* from a vast but undisclosed quantity of public data using *transformer* architecture (Vaswani et al., 2023). In slightly simplified terms this architecture consists of computational neurons organised in layers. Neurons are organised in layers in a neural network architecture—specifically the input layer, hidden layers, and the output layer. Each layer is responsible for processing data and forwarding the output to the subsequent layer, establishing a recursive relationship. Data undergoes transformations as it traverses these layers, owing to the learned parameters, namely weights and biases, of the neurons (Goodfellow, 2016). These transformations build a hierarchical representation of features from simple to complex, thereby enabling ChatGPT to generate contextually coherent responses. Patterns in data form the basis for decision-making in artificial intelligence models like ChatGPT. These patterns range from elementary attributes, such as colour in images, to intricate structures in language or sentiment. The capability to recognize and apply these patterns allows AI models to generalize from observed data to new, unseen data. Improved pattern recognition correlates with the model's increased accuracy in its operational tasks.

In the following discussion, we present the implications of this in more practical terms. Our theoretical discussion reveals that ChatGPT and LLMs more generally have had and will continue to have an impact on education society. However, what we have emphasised that seeing ChatGPT as an intelligent being does not capture the entanglement of technology, modern society, the individual, and learner and education. AI is not something else, it is *us*. In a similar way to spoken and written language, it is entwined with society and thinking, and has emerged and evolved within the contingency of experience.

Discussion

We now consider the issues outlined in the introduction, around what the technology is and its capability; what the public and media perception of ChatGPT is and most importantly, *why?* Additionally, we explore its role in education and inclusion. We round this off with consideration of ethical dimensions of ChatGPT in education. Finally, we conclude with some implications for educators, learners and policymakers and more generally. This is not intended as a normative account but, developing from the systems theoretical analysis previously, it is intended to stimulate discourse on critical dimensions: the technology's capabilities, public and media perceptions, roles in education and inclusion, and ethical considerations. The objective is to inform educators, learners, and policymakers about the complex interrelations between ChatGPT and its societal impact, specifically in the educational domain.

What ChatGPT is

Overall, ChatGPT is better understood not as an independent, conscious being but as a system that bridges thought and society and thought and the physical world. It operates within specific cause-and-effect boundaries and operates within the realm of linguistic patterns, meaning and semantics.

ChatGPT functions in two ways: instrumentally and semantically. Instrumentally, ChatGPT responds to human prompts by generating completions based on semantic structures in the text. Utilizing deep learning, it identifies patterns within large data sets but does not 'understand' these patterns like a human. Instead, it models statistical

relationships between symbols, words, word sequences and genre. It is therefore a transformative rather than generative tool. It can rephrase or summarize text, translating ideas into required textual forms based on recognized patterns, including, for example, writing computer code.

Semantically, ChatGPT mediates between individual thought and societal communication. It represents an evolution in semantic mediation like, for example, facilitating understanding between people with different conceptual or linguistic frameworks. This does not mean that it promises consensus, however it does sustain the possibility of mutual understanding. As society has shifted from unified frameworks of meaning to fragmented digital landscapes, ChatGPT works to align divergent meanings. It serves as a computational sense-maker, increasing the likelihood of mutual understanding in a society increasingly characterized by individualism and fragmentation (*cf.* The Tower of Babel, Genesis 11:1-9). While ChatGPT can facilitate understanding, it does not inherently aim for that. Its primary function is to generate text based on the data it was trained on and the prompt it is given.

Public and media perceptions of ChatGPT

The media response to ChatGPT as an intelligent being with either utopian or dystopian possibilities (see, for example, Seddon, 2022) can be understood using a systems theory approach. Operating on its binary code of distinguishing information from non-information, the systems of mass and social media present ChatGPT and LLMs as new news, contributing to public discourse by framing it as an intelligence that is either a societal blessing or curse. This appears to resonate with initial user experience of ChatGPT, which gives an impression of being an ‘artificially’ intelligent being because of the plausibility of the responses it gives to user prompts.

For the first few months since ChatGPT’s release there was a widespread public perception that ChatGPT presented a new frontier in information retrieval, a viewpoint fuelled by media accounts (Acres, 2023 for example). This also related to perceptions about the technology’s potential impact on educational integrity, such as aiding plagiarism or academic misconduct (Woolcock, 2023). Search engines and ChatGPT serve different functionalities. While search engines aim to retrieve information based on a user query by scanning indexed data, ChatGPT is geared towards interactive dialogue. It processes and produces responses based on patterns in the training data rather than merely retrieving pre-stored information. We do concede however, that even though several surveys and analysis are attempting to understand media representation of and public opinion about ChatGPT, the overall picture is unclear, but we believe that our representation of media and public opinion in the UK context, at the time of writing, is plausible.

It is likely that this kind of media narrative will continue, however, increasing numbers of people are using it and integrating it with their work and lives which may prompt a change in public perception. We have found that once people start to make use of ChatGPT, their understanding of it changes. However, it is important that education provides programmes that prompt a rich understanding of what the technology is both as a tool and semantically.

Education and inclusion

Students and educators are making use of the technology to assist teaching and learning, although we add the same caveat as we did previously about the analysis of surveys (for example, Hennessey, 2023; Prothero, 2023; Snepvangers, 2023). However, there are many who are fearful of it or simply do not have the time to engage with it, based on our experience in higher education and this is reflected in schools. Part of this comes from an uncertainty about what the technology is and what it can and cannot do (see, for example, Grassini, 2023). This uncertainty is also apparent in the difficulty administrators have had in regulating its use (for example, Stephens, 2023). The situation is likely influenced by media narrative and public accounts which mislead in this regard. Furthermore, while the technology has many possibilities, it also takes considerable time and effort to become familiar with it to use it effectively. If we are to integrate it ‘usefully’ in education and in wider society then it must be done in an informed way and which affords people time to interact with it productively and creatively, while also collaboratively working on problems with it

Educationally, there are immediate and obvious possibilities. There are several potential applications for ChatGPT in educational inclusion, in providing individualised feedback for learners, helping them to turn ideas into text, and importantly into textual forms that are required by standardised assessments. Recent reviews of research concur, suggesting a range of possibilities while recognising practical and ethical challenges (Kasneci et al., 2023; Yan et al., 2023). But inclusion comes with exclusion; notably, the digital divide, it is expensive technology, and it is owned by a private company. It is also evident that while it is inclusive many people are alienated by it. In our experience learning to use ChatGPT effectively requires time and resources to develop expertise, to understand the technology and how it can be integrated into work and study (see also Kasneci et al., 2023; Yan et al., 2023). There are many potential uses for ChatGPT in all levels of education and in its

administration; resources are appearing with a range of ideas for its use in education (OpenAI, 2023a; Sabzalieva and Valentini, 2023). The challenge is in integrating it practically and ethically within the practices and programmes of education while maintaining the integrity of the education system. To address this there appears to be a consensus growing around for contextual research and development and that involves multiple stakeholders (Yan et al., 2023).

Society, the individual and ChatGPT

Modern liberal society is premised on the notion of the autonomous individual as distinct from and therefore excluded from society. Technology in its bimodal form makes the improbability of the individual possible. Technology provides the structural basis for such individuality to exist, although we must emphasise this is not deterministic, technology is autopoietic and such structures are responding dynamically to individual experience, thought and society. Technology connects physical action and causality to thought and then to society in reciprocal ways. It operationalizes the distinction between the individual and society by providing mechanisms for both individual action and communication. The smartphone for example, allows the individual to perform actions that have tangible effects in the world based on meaning making in the conscious realm, while those meanings both influence and are influenced by societal communication. The meaning of action in the contingency of experience becomes a representation of the individual which is at the same time structurally coupled with society semantically.

Instrumentally, ChatGPT identifies semantic structures in text and images by recursively ‘looking’ for patterns in its training data, i.e., public texts and images. When a user prompts it, ChatGPT matches the pattern of the semantic structures in the prompts to provide a completion - what we understand as a plausible response. ChatGPT’s inherent capability is the identification of equivalent semantic structures. When prompted with text or an image in one form, with instructions in the prompt to transform it to another form, it does so while maintaining the meaning of the text. As a semantic medium, it then makes the sharing of meaning, i.e., the possibility of mutual understanding more probable in the context of individualised society because it has statistical reference within the model to stabilised meanings and semantic structures in society.

Ethical considerations

The ethics of AI and LLMs are subject to intense academic debate across multiple dimensions (Holmes et al., 2019; Zembylas, 2023). Concerns range from data privacy and ownership to the reproduction of societal biases. The question of human agency and liability becomes crucial as AI systems increasingly influence decision-making. Transparency and explainability are hot topics, especially with the ‘black box’ nature of many algorithms. Economic impacts, such as job displacement and social inequality, are also a focus. Finally, the potential for misuse and existential risks prompt calls for regulation, even as scholars debate whether advanced AIs deserve any form of moral consideration.

When examining ChatGPT from an ethical standpoint, it is essential to consider both instrumental and semantic levels. Instrumentally, ChatGPT serves as a versatile tool that can be deployed for a range of ethical outcomes, mirroring the dual potential inherent in most technologies. The inclination to project moral judgments onto this technology may reflect modern society’s habit of assessing individuals on a moral spectrum, a framework that proves insufficient when evaluating a tool with such varied applications. Semantically, ChatGPT’s increasing role in automated communication presents an ethical dichotomy. On one hand, the technology poses risks in generating deceptive or untrustworthy interactions, undermining societal trust. Conversely, it holds the promise of enriching dialogues across geographical, linguistic, and cultural divides, acting as a bridge to a more interconnected global community. This duality highlights ethical contingencies that society must confront, particularly as we grapple with the paradox of universal notions of ‘good’ and ‘bad’ in an increasingly complex ethical landscape. In sum, the ethical discourse around ChatGPT demands a nuanced exploration that goes beyond mere instrumental considerations, addressing its broader and potentially transformative impact on social relations and moral frameworks.

Conclusion

In this paper, systems theory has been applied to analyse the interconnectedness of ChatGPT and other LLMs with societal and educational systems. By employing key concepts like autopoiesis, structural coupling, and functional differentiation, we demonstrate that LLMs are not mere external entities but are intricately linked with these systems. The paper introduces a dual role of technology as both an instrumental and semantic medium. This helps to articulate how ChatGPT is involved in mediating thought, action, and communication, and maintains a recursive relationship with societal structures. This analytical approach surfaces paradoxes in the arenas of social and educational inclusion and exclusion, thereby guiding discourse toward a responsible integration of LLMs into these systems, rather than adhering to extreme utopian or dystopian viewpoints.

Systems theory views society as a systemic overlay of interpretation which makes meaning of, anticipates and interprets individual action and behaviour. Meanings, as actualisations selected from possibility, endure if they prove useful, they become stabilised interpretations but are always subject to influence by human experiences, actions and behaviours. The stabilisation of meaning is not just as an enduring conceptualisation of something observed in the real world, it is a process too, that guides meaning making. The stabilisation of meaning thus implies semantic structures that govern how meaning is produced and which involves difference (making meaning) and recursion (stabilisation).

We have presented a general perspective of technology as an autopoietic system in this paper. In modern society, technology has a dual role in the structural coupling between the individual with the physical world and actions – its role as instrument. It has a semantic role structurally coupling between the individual and society. In this, technology in its semantic role can be understood as a semantic structure, it provides a means of making the sharing of meaning more likely through simplification and repetition/recursion. This is consistent with previous technologies of spoken language, writing, printing and digital technology. In the historical contexts of the societies they emerged, they provided a shared medium of meaning for thought and communication. These legacy technologies are limited in relation to the diverse, multi-layered and multifaceted nature of meaning in the complexity of the modern society. ChatGPT and LLMs demonstrate the capacity to ‘recognise’ semantic structures in modern society and to be able to make the sharing of meaning more likely in this social context.

Education’s role in society is to change the psychic environment of society, this is often articulated in terms changing the learners thinking about society. While education in pre-modern society can be understood in terms of socialisation, modern education extends from this to individuals learning the semantic structures of distinct disciplines or subjects. In other words, central to modern education is the learning of specialised knowledge and skills. The changed psychic environment of society equates to learning specialised or ‘disciplinary’ technologies, which incorporate stabilised meaning (disciplinary knowledge and facts) as well as the processes that guide how meaning is stabilised (practices and skills). Together these represent a technology’s semantic structure. Literacy involves learning the facts and rules of language as well as learning how to use the language in communication. A similar analysis can be applied to the disciplines of science, mathematics and the humanities etc.

We offer some considerations of implications based on our analysis. There are several opportunities for developing inclusion in education with ChatGPT as we have outlined above, however, there is a delicate balance that involves the contradictions of inclusion and exclusion in modern society. In other words, inclusion is identified in relation to what is excluded in modern society and education.

The implications of this for education is a need for research and development in context, close to practice and that involves multiple stakeholders. The reasons for this include the limited understanding of the capabilities of ChatGPT in education as well as the need to develop approaches to its integration that is oriented toward the complexity of practice (see, for example, Jeon and Lee, 2023).

While education has been characterised by disciplinary specialisation; beyond calls for versatility and interdisciplinarity, there is an increasing need to understand the relationship between disciplines and even the relationship between systems more generally as a transdisciplinary approach that emphasises not just the comparisons and contrasts between different systems but, one that promotes second order knowledge and skills of and for interoperability.

While ChatGPT is likely to change education, this change is likely to be more gradual than anticipated revolutionary changes. In this its role will likely feel more mundane than some media accounts anticipate. This can be explained in terms of understanding its entanglement with education and society. However, this has been a considerable change to the environment of education, and it would suggest the need for governments and institutions to invest in the co-ordination of research and development that is close to practice and involves relevant stakeholders.

Notes

1. Here we have focussed our attention on ChatGPT, which at the time of writing this, is the dominant LLM globally, however, our analysis does suggest the implications of this paper apply to other LLMs like, for example, Google Bard. We have also focussed on text, although LLMs also work with images and multimedia in the same way technically. So, the arguments here broadly apply to multimedia. It is network and processing capacity that limits possibility of multimedia LLMs.
2. We used ChatGPT extensively in the production and revision of this paper. It was used to organise and reflect on ideas, historical accounts, re-phrase, elaborate, condense and summarise and to exemplify, it was also used as an artificial reader and reviewer.

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