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Rethinking Alsberg: Cognitive Offloading and Technologically Induced Cognitive Diminishment in the Era of Digital ICTs

Abstract: This paper revisits Paul Alsberg's theory of *Körperausschaltung* (bodily deactivation) to address contemporary questions about cognitive offloading in the context of digital information and communication technologies (ICTs), particularly large language models (LLMs). Alsberg's 1922 work *Das Menschheitsrätsel,* republished in 1937 in German and re-written in 1970 in English, offers a prescient framework for understanding how technical artifacts fundamentally reshape human cognitive capacities by transferring functions from organic to extra-organic media. We situate Alsberg's philosophy within recent empirical research on technologically induced cognitive diminishment (TICD), the Extended Mind Thesis, and studies of LLMs in educational contexts. Drawing on Fasoli's taxonomy of cognitive artifacts (substitutive, complementary, and transformative), we analyse different modes of human-AI interaction and their implications for cognitive development. The paper demonstrates that contemporary digital technologies represent an intensification of long-standing technogenetic processes and argues for design principles and policies that minimize harmful cognitive substitution while fostering transformative integration. Rather than framing the question as enhancement versus diminishment, we propose a more nuanced understanding of cognitive transformation that recognizes technology as constitutive of human cognition itself.

Keywords: Alsberg, cognitive offloading, Extended Mind, LLMs, philosophical anthropology

1. Introduction

The question of the relationship between nature and culture necessarily concerns the relationship between humans and their artifacts. According to a certain tradition of German philosophical anthropology, the eminently technical nature of the human arises from an ontological gap between humans and the natural world — a fracture that the human being, as a *Mängelwesen* (deficient being), recomposes through technique and culture (Gehlen, 1940/1988). This tradition, usually traced back to Herder, has in Arnold Gehlen and his theory of *Entlastung* (relief or exoneration) its most eminent exponent. It reads technology as the medium of continuity in the human between nature and culture: humans are naturally deficient animals and therefore naturally technical. Technology emerges as a necessary consequence of this original deficiency — the need to survive despite biological inadequacy leads to the development of the technical-symbolic complex. The cor-

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relation between technology and nature is etiological: first comes biological deficiency, then technique as a compensatory response.

The German philosopher and physician Paul Alsberg, in his 1922 work *Das Menschheitsrätsel*[1], highlights a logical paradox inherent in deficiency theories: an animal so maladapted would have become extinct before being able to develop any technique. One cannot explain either how it could have survived long enough to invent tools, nor what would have driven it to do so if the environment had been favourable. Alsberg's central contribution is to identify *Körperausschaltung* (body-liberation, deactivation of the body)[2] as the defining principle of human evolution: rather than adapting through the body, humans adapt by externalizing adaptive functions into extra-corporeal artifacts, causing organ regression and liberation through feedback effects. The full theoretical development of this principle — including its contrast with Kapp's theory of *Organprojektion* and the key textual evidence from Alsberg's own analyses — is the subject of Section 2.

Alsberg's analyses seem today, in the era of digital ICTs, to regain new hermeneutic vigour and theoretical-epistemological relevance (Di Vincenzo 2025). Studies from cognitive sciences, developmental psychology, and anthropology have highlighted how new digital media, through a series of deactivations, are reconfiguring the cognitive structures of human beings, with impact intensifying with earlier exposure (Wilmer *et al.,* 2017; Liebherr *et al.*, 2020; Firth *et al.*, 2019; Loh & Kanai, 2016). From the philosophical side, postphenomenology and philosophy of mind, especially within the Extended Mind Thesis (EMT) and the 4E perspectives, have also highlighted the retroactive character of technologies and their

1 According to the preface to the Italian translation of *Das Menschheitsrätsel*, Elena Nardelli (2020) highlights how the work was refinished, modified and republished over time. The first edition of 1922 was followed by the revised and refined version of 1937, from which the Italian translation is derived. In 1970, Alsberg rewrote the text in English under the new title *In Quest of Man: A Biological Approach to the Problem of Man's Place in Nature* (Alsberg 1970). Some years later, Dieter Claessens republished the work under an editorial title of his own devising: *Der Ausbruch aus dem Gefängnis: zu den Entstehungsbedingungen des Menschen*, simultaneously streamlining and condensing it, while supplementing it with a critical apparatus of notes designed to situate the content in relation to the most recent scientific advances of the time. This edition was subsequently reprinted by Edition Schlot under the title of the original 1922 edition, which is twice as long. A digitized version of this edition has been made available by the platform *vordenker* since 2010. In addition Paul Alsberg (1883–1965) is the author of the following essays: *Homunkulus in Goethes «Faust»* (1918), *Pithecanthropus erectus – Homo Trinilis* (1925), *Die Abstammungsfrage des Menschen* (1928), *Zur Phänomenologie der Vernunft* (1929), *Zur Grundbestimmung der Vernunft* (1931), and *Vom beliebten Redner und guten Journalisten* (1983).

2 The term *Körperausschaltung* is rendered in English as *body-liberation* in *In Quest of Man*; we may therefore infer, as noted above, that Alsberg himself validated and endorsed this choice. However, the locution *deactivation of the body*, found in Ian Alexander Moore"s English translation of Sloterdijk's *Not Saved*, appears to capture more fully the aspect of deactivation proper to the German *Ausschaltung*, rather than mere liberation. In what follows, both locutions will be employed according to context and theoretical necessity.

continuity with our cognition (Clark & Chalmers, 1998; Clark, 2008; Ihde, 2009; Varela *et al.*, 1991).

Clark and Chalmers' thesis of active externalism, explicitly rejecting an anthropology of deficiency, appears consonant with Alsberg's account, insofar as both emphasize the functional role of external artifacts in cognition. Since external objects, such as the famous notebook for the Alzheimer's patient mentioned in their essay, play a constitutive role in cognitive processes, mind and medial ecosystem form a "coupled system" (Clark & Chalmers, 1998, p. 8), that is, a new ecological niche in which cognition is distributed across agent and environment. The mind is therefore extended into the physical world.

However, this convergence must be carefully qualified. The EMT's Parity Principle holds that if an external process would be considered cognitive if it occurred internally, then it is cognitive externally (Clark & Chalmers 1998). On this view, cognition is not bounded by the organism but distributed across a hybrid system. While critics have challenged this thesis (Adams & Aizawa 2010; Colombo *et al.* 2019; Menary 2010; Cassinadri & Fasoli 2023), it remains influential in emphasizing the continuity between internal and external processes. Alsberg's position diverges precisely here. Although he recognizes the centrality of extra-corporeal artifacts in human adaptation, he maintains a strict distinction between organism and tool: the artifact remains external, replacing organic function rather than being constitutively incorporated into a unified cognitive system. *Körperausschaltung* designates a process of functional substitution, not seamless integration.

This distinction has direct analytical consequences. When agent and artifact are treated as components of a single undifferentiated cognitive system, it becomes difficult to establish principled criteria for distinguishing between endogenous cognition and externally supported processes — and with them, the very notions of cognitive offloading and cognitive diminishment risk losing their analytical traction. From an Alsbergian perspective, the externality of the artifact is precisely what makes it possible to identify when a function has been displaced and when substitution and potential diminishment occur. This is a problem that Clark himself has recently foregrounded: in a hybrid cognitive ecosystem, the question of where to draw the line between cognitive impoverishment and cognitive laziness — of what criterion allows us to understand what has been delegated to the machine, and how much — remains unresolved (Clark, 2025).

Fasoli, Cassinadri, and Ienca (2025) introduce the concept of technologically induced cognitive diminishment (TICD), defined as "the diminishment of cognitive abilities or cognitive performances in healthy individuals, induced by some technological artifacts" (p. 5). This framework distinguishes between short-term (synchronic) and long-term (diachronic) diminishment, as well as between performance impairment and capacity degradation (see also Fasoli 2018a; 2018b). Empirical evidence supports this framework across multiple cognitive domains: memory and knowledge (Sparrow *et al.* 2011; Grinschgl *et al.* 2021; Henkel 2014; Kelly & Risko 2019; Barasch *et al.* 2017; Roncaglia 2023; Paglieri 2024), attention and learning (Mueller & Oppenheimer 2014; Fisher *et al.* 2015, 2021; Thornton *et al.* 2014; Morehead *et al.* 2019), metacognition (Dunn *et al.* 2021; Grinschgl & Neubauer 2022; Ward 2013), and spatial cognition (Ruginski *et al.* 2019; Ishikawa *et al.* 2008; Gardony *et al.* 2013, 2015; Gillett & Heersmink 2019).

The aim of this paper is therefore to analyse cognitive offloading as a precise modality of *Körperausschaltung* in reference to digital ICTs, particularly generative AI (GenAI) and large language models (LLM). By situating Alsberg's century-old insights within contemporary research on TICD, the EMT, and AI in education (Kasneci *et al*. 2023; Yan *et al*. 2024; Zhai *et al.* 2024; Cassinadri 2024), we seek to move beyond simplistic narratives of technological enhancement or decline toward a more nuanced understanding of cognitive transformation, grounding it in a more general anthropological-evolutionary dynamic.

2. Alsberg's Theory of Technogenesis: *Körperanpassung* and *Körperausschaltung*

Paul Alsberg's philosophy of technology is grounded in a radical reinterpretation of human evolution. Contrary to both biological reductionism and spiritualist exceptionalism, Alsberg argues that the defining trait of the human species is not the possession of superior organs or innate faculties, but a distinctive mode of adaptation: the systematic replacement of organic functions by artificial ones. Human beings do not primarily adapt to the environment by modifying their bodies but by modifying the world in such a way that body-compulsion becomes unnecessary.

To capture this difference, Alsberg introduces the contrast between *Körperanpassung* (body-compulsion)[3] and *Körperausschaltung* (body-liberation/deactivation). In non-human animals, evolution proceeds through the gradual refinement and specialization of endogenous organs in response to selective pressures. Claws, teeth, wings, camouflage, digestive systems, and sensory apparatuses are optimized through genetic and morphological change in order to secure survival within a given *Umwelt*. The organism itself becomes the site where adaptive functions are embodied. This is what Alsberg calls *Körperanpassung*: the body is forced to become the tool (Alsberg 1922, pp. 197-209; Alsberg 1970, pp. 100-110).

Human evolution, by contrast, is characterized by a systematic inversion of this logic. Instead of evolving sharper claws, humans create knives; instead of growing thicker fur, they invent clothing and shelter; instead of developing stronger muscles, they build levers, engines, and machines. Adaptive functions are no longer incorporated into the organism but externalized into artifacts. The biological body is thereby liberated from the need to specialize, at the price of becoming structurally dependent on technological prostheses. This is

3 For the English rendering of the term, we follow Alsberg's own terminology as established in *In Quest of Man* (1970).

Körperausschaltung: the body does not become better at performing a function — it ceases to perform it at all or adapt in different ways, because the function has been transferred elsewhere.

Alsberg also criticizes theories that view the technical artifact as a projection and externalization of the body. His critical target is Ernst Kapp and his theory of *Organprojektion* (organ-projection), according to which techniques would be preconscious projections and externalizations of organs (Kapp, 1877/2018). In technology, for Kapp, the organs would have their natural externalization and empowerment, following a Hegelian dialectical movement whereby humans tend in work to impose on external nature not only their own spirit and self-consciousness, but above all their body and their power. However, Alsberg argues that tools do not extend organs — they replace them entirely, causing organ regression through feedback effects (Cusinato 2008).

In this regard, Alsberg is explicit:

> It cannot be doubted that the concept of "organ" is inseparably bound to the characteristic of corporeality. The organs constitute an "organism", that is, a living body; they "are" the body. By contrast, the concept of "tool" contains, with equal certainty, the characteristic of the extra-corporeal. The tool is no part of the body; it is "outside" the body; it is used "in place of" the body (as the hammer in place of the fist, the nutcracker in place of the teeth, and so on). If one conflates the two concepts — organ and tool — the very characteristic of the extra-corporeal that is **essential** to an assessment of human development is suppressed within the concept of the tool, and the illuminating idea of the bodily deactivation accomplished in man is thereby thrust back into darkness. The tool can fulfil its purpose of bodily deactivation only because it is situated outside the body. And for this reason — because it is extra-corporeal and because it functions in place of the body — the tool is also designated an "artificial" means. (Alsberg 1922, 109)[4]

Alsberg's interpretation of the relationship between human beings and object is radically different:

> In our entirely contrary interpretation of the concept of the tool, it may well appear paradoxical at first that an organ destined to be deactivated must come into activity for the very purpose of its deactivation. How could one maintain that the hand is freed, when it is the hand alone that wields the hammer? Yet nothing would be more mistaken than to designate the hand as the most essential part of the process. It is always the tool that alone accomplishes the performance, and the participation of the organ (in its own deactivation) relates solely to the operation of the tool. It is the hammer that drives the nail into the wall or kills the animal, not the fist. […] The hand "operates" the tool only, and is therefore active only to the degree that the tool requires operation. (*Ibid*., 111).

4 Where not specified, all the translations are mine.

The relationship between bodily disengagement and tools is inversely proportional:

> The deactivation of the organ (effective and with respect to participation) occurs in the same measure as the tool assumes the performance. The more capable of performance the tool is in general, the smaller the demand on the organ — the latter standing, therefore, in inverse proportion to the capacity of the tool. (*Ibid*.)

This move has far-reaching evolutionary consequences. In animal evolution, function and organ remain tightly coupled: what the organism can do depends on what it is. In human evolution, by contrast, function and organ become decoupled: what humans can do depends increasingly on what they have built. As Alsberg puts it, humanity is not defined by what it is biologically, but by what it is able to externalize technologically and culturally. Culture, technology, and symbolic systems are not late additions to an otherwise natural species; they are the very mechanism through which the species comes into being: Anthropogenesis is technogenesis.

This thesis directly undermines both traditional biological and traditional humanistic accounts of human nature. Against biological continuity theories, Alsberg insists that the human mode of evolution introduces a genuine qualitative discontinuity. Even if the human organism is genetically continuous with other primates, the human way of adapting to the world is not. At the same time, against spiritualist theories, he rejects the idea that this break is due to an immaterial soul or a metaphysical faculty of reason (Alsberg 1970, pp. 109 f.). What makes humans different is not what is inside their heads, but the material infrastructure of tools, symbols, and institutions in which their lives are embedded. Importantly, Alsberg emphasizes the recursive nature of this process; as Carmine Di Martino has pointed out, liberation has feedback effects: tools feed back to shape the user (Di Martino 2017, 96 ff.). Technologies are not merely used by humans; they reshape the very organs and capacities that humans possess — and this process is not merely confined to the physiological level, but extends to the mental and neuropsychic ones as well (Di Martino 2017, p. 103). When a function is off-loaded onto an artifact, the corresponding capacity tends to atrophy. The human body has weak jaws, minimal body hair, poor night vision, slow running speed — not because these capacities were never needed, but because they were replaced by cooking, clothing, fire, and transportation. The price of externalization is biological regression. What appears as a deficiency is actually the result of substitution, not a structural or ontological characteristic of *Homo sapiens.* This leads to a reinterpretation of the deficiency theory (*Mängelwesen*). Gehlen argues that humans are biologically deficient and therefore develop technology (Gehlen 1940/1988). Alsberg inverts this causal order: humans developed technology and therefore became biologically deficient — the artifact does not compensate for prior weakness, it produces subsequent weakness (Pavanini 2018). This shift in causal order has profound implications. It means that human nature is not a fixed essence but an ongoing process of self-modification through technological prostheses. Every artifact, every symbolic system, every institution is simultaneously an enhancement and a constraint, an opening and a closure.

At the centre of Alsberg's reflection lies the idea that human evolution constitutes a completely particular evolutionary process, involving an extraorganic dimension, while placing itself entirely within the domain of natural evolution (Alsberg 1970, pp. 32 ff.). Alsberg categorically excludes any attempt to derive the human from an extranatural principle, considering such an approach a form of crypto-theological metaphysics. However, this does not prevent him from recognizing an essential difference between humankind and the rest of the living: humans represent the only case of a completely autonomous evolutionary strategy. Peter Sloterdijk in the essay *The Domestication of Being* included in *Not Saved* (2017), clarifies Alsberg's idea. Drawing on what he terms the "Alsberg theorem," Sloterdijk frames the emergence of the human as the result of a process of radical insulation from the biological environment. What distinguishes the evolutionary trajectory leading to the human being is not a break with natural history, but the opening of a new dimension within it: the gradual and then chronic use of tools by certain pre-hominids generates a form of distance from the immediate organic environment that progressively emancipates the pre-human being from the constraints of direct biological adaptation. Sloterdijk reconstructs a kind of primal scene of this process: an agile, bipedal, generalist East African ape on the savannah grasps a stone — not arbitrarily, but already according to a logic of "handiness," as though the stone were formed with two sides, one for the grasping paw and one for contact with the object — and uses it either to strike or to throw, thereby forcing the environment to yield. In this gesture, bodily deactivation is inseparable from a corresponding activation of the hand: the organ is not suppressed but redirected, becoming the operator of an extra-corporeal means that takes over the performance. It is precisely in this redirection that, for Sloterdijk, the ontological niche of the human opens up within nature — not above it or against it, but as its most radical internal possibility.

Human specificity resides then in a different relationship of adaptation to the environment. While animals develop according to the principle of body-compulsion (*Körperanpassung*), phylogenetically modifying their organic constitution based on environmental requirements, humans undertake a process of extracorporeal evolution that actively builds its own niche. Their adaptation does not occur through modifications of the body but through the development of technical instruments: extra-organic media (Alsberg 1970, pp. 16 ff.; Breun 2021, pp. 50 ff.). Anthropogenesis therefore corresponds to a constitutive technogenesis: it is the complex of instruments that guarantees the adaptation of the living being that becomes human, no longer (or at least not only) its biological constitution. The entire psychophysical sphere of the human, including linguistic, conceptual and institutional phenomena, responds to the same adaptive function with extranatural means (Marino 2015; Lysemose 2012).

As the preceding analysis has shown, Alsberg's own analyses extend the principle of *Körperausschaltung* well beyond physical tools, into the cognitive and symbolic domains of language and reason (von Kalckreuth 2018). Concrete words already liberate humans from the compulsion of direct perception — the word evokes an image in the absence of the object, functioning as an extra-corporeal means of representation. Abstract language goes a step further: Concepts, for Alsberg, are imageless universal ideas that grasp the totality of things without any sensory intermediary. They are, in the strict sense, tools: extra-corporeal, self-existent entities that can be transmitted, operated by machines, and adopted ready-made — independently of the individual mind that formed them. Reason, accordingly, is defined as the faculty of thinking in concepts, standing alongside technology and language as the third great tool-faculty of the human species.

The same logic of deactivation, liberation and feedback applies at the cognitive level. Just as physical *Körperausschaltung* reduces the organic demand on the body in proportion to the performance capacity of the tool, cognitive *Körperausschaltung* reduces the endogenous cognitive demand in proportion to the performance capacity of the symbolic or computational medium. The question is then what feedback effects appear when a machine thinks for us, expresses concepts for and with us, and speaks and writes instead of us. Alsberg also extends the principle into the domains of science, morals, and aesthetics (Alsberg 1970, 48 ff., 69-73): in each case, an idealistic concept — e.g. the idea of truth, the good, the beautiful — overrides and supersedes innate biological impulses and desires. This is bodily disengagement operating at the level of conduct and feeling: spiritual, moral, and aesthetic freedom are, for Alsberg, the cultural culmination of the same evolutionary process that began with the first stone thrown in place of the fist (Sloterdijk 2017, 114 ff.). Hammer, word, concept — three successive technologies, each a further step in the same direction: away from direct organic compulsion and toward an ever-wider emancipation from biological constraint. It is this internal extension of the *Körperausschaltung* principle to the domain of cognition that grounds the analysis developed in Section 3.

3. From Organic *Körperausschaltung* to Cognitive Offloading

As we have shown, Alsberg's theory, although originally developed in relation to bodily organs and physical tools, extends naturally to cognitive functions and symbolic artifacts. Writing, mathematical notation, calendars, maps, diagrams, and, more recently, computers, smartphones, and LLMs can all be understood as cognitive objects (Norman 1991), i.e.: externalizations of cognitive operations. Just as the invention of clothing reduced the evolutionary pressure to maintain body hair, the invention of writing reduced the pressure to maintain exceptional memory. However, this analogy must be handled with care, since not all forms of externalization operate at the same level or with the same consequences.

In contemporary cognitive psychology, this dynamic is captured by the concept of cognitive offloading. Risko and Gilbert (2016) define cognitive offloading as "the use of physical action to alter the information processing requirements of a task so as to reduce cognitive demand" (p. 676). This notion encompasses a wide range of practices, from the use of external memory aids (shopping lists, calendars, smartphone reminders) to the delegation of computational tasks (calculators, spreadsheets, search engines). In this minimal sense, offloading is best understood as a functional redistribution of cognitive labour, rather than as a complete transfer of function. It is typically partial, task-specific, and reversible.

It is therefore important to distinguish cognitive offloading from stronger forms of externalization. While offloading reduces the cognitive burden associated with a task, it does not necessarily eliminate the underlying capacity. By contrast, what Alsberg describes as *Körperausschaltung* corresponds to a more radical process of functional substitution, in which a task is no longer performed by the organism at all, but is delegated to an extra-organic medium. In this stronger sense, the function is not merely supported or scaffolded, but effectively displaced.

This distinction allows us to clarify an ambiguity that often arises in discussions of digital technologies. Not every instance of offloading leads to substitution, and not every substitution produces long-term cognitive diminishment. Offloading can be adaptive and efficiency-enhancing, allowing finite cognitive resources to be allocated more strategically (Ward 2013; Norman 1991; Hutchins, 1995). However, when offloading becomes stable, habitual, and structurally integrated into task performance, it may gradually approximate substitution, thereby reducing the opportunities for the corresponding cognitive capacities to be exercised.

It is at this point that the framework of technologically induced cognitive diminishment (TICD) becomes analytically relevant. Fasoli *et al.* (2025) distinguish between synchronic (short-term) and diachronic (long-term) forms of diminishment, as well as between performance impairment and capacity degradation (see also Fasoli, 2018a; 2018b). This distinction maps onto the difference between offloading and substitution. In cases of synchronic diminishment, the use of a tool temporarily alters performance without necessarily affecting underlying capacities — for example, relying on GPS navigation may impair spatial encoding during a specific task (Fenech *et al*. 2010; Leshed *et al.* 2008). In cases of diachronic diminishment, however, prolonged reliance on external systems can inhibit the development or maintenance of endogenous capacities, as suggested by studies linking habitual GPS use to reduced spatial abilities (Ruginski *et al.* 2019).

The distinction between performance and capacity is therefore crucial. Empirical studies consistently show that cognitive offloading can improve immediate task performance (Grinschgl *et al.* 2021). Students using laptops for note-taking can transcribe more information than those writing by hand; individuals who photograph experiences can capture more detail; and navigators using GPS reach their destinations more efficiently. Yet these performance gains can mask deeper changes in cognitive processing. Laptop note-taking is associated with reduced semantic processing and poorer long-term retention (Mueller & Oppenheimer 2014; Morehead e*t al.* 2019), while the photo-taking impairment effect suggests a decline in episodic memory encoding (Henkel 2014; Lurie & Westerman 2021; Soares & Storm 2018).

From an Alsbergian perspective, these findings can be interpreted as different stages along a continuum of technogenesis. Offloading represents the initial redistribution of cognitive labour, while substitution corresponds to its stabilization in external media. Cognitive diminishment, in turn, is not an automatic consequence of offloading, but a possible outcome when externalization reduces the functional necessity of certain endogenous capacities over time. What characterizes contemporary digital ICTs is not the emergence of a fundamentally new process, but the acceleration and intensification of this dynamic across an unprecedented range of cognitive domains.

4. LLMs and Educational Contexts: the case of TICD in the Classroom

The rapid integration of LLM into educational settings has made the question of cognitive diminishment urgent and concrete, since education is the crucial domain in which the cognitive destiny of future generations is at stake. Tools like ChatGPT, Claude, and similar systems can generate essays, solve mathematical problems, write computer code, summarize complex texts, and engage in sophisticated reasoning across virtually any domain. For students, these capabilities present an obvious temptation: why struggle through difficult cognitive work when an AI can do it faster and often better? The educational literature on LLMs reflects a deep ambivalence. On one hand, researchers recognize enormous potential benefits: personalized tutoring, adaptive feedback, scaffolding for struggling learners, assistance for students with disabilities, and support for creative exploration (Bearman & Luckin 2020; Kasneci *et al.* 2023; Yan *et al.* 2024; Rudolph *et al*. 2023). On the other hand, there is widespread concern about skill atrophy, and the undermining of learning processes (Shanmugasundaram & Tamilarasu, 2023; Zhai *et al*. 2024; Fan *et al.* 2024).

Empirical evidence is beginning to emerge. A recent study by Bastani *et al.* (2024) found that access to generative AI can improve performance on specific tasks while simultaneously impairing learning. Students who used AI to solve practice problems performed worse on subsequent assessments than those who solved problems without assistance, even though their practice performance was better. This is a textbook case of synchronic enhancement coupled with diachronic diminishment: the tool boosts immediate output but prevents the development of underlying competence. Similarly, Fan *et al.* (2024) demonstrate that generative AI induces metacognitive laziness — a reduced willingness to engage in effortful cognitive processing. When students know they can delegate difficult tasks to AI, they become less motivated to persist through challenge. This erosion of cognitive effort has downstream effects on learning, retention, and transfer. Gerlich (2025) surveyed 666 participants and found significant correlations between AI tool use and reduced critical thinking. Lee *et al.* (2025) report that knowledge workers using generative AI describe experiencing reductions in cognitive effort and diminished confidence in their own abilities. These findings align with TICD theory. Fasoli *et al.* (2025) identify three key mechanisms through which technology can impair cognition: (1) substitutive use, where the tool entirely replaces a cognitive function; (2) dependency formation, where prolonged offloading leads to skill atrophy; and (3) metacognitive distortion, where reliance on external resources undermines self-awareness and self-regulation. All three mechanisms are clearly operative in educational LLM use.

However, the picture is not uniformly negative. Cassinadri (2024) argues that the educational impact of LLMs depends critically on how they are integrated into pedagogical practice. When used as substitutive artifacts — doing the cognitive work for the student — they undermine learning. When used as 'complementary' artifacts — supporting specific sub-processes while leaving core work to the student — they can enhance learning. And when used as transformative artifacts — enabling new forms of inquiry and creation that were previously impossible — they can fundamentally expand educational possibilities. The challenge for educators, designers and policy makers is therefore to structure LLM interactions in ways that foster complementary or transformative use while minimizing substitutive use. This might involve prompts that require students to critique, revise, or extend AI outputs rather than simply accepting them; assignments that reward process documentation and metacognitive reflection rather than mere final products; and assessment methods that test endogenous understanding rather than outsourced performance.

While Section 4 has focused on the educational domain as a concrete case study, Section 5 develops a more systematic analytical framework applicable across all modes of human-AI interaction, drawing on Fasoli's taxonomy of cognitive artifacts to distinguish the different structural relationships between tools and cognition.

5. A Taxonomy of Cognitive Artifacts and Modes of Offloading

5.1 Substitutive Artifact and Strong Offloading

To systematically analyse the relationship between AI tools and cognition, we can draw on Fasoli's (2018a, 2018b) taxonomy of cognitive artifacts. Fasoli distinguishes three modes of artifact-cognition interaction based on how the artifact relates to existing cognitive processes: substitutive, complementary, and transformative (or constitutive). Each mode has different implications for TICD. Substitutive artifacts completely replace a cognitive function that the agent could, in principle, perform unaided. A calculator substitutes for mental arithmetic; a GPS substitutes for spatial navigation; spell-check substitutes for orthographic knowledge; a language translation tool substitutes for bilingual competence. In each case, the artifact does not merely assist the cognitive process — it takes it over entirely, rendering the corresponding endogenous capacity unnecessary for task completion. When LLMs are used substitutively, they generate complete outputs (essays, code, solutions) with minimal cognitive engagement from the user. The user provides a prompt, and the AI delivers a finished product. This is the paradigm case of strong *Körperausschaltung* in the cognitive domain. The cognitive function (writing, problem-solving, reasoning) is switched off and transferred to the external system. The consequences for learning are severe (Dwivedi *et al.* 2023). Learning requires active cognitive processing — encoding, elaboration, integration, retrieval practice: it takes time. When these processes are bypassed, learning and the sedimentation of knowledge do not occur. Students may complete assignments and produce high-quality outputs, but they acquire neither knowledge nor skill. Over time, prolonged substitutive use can create what Casner *et al.* (2014) call cognitive dependence — a state in which the agent becomes unable to perform the function without technological support. For example pilots who rely heavily on autopilot exhibit degraded manual flying skills (Casner *et al.* 2014; Ebbatson *et al.* 2010). Similarly, students who habitually delegate composition to AI may lose the ability to write coherently on their own. Our technological culture impacts heavily on our natural skills.

From an Alsbergian perspective, substitutive artifacts represent the most direct instantiation of technogenesis: the externalization of function leads to the regression of capacity. The more completely a cognitive task is offloaded, the less opportunity there is for the corresponding neural circuits to develop or maintain themselves. This is not inherently problematic — many cognitive functions are worth externalizing — but it requires conscious choice rather than passive drift. We must ask ourselves which cognitive capacities we want to preserve, and which are we willing to let atrophy; but more importantly: to what extent does cognitive offloading transform into structural diminishment — that is, when certain acquired functions are lost in the name of a re-functionalization of neuronal processes.

5.2 Complementary Artifacts and Partial Offloading

Complementary artifacts support cognitive processes without entirely replacing them. They handle specific sub-tasks, reduce cognitive load, or provide scaffolding, but leave core cognitive work to the agent. Spell-check that highlights errors but requires the user to generate corrections; autocomplete that suggests options but requires selection and editing; retrieval tools that find information but leave synthesis and evaluation to the user — these are complementary rather than substitutive. Here, *Körperausschaltung* is partial and selective. Some micro-functions are externalized — such as error detection or information retrieval — while core processes remain endogenous. This mode of integration is often associated with cognitive enhancement in the narrow sense: performance improves without necessarily undermining underlying abilities (Cinel *et al.* 2019). However, even complementary offloading can lead to subtle forms of dependency if it becomes so pervasive that users no longer practice the supported skills independently (Heersmink, 2016; 2017; 2024).

The critical variable is whether the artifact preserves the user's role as an epistemic agent. When AI tools function as tutors rather than substitutes — prompting questions, providing hints, requiring active engagement — they may strengthen metacognition and understanding (Kasneci *et al.* 2023). When they become invisible crutches, they may quietly erode them (Dunn *et al.* 2021; Grinschgl & Neubauer 2022).

5.3 Transformative Artifacts and Technogenetic Reconfiguration

Transformative (or constitutive) artifacts do not merely replace or assist existing cognitive functions; they reconfigure the structure of cognitive activity itself. Writing systems, mathematical notation, and digital hypertext are classic examples. They create new forms of thinking that would not be possible without them.

In Alsbergian terms, transformative artifacts represent deep technogenesis. They do not simply switch off a function; they reorganize the entire ecology in which cognition occurs. Importantly, this reorganization can generate new endogenous capacities, even as it renders older ones obsolete. The advent of writing diminished oral memory but enabled abstract reasoning, historiography, and science (Ong 1986; Havelock 1982). Similarly, appropriately integrated AI systems might diminish some traditional skills while enabling new forms of collaborative intelligence, simulation, and exploration (Cinel *et al.* 2019; Georgiev *et al.* 2021).

It is worth asking what a genuinely transformative use of LLMs would look like in practice — as distinct from merely complementary use. The distinction is not one of degree but of kind: complementary use leaves the structure of a cognitive task intact while supporting its execution; transformative use changes what the task itself is. A student who uses an LLM to check a draft they have written is engaged in complementary use. A student who uses an LLM as a Socratic (Fakour & Imani 2025) interlocutor — submitting a position, receiving structured objections, revising their argument in response, and iterating across multiple rounds of dialogue — is engaged in a qualitatively different epistemic practice, one that may develop argumentative and self-critical capacities that would not emerge through solo composition alone. Similarly, researchers who use LLMs to generate and stress-test hypotheses across large conceptual spaces, or educators who design simulation environments in which students must interrogate AI-generated scenarios rather than consume AI-generated answers, are exploiting the transformative potential of the technology. In each case, the cognitive demand on the human is not reduced but restructured: the relevant capacities are not switched off but redirected toward forms of evaluation, judgment, and synthesis that the artifact alone cannot perform. From an Alsbergian perspective, this is precisely the condition under which technogenesis generates new capacities rather than merely eroding existing ones.

The key normative challenge is therefore not to prevent substitution or to mandate complementarity, but to steer technological and AI development toward genuinely transformative integrations — ones that expand the space of human agency rather than shrinking it (Kamar 2016; Nyholm 2024). This requires moving beyond the contraposition enhancement versus diminishment and recognizing that cognitive transformation always involves trade-offs, redistributions, and reconfigurations. This aligns also with Alsberg's extramoral evaluation of the *Körperausschaltung* — his explicit refusal to assign any positive or negative moral value to the process of bodily deactivation, which he treats as a purely descriptive evolutionary principle.

6. Normative and Design Implications: Governing Technogenetic Minds

If Alsberg is right that the human mind and body are products of technogenesis, then the design of digital ICTs cannot be understood merely in terms of efficiency or utility. It must be understood as a form of normative intervention in the ongoing reconfiguration of human cognitive capacities. LLMs, in particular, are not neutral instruments but active participants in the redistribution of cognitive functions. Their architecture, affordances, and modes of deployment shape which capacities are externalized, which are preserved, and which new ones emerge. In this sense, human–AI interaction is not simply a matter of tool use, but of cognitive governance.

From this perspective, the central normative concern is not the preservation of a supposedly "natural" or pre-technological cognition, but the maintenance of what can be termed epistemic agency: the capacity of individuals to understand, evaluate, and take responsibility for the cognitive processes that generate their beliefs, judgments, and actions. Technological systems can support or undermine this capacity depending on how they are designed and integrated. Ethical issues emerging from human–AI symbiosis (Gilbert *et al.* 2023) should therefore be reframed not only in terms of rights or harms, but in terms of how technologies structure the conditions for epistemic agency.

This reframing allows us to reinterpret the risks identified by the TICD framework. Substitutive uses of AI, in which the system fully replaces cognitive functions, are normatively problematic not simply because they may lead to capacity degradation, but because they displace the user from the epistemic process itself. When outputs are generated without requiring understanding, evaluation, or justification, users risk becoming passive recipients rather than active knowers. This is particularly critical in educational contexts, where the goal is not merely correct performance but the formation of autonomous cognitive agents.

By contrast, complementary and transformative uses of AI can be normatively preferable insofar as they preserve or even enhance epistemic agency. Systems that scaffold reasoning, prompt reflection, or require active engagement can redistribute cognitive labour without eliminating the user's role in the process (Kasneci *et al.* 2023; Cinel *et al.* 2019). Transformative artifacts, in particular, may expand the space of possible cognitive operations, enabling new forms of inquiry and collaboration (Georgiev *et al.* 2021; Nyholm 2024). The normative task is therefore not to prevent offloading per se, it is an evolutionary constant, but to govern its form and distribution.

This has direct implications for the design of AI systems. First, interfaces should be structured to maintain visibility and contestability of AI outputs. Users should be able to trace, question, and revise the contributions of the system, rather than receiving them as opaque results. Second, systems should be designed to require active participation, for instance by prompting users to justify, critique, or extend generated content. Third, educational and institutional practices must distinguish between outsourced performance and endogenous competence. If evaluation systems reward only outputs, they will systematically incentivize substitutive use and accelerate forms of cognitive diminishment. If they reward processes of reasoning, interpretation, and reflection, they can counterbalance this tendency (Dawson 2020; Rudolph *et al.* 2023).

At the policy level, existing regulatory frameworks such as the EU AI Act (Regulation 2024/1689) can be interpreted as early attempts to formalize this form of cognitive governance. However, current approaches remain primarily focused on risk mitigation and harm prevention. An Alsbergian perspective suggests a broader objective: the deliberate shaping of the technogenetic trajectory of human cognition. This involves not only limiting harmful forms of substitution, but actively promoting forms of human–AI interaction that sustain and expand epistemic agency.

More generally, this framework invites a reconsideration of what it means to protect human cognitive integrity. It is not a matter of preserving an untouched biological core, but of maintaining the capacity to critically engage with the technical systems that increasingly constitute our cognitive environment. Human cognition has always been hybrid and artifact-dependent; the normative question is not whether we think with machines, but whether we remain capable of understanding, governing, and, when necessary, resisting the systems through which we think.

7. Conclusions

Revisiting Alsberg's theories in the age of generative AI reveals a continuity between the intuitions of early twentieth-century philosophy of technology and contemporary debates on cognitive offloading. What we are witnessing today is not a sudden rupture but the intensification of a long-standing evolutionary strategy: the externalization of human capacities into artifacts. Generative AI makes this strategy visible in its most radical form. It expose both the power and the peril of technogenesis. By interpreting technologies through the concepts of *Körperanpassung* and *Körperausschaltung*, and by integrating this framework with contemporary work on TICD and cognitive artifacts, we can move beyond simplistic narratives of enhancement or decline. The future of human cognition will be neither purely biological nor purely artificial, but a contested, evolving hybrid. The task before us is to ensure that this hybrid remains capable of thinking for itself, even as it thinks with machines.

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