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TELEOGENESIS. A BERGSONIAN VIEW ON PROBLEM-FINDING IN HUMAN AND ARTIFICIAL INTELLIGENCE

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1. Inductive metaphysics of intelligence

Psychology has penetrated everyday life and the cultural self-conception of modern civilisation in different ways, but especially regarding cognitive ability of individuals: Intelligence has become a ubiquitous notion which suggests the measurability of everybody's mental capacity by means of the so-called *intelligence quotient*. Disregarding the necessary discussion about societal and ethical consequences of this development, it may be said that the determination of cognitive aptitude has been the paradigmatic achievement of psychometrics: «One of the most successful undertakings attributed to modern psychology is the measurement of mental abilities» [Lamb 1994, 386].

The historical sources of psychological research on intelligence can be found in scholars, such as Francis Galton, Alfred Binet, and William Stern, although their approaches and epistemic interests were significantly different. Galton was influenced by Darwinist adaptationism [Daly & Wilson 1999, 510], Binet – despite championing psychometrics – continued the heritage of French introspectionism, suggesting a method of «comparative introspection» [Varon 1936, 38], and Stern stood in the proximity of the personalist movement in Germany, providing a philosophical foundation for his differential psychology [see Sichler 1998]. Irrespective of the particular intentions

of these classics, it may be said that they did not merely investigate intelligence as a cognitive function, as a generic component of human adaptation alone, but their research interest was directed at understanding the meaning or essence of cognition itself. For example, Galton wished to observe «the elementary operations of the mind» despite their «exceedingly faint and evanescent» [Galton 1883, 185] nature while Binet struggled to investigate the «higher phenomena of mind» [Binet 1903, 2; translation ANW]. In other words, the original research interest in intelligence derived from or at least connected to the archetypical quest of understanding mind.

When Henri Bergson, who may be called «the most important French philosopher of the first half of the twentieth century» [Michell 2012, 2, footnote], proposed his understanding of intelligence, for example in his 1902 article *L'effort Intellectuel*, the psychological discourse was still concerned with a structural understanding of mind. Drawing on a tradition of intuitionism and spiritualism, Bergson contribution did not agree with the positivistic distinction between metaphysics and empirical science. His approach may be called «inductive metaphysics» [Pflug 1959] and established the concept of intelligence as the dualistic antagonist of intuition, viz. instinct.

Bergson did not embrace the development of experimental psychology. In fact, he had originally developed an elaborate critique of psychophysics in his *Essai sur les données immédiates de la conscience* (1888), rejecting Fechner's classical approach of measuring the intensity of impression. It comes with no surprise that Bergson, when faced with the decision for a successor of the eminent psychologist Théodule-Armand Ribot at the Collège de France, rather sided with Pierre Janet who was open for philosophical considerations instead of Alfred Binet whose approach focussed on empirical methodology [see Nicolas & Ferrand 2002]. Despite recognising the value of empirical contributions, Bergson was not willing to forfeit psychology to an exclusively psychometric approach.

As the historian of French psychology, Georges Dwelshauvers, argues, Bergson's method of choice was self-observation despite the upsurge of behavioural methodologies during the early 20th century: «He shows that it is the psychological method par excellence»

[Dwelshauvers 1920, 199]. Still, moving beyond the eclecticist attempts of his predecessors, Bergson advances introspection by drawing on Hippolyte Taine who had dedicated his investigation *De l'intelligence* (1870) to the matter in question. He approximates the English methodology without committing to associationism while maintaining distance to the reflexive methodology of the rationalists insofar as Bergson dedicates his research to the subject-matters of philosophy of life: «tension, lived duration, character, freedom» [Dwelshauvers 1920, 200]. The centrepiece of Bergson's mode of investigation, which may be called «vital science» [Paul 2016, 252], is intuition. By investigating it, vital science strives deeper into the order of life than the mere surface of cognitive mechanisms, instead attempting to determine the creative evolution of life which unfolds within, leading to a «coincidence of psychological and metaphysical knowledge» [Dwelshauvers 1920, 220].

Bergson's vision of psychology did not succeed in establishing a lasting impact on the empirical discipline. In fact, he was struggling against the current of time insofar as he belonged to «the French philosophers who could not accept the idea that the psychology of the time was in transformation» [Nicolas & Ferrand 2011, 104]. It was Alfred Binet himself who expressed this distance when publishing a review of Bergson's essay on intellectual effort in 1901. Arguing from the standpoint of experimentation, Binet would state that «it is difficult to criticise Bergson's theory because it only exposes possibilities and as long as nobody has verified it, one cannot know what to think about it» [Binet 1901, 477]. Ultimately, Binet – *pars pro toto* for the movement of psychometric psychology – declares empiricism the judge over metaphysics.

The following investigation revisits both empirical psychology of intelligence – on the occasion of developments in so-called artificial intelligence – and Bergson's contribution to it. The main claim is that empirical psychology requires a foundation for theory-building when inquiring into (either human or artificial) intelligence. Bergsonian philosophy of intelligence can enrich such a foundational discourse. This is exemplified by the problem of *teleogenesis*, i.e., the origin of goals.

2. Structural presuppositions in the psychology of intelligence

The initial complexity within the psychology of intelligence was ultimately superseded by the psychometric thrust of the discourse, especially thanks to the promotion of operationism and advancement of inferential statistics, for example, by Raymond Cattell, Gordon Allport, and Hans Jürgen Eysenck. The centrepiece of the psychometric conception of intelligence is a general factor of cognitive ability, which developed from Charles Spearman's initial investigations at the beginning of the 20th century to John Carroll's claim of a hierarchical factor structure of intelligence whose apex is the so-called *g-factor* at the end of the century. According to this view, intelligence is not treated as the expression or a feature of mind anymore but as a statistical aggregation of behavioural patterns, an abstraction from different classes of tasks which resemble one another because they require performance, i.e., subjects may succeed or fail when trying to solve the task. In the end, intelligence became a general compound success rate for performance in psycho-diagnostic tasks.

The difference between the classic and the contemporary approach of investigating intelligence is the epistemic scope. The prior addresses intelligence as a member or aspect of the mind, as a trace of intellect which is the supposed subject-matter of psychology. The latter refrains from such commitments and views intelligence as a function, or rather a form of conduct which might or might not have a substrate. To describe this difference, one may draw on the dichotomy of structuralism and functionalism as it has been used at the beginning of the 20th century, especially in the North American discourse on psychology.[1] The debate between structuralists, such as Edward Titchener, and functionalists, such as John Dewey, concerned the foundation of psychology as a science. The structuralists held a defensive position, continuing a European tradition, for example under the influence of (but also different from) Wilhelm Wundt, according to the basic claim that one «could study psychological functions such as memory, imagination, attention, and volition, but this cannot proceed successfully until the

[1] Albeit with a different meaning, the terminology has also been used on other occasions, for example in social sciences [cf. King 2011].

basic structures of the mind have first been worked out» [Green 2009, 79]. The functionalists rejected the burden of determining the nature of mind before investigating cognitive functions and replaced its epistemological liability with a less foundationalist framework, which was inspired, for example, by pragmatism.

The historical background provides two alternative approaches of understanding intelligence. Either intelligence is treated as an empty signifier within a general framework, such as cognitive science, or one claims that there actually is an entity of unique properties which emerges under certain conditions. This entity could be called soul or rather mind but also intellect, which helps highlighting the connection to the problem of intelligence. The first approach is functionalist, it can describe processes in terms of relations according to certain principles. A typical case of such principles would be evolutionist, which means that intelligence would be a function which serves adaptation with the goal of maintaining an equilibrium, such as survival. The second approach is structuralist, which means that intelligence is treated as an expression of a type of being. A classic example for this point of view is the Aristotelean understanding of man as a ζῷον λόγον ἔχον, as a being which is able to think, or rather, which partakes in logos, in the ideal order of being.

It is obvious to the naked eye that both approaches lead to entirely different psychologies. This begs the question which of the two directions is the right one; a question which may be reformulated: What is the epistemological criterion to decide for either functionalist or structuralist psychology? In other words, should intelligence be understood as a cognitive function or as the manifestation of intellect? It comes with no surprise that different answers are possible and have been defended throughout history. For the longest time, especially before the 19th century, the predominant answer was that the mind is an evident givenness and the purpose of psychology is determining its structure. Due to different steps of methodical doubt, this certainty has lost its foundation until the early 19th century and Immanuel Kant as well as Johann Friedrich Herbart put the last nail into the coffin of the project called rational psychology [cf. Dyck 2014]. After a period of transition, the predominant answer of the 20th century was that the

assumption of mind as an autonomous entity is unjustified and all that is left to be investigated are the functional relations which are accessible to direct or indirect observation.

To put it in a nutshell, history has decided in favour of functionalist psychology. This would suggest that intelligence is nothing by itself, at least nothing epistemically accessible. Rather, intelligence can be anything that derives from observations under the premises of explanation in a theoretical framework, for example, it can be cognition, information-processing, or problem-solving. This is where the actual issue arises because such theoretical frameworks are neither uncontroversial nor trivial, they depend on assumptions of different kinds. In fact, even the fundamental idea of a functional nature of cognition is a debatable conceptual commitment.

The problem can be illustrated by an example: The (functionalist) claim that intelligence is a function of information-processing inherits all issues underlying the concept of information. Far from being a generic term, the concept of *information* derives from a long tradition which is already evident from a linguistic point of view. The concept originates from the logical notion of *form* which typically contrasts with *matter*. This dichotomy can be traced back to the so-called *hylemorphism* which belongs to the Aristotelean tradition [cf. Witt 1987]. But even if one forgets about the two millennia which provide the background for the understanding of information, the younger conceptual developments are no less complex.

It were Claude Shannon and Warren Weaver who conceptualised information within a sender-receiver model and deprived it of any semantic properties («information must not be confused with meaning»; Shannon & Weaver [1964]), a fateful divorce which allowed the concept to become both universal and abstract. They developed their approach on the basis of a theory of message transmission as a physical rather than psychological process which was published by Ralph Hartley in 1928. Their concept of information was limited to being «a measure of freedom of choice in selecting one message from others» [Capurro 1978, 211]. Understood as a signal, its primary feature becomes the effect it has within a system.

When applied as the foundation for cognitive science's concept

of information-processing, which means transposing the concept of signal from inanimate to animate systems, a fundamental ambiguity arises from the mathematical understanding of information since it «thus describes both the effect of the forms or structures of reality in themselves and the effect of these forms on cognition» [*ibid*., 229-230]. In other words, the notion of information struggles with the *explanatory gap* [cf. Levine 1983] insofar as it is a challenge to reconcile the idea of signal transmission with the domain of physical relays, as in the case of telegraphy, as well as with phenomenality: «If we can say how much information these messages represent, then we can speak about their average. But this tells us nothing about what information is being communicated» [Dretske 1983, 56].

The problem led Fred Dretske to the attempt of reintegrating semantics into the mathematical concept of information by drawing on John Searle's so-called *semantic intentionality*: «Whereas different equiprobable signals are all alike in their degree of non-semantic informativeness, they differ in their degree of semantic informativeness, insofar as the selection of each of them stands for something different» [Piccinini & Scarantino 2010, 241]. Dretske's proposal is in itself controversial, and it takes no wonder that Searle's version of intentionality can be challenged, for example from phenomenological grounds. Thus, cognitive science conceptually depends on the paradigm of information without being able to fully conquer its immanent contradictions or to appease underlying controversies.

To understand intelligence as information-processing is a functionalist approach and a doxographic analysis may reveal its presuppositions. However, the conceptual revision can even include the notion of function itself. This means turning to the presuppositions of functionalism as a whole. To treat intelligence as something which enacts a function means to ascribe *directedness* to it, for example in the sense of causality, means-end relations, or goal-directedness. This might not seem a controversial assumption, but a rigorous examination of these commitments demonstrates that they are not logically different from structuralism: Describing mental life and human behaviour in terms of functions entails the assumption of isomorphy or homology of the explanandum to the explanans. Otherwise, no functionalist model could

claim representativeness. Ultimately, the understanding of intelligence will always have to draw on a preconception and it would be a mistake to overlook this conceptual commitment.

Against the background of an analysis of conceptual foundations, the historical bifurcation in psychology can be reassessed: Understanding intelligence either depends on a structuralist concept of intellect or rejects it from the standpoint of functionalism. Still, even functionalism relies on hidden assumptions about the nature of the functions it tries to describe and explain. In other words, *any type of functionalism has structuralist presuppositions*. The distinction between both approaches rather concerns research procedures than reflecting differences in dependency on epistemological foundation. Like positivism, functionalism cannot abolish its foundational issues. This problem can be met in one of two ways. Either functionalism tries to abolish its conditions in an iterative and possibly infinite process, but this means an approximation of an explanatory minimum because cognitive science would detach from its own subject-matter. Or functionalism embraces the fact that any investigation of cognition depends on a pre-reflective acquaintance with the intellect.

Only the second alternative is valid, which is to say that it is necessary to accept that the conception of intelligence shows traces of an original understanding of what intelligence amounts to. This does not rely on an infallible introspective intuition about the nature of intellect, but its structure is not entirely opaque. Conceiving of intelligence as a goal-directed function implies abiding by an anthropological premise which is rooted in logic and the primordial acquaintance with temporality. The directedness of mental processes is different from an arbitrary assumption because it is contained in the texture of the reasoning with which one could corroborate it. Like the law of noncontradiction belongs to formal logic, seriality and consecutiveness is analytically inherent to the concept of processes. For this reason, it is safe to say that intelligence as a mental function is constituted by directedness. This presupposition of intelligence research may be called the *primordiality of directedness*.

In lucid moments, even experimental psychologists have been aware of the theoretical conundrum. In an article by the influential psychometrician David Wechsler who is responsible for the development

of one of the most used if not the most used intelligence tests, the author draws on Bergson to argue «against the identification of general intelligence with intellectual ability» [Wechsler 1950, 78]. Without taking notice of the philosophical issues in the background, Wechsler proposes future research to investigate the non-intellective factors which determine cognitive ability, implicitly reaching beyond the operational understanding of intelligence which reduces the issue to a concern of psychometrics.

3. Problem-solving and problem-finding

The field of psychological research which is originally concerned with directedness is problem-solving research, which is a part of psychology of thought. Psychology of problem-solving tries to describe and explain how humans solve problems. Within cognitive science, the most influential program in this domain was developed by Allen Newell and Herbert Simon [1972] who treat problem-solving as the transformation of states according to rules. Ultimately, almost all contemporary psychological problem-solving research aligns with their approach and therefore commits to a specific idea of directedness. It can be summarised by saying that problem-solving transforms an initial state into a goal state. Due to this cognitivist tradition, most of psychological research is committed to goal-directedness as the paradigm of human intelligence. It has been questioned only on few occasions, for example in the concept of *polytely* [see Dörner & Funke 2017].

Goal-directedness is also a predominant idea in research on artificial intelligence. In fact, the operative architecture of computers entails the permanent execution of tasks, for example on the level of the atomic operations of a Turing machine [cf. Turing 1992]. Hence, the convergence of problem-solving in humans and machines is not controversial. Yet, a different problem lingers at the conceptual fringes of goal-directedness, namely the issue of so-called *goal formulation* or problem-finding.

While problem-solving has frequently been investigated in psychology, problem-finding has rarely been touched upon beyond exceptions like Jacob Getzels [1979; 1982]. Essentially, the main research

question is: What makes it so a human or an artificial system has a problem or a task to solve? Instead of investigating performance and permutation, problem-finding is a matter of decision, choice, preference and ultimately motivation. Not all possible tasks become the actual problem for a person. The difference between a merely possible and an actual problem resides in aspects like relevance and value. Against this background it becomes clear why problem-finding has received less attention than problem-solving. The phenomena require entirely different perspectives and discourses.

Recently, problem-finding has received some attention in the field of artificial intelligence. The journal *Advances in Cognitive Systems* has been dedicated to the discussion of so-called *goal reasoning* for over a decade. Michael Cox has published a paper entitled *The Problem with Problems*, in which he challenges the classical conception of problem-solving as «a combination of an initial and goal state along with some background domain knowledge» [Cox 2023, 15]. According to his own approach, «a problem is a state of the world that limits choice in terms of potential goals or available actions» [*ibid*.]. Some cognitive scientists, such as Cox and other scholars at Wright State University in Ohio, have already engaged with the conceptual underpinnings of intelligence research by challenging the status quo, although they do not draw on philosophy.

The discourse on goal reasoning is critical of mainstream artificial intelligence research. In a previous paper, Cox argues that the established theories of artificial intelligence «generally do not account for how goals originate» [Cox 2012, 11] with two exceptions: «One assumption is that goals are simply input by a human. A second possibility is that goals arise due to subgoaling» [*ibid*.]. The latter option is an implicit reference to Newell and Simon who had advanced their agenda of understanding human problem-solving towards *Universal Subgoaling and Chunking* [Laird *et al*. 1986]. Cox argues that these two alternatives fall short of the classical ambition (or maybe utopia) of artificial intelligence, namely *autonomy*. For him, «autonomy means being able to generate new goals rather than just following the goals of others» [Cox 2013, 11]. This is the primary concern of goal reasoning research.

To illustrate the meaning of goal reasoning research, one may

engage with Cox's own approach, which is called Metacognitive, Integrated, Dual-Cycle Architecture (MIDCA). As apparent in the name of this cognitive model, Cox aligns with the research tradition of *metacognition* and especially with Thomas Nelson's [1990] concept of metamemory. Accordingly, the model makes a hierarchical distinction between three levels, the ground, object, and meta level. These levels are connected by two cycles, the lower one relates to action and perception whereas the upper one is a matter of introspection and control in the sense of metareasoning. Evidently, the MIDCA cognitive model bears resemblance to other architectures, such as SOAR, ACT-R, and ICARUS as well as DISCIPLE. Yet, Cox and colleagues claim that only «MIDCA distinguishes between meta-level and object-level explicitly in the hierarchy» [Cox *et al*. 2016, 3717]. Whether this is true or not, might be a technical question but it is not of primary relevance for the issue of goal reasoning.

In Cox's [see 2013, 18] model, the executive function at the meta-level is responsible for managing the goal set $\mathcal{G}$. In this capacity, it has the ability to introduce initial goals ($g0$), subgoals (gs), or new goals (gn) into the set, alter goal priorities, or modify a specific goal (Δg). In the context of problem-solving, the *Intend* component selects a current goal (gc) from the available options by forming an intention to execute a *Task* capable of achieving the goal. Subsequently, the *Plan* component generates a series of *Actions* (πk) that instantiate that *Task* based on the current understanding of the world ($M\Psi$) and background knowledge (e.g., semantic memory and ontologies). The plan is executed by the *Act* component to bring about changes in the actual world (Ψ) through the effects of the planned *Actions* (ai). In the process of problem-solving, the goal and plan are stored in memory, providing the agent with expectations about how the world will evolve in the future. Consequently, the comprehension task involves grasping the execution of the plan and its interaction with the world in relation to the goal, ultimately leading to success.

The critical part of this description concerns changing goal priorities, adding new goals and committing to a current goal. In the MIDCA architecture, the crucial mechanism is a matter of what Cox calls *anomaly*. He says: «The key is to identify when observations

violate expectations, to ask why such an anomaly occurred, to answer by explaining the causes of the anomaly, and to generate a goal to remove the primary cause» [Cox 2013, 11]. In other words, MIDCA compares two sets of information and adapts the goals accordingly. As Cox summarises [*ibid*., 19], this comparison is executed by the model through the utilization of two distinct machine learning algorithms, both of which operate on symbolic predicate representations of the world. When provided with an interpretation of the world state, the model's first step involves categorizing the state into one of multiple state classes using a decision tree. Each class is associated with a goal generation rule that was acquired during the learning process. Upon receiving an interpretation and a class, the model proceeds to iterate through various permutations of the rule's variable groundings. It continues this process until either a grounding is found that satisfies the rule (at which point a goal can be generated) or until all possible permutations of groundings have been exhausted (signifying that no goal can be generated).

Research on goal reasoning in artificial intelligence offers further attempts of goal generation. In a comprehensive literature review, Vattam and colleagues [2013] enlist five classes of triggers for goal formulation and six methods of goal formulation. Still, these different approaches are technical solutions for the problem of integrating meta-cognition into artificial intelligence. What they provide are static or dynamic routines for the generation of goals. All of these proposals share a common theoretical frame which suggests that cognition entails goal-directedness. The philosophical presuppositions of this issue remain untouched.

4. Critique of finalism

Goal reasoning is invoked when engaging with the idea of artificial intelligence in autonomous agents. For example, Hussein Abbas and colleagues [2018] have recently edited a collected volume on the *Foundations of Trusted Autonomy*. A well-established approach to making artificial agents autonomous is so-called *goal-driven autonomy* and it takes no wonder that the MIDCA framework has been suggested as a foundation for this type of autonomy. Yet, is metacognition a valid

articulation of proper autonomy? This question coerces a conceptual analysis of autonomy concerning freedom of action and will. This philosophical discourse provides a foundation for further reflections.

Goal reasoning and problem-finding as the core of metacognitive models, such as MIDCA, which try to create actual autonomy, commit to the notion of the goal in a specific sense. In the general conceptual field of cognitive sciences, goals are possible states of the world which are the object of representation by information. Thus, goals become the point of reference for means-ends analyses which allow problem-solving. However, it is justified to doubt whether this concept of goal can be universalised. In fact, the limitation of means-end-analyses has already become evident in the 1970s when the ambitious project of the General Problem Solver could not meet the expectations because its performance diverged from the empirical behaviour of human problem-solving. In the words of Stellan Ohlsson:

> [The General Problem Solver] was the closest thing to an operational artificial intelligence that the world had yet seen. From the point of view of psychology, this approach to generality failed. In many task domains, people do not engage in means-ends analysis but use forward search, hill climbing, reasoning by analogy, or some other type of strategy [Ohlsson 2012, 114].

Ohlsson suggests that human intelligence employs forms of reasoning which are dissimilar from means-end-analyses. However, Ohlsson did not reflect on the conceptual consequences of these limitations. In contrast, one may claim that the artificial intelligence of the general problem solver did not only fail due to a lack of strategy but because its architecture depends on the functionalist concept of the goal in the sense of an explicit representation of future states. The directedness which is evident in our experience of the world cannot only be explained as directedness at this type of explicit goals.

The empirical critique of problem-solving research resonates with a philosophical position which predates his comments by a century. Bergson identified the shortcomings of mechanistic as well as finalistic worldviews in his philosophy of organism and life:

> The error of radical finalism, as also that of radical mechanism, is to extend too far the application of certain concepts that are natural to our intellect. Originally, we think only in order to act. Our intellect has been cast in the mold of action. Speculation is a luxury, while action is a necessity [Bergson 1944, 50].[2]

Bergson accuses mechanistic and finalistic positions of intellectualism insofar as they overestimate the importance of explicit conceptual consciousness of goals. This argument runs strictly parallel to Ohlsson's observation that human behaviour cannot be reduced to means-end-analyses. More immediate and general are processes of the «unforeseen, […] invention, or creation» [*ibid*., 45] which defy the description in terms of finalism. In Bergson's philosophy,[3] these processes of instinct precede the declarative consciousness of intelligence, i.e., they articulate the primordial genesis of directedness. The philosopher describes it in terms of evolution which is «different from a series of adaptations to circumstances, as mechanism claims; entirely different also from the realization of a plan of the whole, as maintained by the doctrine of finality» [*ibid*., 113]. More specifically, life «transcends finality, if we understand by finality the realization of an idea conceived or conceivable in advance. The category of finality is therefore too narrow for life in its entirety» [*ibid*., 244-245]. Bergson suggests that the intuitive processes which devise the genesis of intelligence (*genèse de l'intelligence*) belong to the domain of life itself:

[2] «L'erreur du finalisme radical, comme d'ailleurs celle du mécanisme radical, est d'étendre trop loin l'application de certains concepts naturels à notre intelligence. Originellement, nous ne pensons que pour agir. C'est dans le moule de l'action que notre intelligence a été coulée. La spéculation est un luxe, tandis que l'action est une nécessité» [Bergson 1911, 47].

[3] Another field of research which can help to criticise the presuppositions of functionalism is teleosemantics and it might appear to be generally commensurable to Bergson's approach insofar as teleosemantics also focusses on the understanding of biological evolution [e.g., Millikan 1984]. Yet, teleosemantics commits to a goal-based concept of function and does not engage with the problem of life as investigated by Bergson. Instead, it supports a naturalistic and even physicalistic conception of intentionality. Hence, it would require additional conceptual steps to synchronise these two discourses.

> [I]ntuition may bring the intellect to recognize that life does not quite go into the category of the many nor yet into that of the one; that neither mechanical causality nor finality can give a sufficient interpretation of the vital process [*ibid*., 195].[4]

5. Teleogenesis by effort

To introduce an alternative to the finalistic means-end paradigm of understanding directedness, one may use the term *teleogenesis*[5] (or telogenesis) which translates to goal generation but invites a different conceptual framework than the aforementioned goal formation and problem-finding. The term can be found in the work of the American philosopher William Pepperell Montague who developed a Bergsonian position and claimed that «before a telos can be actualized in the organism it must have originated in the germ. Teleology must be preceded by Telogenesis» [Montague 1920, 17].

Montague argues that any kind of organic and ultimately mental behaviour indeed serves adaptation, just like Michael Cox would suggest, but on a more fundamental level, the principle of adaptation has an origin in a different type of process. In agreement with Bergson, Montague argues that teleogenesis is not a mechanistic process. Bergson would instead use the term *élan vital* which means vital drive or force. Accordingly,

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[4] «Ainsi, elle pourra amener l'intelligence à reconnaître que la vie n'entre tout à fait ni dans la catégorie du multiple ni dans celle de l'un, que ni la causalité mécanique ni la finalité ne donnent du processus vital une traduction suffisante» [Bergson 1911, 193].

[5] The term has also been used by the cultural psychologist Jaan Valsiner who defends a semiotic account, according to which «Signs are constructed by active sign-makers who operate toward goals (intentionality) that are constantly being modified (teleogenesis)» [Valsiner 2017, 6]. Valsiner uses the term to address «imaginative processes» [Valsiner 2021, 269] of goal-creation but without sharing the philosophical background of Bergson, rather drawing on the so-called *Rubicon model* which was developed by the motivational psychologists Heinz Heckhausen and Peter Gollwitzer 1987.

> Telogenesis is the heart of what Bergson calls «creative evolution»; and that great philosopher has clearly demonstrated that creative evolution depends upon the cumulative preservation of the past. Because of this preservation of the past every product of a telogenetic process must have two basic characteristics: first, the characteristic of pertinence and, second, the characteristic of novelty. Since a telos arises from the past, it must be pertinent or relevant to it; it must carry on or carry out the tendencies which generate it, and make explicit what was implicit. But that which is a function of the whole past cannot be a mere repetition of a part of the past; hence the telos that arises will not merely be pertinent, it will also be novel [Montague 1920, 20].

When taking the term autonomy in its literal sense, i.e., self-determination insofar as something determines its own laws, a cognitive model like MIDCA will always struggle with its own conceptual constraints since the metacognitive loop is a formal precondition of the system's activity. The structural logic of meta-cognition entails an implicit meta-goal which determines the entire vertical regulation and therefore undermines actual spontaneity or autonomy. Metacognitive models rather describe, as it were, auto-*tely* than auto-*nomy*. Teleogenesis on the other hand tries to account for the spontaneity of intelligence. Montague provides different examples for this kind of activity, such as artistic freedom: «In the domain of affective experience, telogenesis is exemplified in almost any case of artistic creation or expression» [*ibid*., 21]. He goes on: «Humour, in particular, because of the suddenness and spontaneity which is of its essence, is a perfect case of telogenetic activity. The flash of wit or pat remark, when at its best, is the acme of both pertinence and novelty» [*ibid*., 21]. A further example is the spontaneity of language «in which the cognitive, conative and affective interests are equally involved» [*ibid*., 21] insofar as, «[i]n talking, a man does not and cannot plan out his words in advance. His sentences are not duplicates of what pre-existed; they do not repeat his thoughts, they express them» [*ibid*., 21].

What one finds in teleogenesis is directedness without a goal, a direction which allows finding a goal, but which does not presuppose the formal nature of what will be encountered. A similar description

can be found in the German philosopher Max Scheler who distinguishes goals or purposes from what he calls striving:

> One cannot find purposes wherever the phenomenon is present that 'something in us is striving upwards'. Here we experience the movement of striving in one case quite simply, without being directed 'away from a state' or 'towards something'; for instance, in the case of a pure 'urge to move', in which even the movement does not in any sense become a 'goal', an 'aspiration' [Scheler 1980, 53; translation ANW].

In Bergson's philosophy, striving corresponds with the concepts of *effort* and *tension* which stand in the philosophical tradition of Maine de Biran: «in paying 'attention' to and thus actively 'resisting' its environment, consciousness becomes aware of itself as an autonomous» [Kotva 2016, 400]. This is to say that the mental faculty of attention is explained by underlying dynamics of effort: «The moment of waiting between the reception of an external stimulus and the following answer is that which Bergson calls 'attention'» [Ramirez Cubaque 2016, 23; translation ANW]. In Bergson's body of work, one can find a continuous engagement with the concept of effort as muscular, intellectual, and intuitive effort. Concerning intellectual effort, which comprises attention, Bergson distinguishes different degrees, from the lowest of the effort of recollection to the more profound effort of comprehension and finally the effort of invention.

Importantly, «to make an effort there has to be resistance» [Ramirez Cubaque 2016, 8; translation ANW]. Bergson's approach integrates into the philosophical current of *voluntative realism* as it was inspired by Biran. For this reason, Bergson's approach is akin to other voluntaristic position, and his understanding of life «is rather of the same order as the Will of Schopenhauer or the Unconscious of Von Hartmann – only that it is more definite, more verifiable by direct experience» [Solomon 1912, 71]. Accordingly, when speaking of the primary intuitive order of life which is characterised by «tension, continuous creation, free activity» [Bergson 1944, 244] and the secondary intellectual order which entails «geometrical mechanism» [*ibid*., 244], Bergson argues «that the vital is in the direction of the voluntary. We may say then that this first kind of order is that of the vital or of the willed» [*ibid*., 245].

6. Ontogenetic teleogeny as the principle of the pre-reflective constitution of directedness

Bergson offers a conceptual alternative to the instrumentalist means-end logic of cognitive processes. This alternative rests on a structurally different ontology, a radical reconsideration of the relation between the possible and the real. The cognitivist understanding of problem-solving hinges on the mechanistic prejudice that the possible determines the real, insofar as the future is the realisation of possibilities of the present. According to this metaphysical presupposition, solutions for given problems may only be extrapolations of the current state. Hence, intelligence attempts to exhaust all possibilities, like a chess computer which analyses all permutations of the pieces. Leonard Lawlor draws on Bergson's treatise on intellectual effort when calling this understanding of intelligence «pure intelligence» which «composes a metaphysics 'in which the totality of the real is postulated complete in eternity'» [Lawlor 2020, 68].

Although Bergson has been interpreted as an anti-intellectualist philosopher, for example due to his allegiance to philosophy of life or interest in pragmatism, he did not expel intellect as a whole from his approach. Bergson scrutinises the validity pure intelligence because such «intellect cannot understand life and its creative evolution» since it omits «the 'upsurge' of invention» [*ibid*.] which is the expression of Bergson's understanding of metaphysics. For Bergson, «the possible does not express the relation of the real to the future but of the real towards the past» [Cusinato 1999, 362; translation ANW]. The real has primacy over the possible, thereby «dynamizing the concept of reality: it is not only a changing reality [*realtà in divenire*] but the horizon of possibility changes with it» [*ibid*., 364; translation ANW]. Therefore, the novelty of the future does not result from the past, but reality organically grows: «While being never remains what it is, it does, however, always already carry virtually in itself a sketch of everything that it can become» [Bernet 2010, 43; translation ANW]. Only a different rationality may do justice to this ontology. Lawlor calls it «true intellect», «inventive intellect», or «dynamic intellect» and «to understand how the true intellect is inventive, we must turn to Bergson's concept of the virtual» since this «intellect must have a kind of power of virtuality to it that

makes it able to produce novelty» [Lawlor 2020, 69].

Virtuality is an iridescent concept of Bergsonian thought, least since Gilles Deleuze's [1968] exegesis. When addressing the problem of intelligence, virtuality emerges from the dialectic relationship between a «dynamic schema» that «is a response to obstacles and resistances» [Lawlor 2020, 70] and images which arise from memory and which are «static and closed (immutable), materialistic, and already done» [*ibid*., 72]. True intellect is not simply the unfolding of speculative schemas but «the 'coming and going between the schema and the images which are trying to materialize it'» [*ibid*., 73]. This is not a deterministic process, and the schema cannot anticipate the development, which ultimately remains unforeseen. Lawlor argues that «the dynamic schema is a solution to a problem» [*ibid*., 78], but this hypothetical solution is continuously transformed when encountering resistance, making it «indeterminately determinate» [*ibid*.]. Ultimately, both components, the schema and the memory-image, cannot provide the solution by themselves: «The complete solution to the problem does not resemble any one of the memory-images or any combination of them» [*ibid*., 80]. Thus, *true* intellect establishes a plain of virtuality which is unattainable for *pure* intellect: «With a preformed and pre-existing possibility, there is no virtuality, no potentiality, and no dynamism» [*ibid*., 84].

The decisive question remains: How do the problems emerge which true intellect needs to solve? Bergson searches for an origin within the subject, namely in impulse which is given in intuition. A more promising perspective is his consideration of sympathy. Nonetheless, despite achieving a paradigmatic breakthrough in the understanding of intellect, his explanation of the dynamic nature of true intellect depends on a spontaneous subject which is irritated by its environment. This preference for the activity of the self could not contend Scheler, for whom Bergson was what Arthur Schopenhauer was to Friedrich Nietzsche, a predecessor who ultimately had to be overcome. Scheler faced the problem of the experience of goals by advancing Bergson's intuitions: Scheler's proposal is that of substituting the term 'teleological' by a neologism: 'teleocline'. A teleocline becoming is a becoming which cannot be predicted or predetermined from the beginning on. Not only intellectual spontaneity but «cosmic evolution» is a teleocline process:

«Teleocliny is thus a direction without a predetermined end» [Cusinato 1999, 260; translation ANW]. *Teleocliny is the ontogenetic principle behind the psychological structure of teleogenesis.*

Rather than searching for the source of motivation inside the subject, a Schelerian advancement of Bergson's philosophy embraces the transformative dynamics of values. The emergence of goals in teleogenesis has its foundation in pre-reflective order of teleocliny. True intellect is not an experience of autonomy in the sense of sovereign autarchy which detaches from the world, but it manifests as openness towards the world and an experience of incompleteness which strives towards growth: «Creative people are not lacking something, but rather are not closed within themselves. They are unsatisfied with repeating what they are already» [Cusinato 2023, 18]. The phenomenological psychiatrist Thomas Fuchs uses the Spinozist term *conatus* to make reference to this original presence of motivation in life [e.g., Fuchs 2012, 152].

Teleogenesis is a conative structure of an organism which results from its teleocline being in the world, from its proper way of living and it precedes the formation of goals. To attend to this level of intelligence, research will have to face conceptual constraints, it will have to revise the foundations of its architecture and to accept that certain classes of phenomena transcend the fringes of the means-ends paradigm. However, the philosophical problem also runs deeper than the paradigm of metacognition can address [cf. Coulter, 1975; Locker, 1992; Locker & Coulter, 1976]. It will remain to be an open question whether or not a form of artificial intelligence can be created which is truly autonomous but if so, research in the field will have to consolidate its conceptual underpinnings to account for structures like teleogenesis.

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intelligence; goal reasoning; problem-finding; Bergson

Abstract

To understand human intelligence, problem-solving has frequently been conceptualised as a goal-oriented mental process, in which an agent transforms the 'problem space' to reach a goal-state: A hungry rat tries to obtain food and a chess player tries to win. From the standpoint of functionalism, goal-states like these are understood as image-like or propositional representations which are the subject of motivation. Due to the presupposition of a finalistic or mechanistic explanatory framework, what is rarely investigated is the origin of goal consciousness. From the point of view of such a framework, 'all life is problem solving' (Karl Popper), i.e., goal consciousness derives from a minimal logical discrepancy of two representations which is a universal type of relation. Yet, this reasoning falls short on processes of discovery which require forward search of goals. Human life is not exhausted by means-ends-analyses in a deductively closed field of operations. Differently put, human problem-solving entails *teleogenesis*. In it, human striving emerges, a process that may post hoc be described as teleological. Integrating this primordial constitution of goals into the understanding of problem-solving requires overcoming functionalist, mechanistic, or finalist presuppositions, which is only possible when revisiting the conceptual foundations. Bergson's philosophy of creative evolution offers a critical perspective. According to his organistic standpoint, *teleogenesis* is different from a logical relation between two representations. Under the condition of new foundations, it might be possible to leave the conceptual impasse of problem-solving research in the human sciences, which has lasted for several decades.

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