Thinking like a State

Embodied intelligence in the deep history of our collective mind

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Abstract

This article aims to show how the deep history of early State societies entails the development of a collective form of cognitive agency. It relates classical works in the anthropology of States (in particular Scott's *Seeing like a State*) with the enactive account of biological and cognitive organisation, thanks to the unified ontology for self-organisation dynamics across scales offered by the Active Inference framework.

Active Inference conceives of cognition as synchronisation across individuated sensorimotor states. It entails that biological or sociocultural constraints display a minimal form of cognition by shaping the behaviour of faster dynamics in a certain way. When such constraints collectively define a basic life form (an integrated, operationally closed system), they can therefore be said to embody adaptive knowledge properly speaking.

The (en)Active Inference account I articulate here strongly motivates and methodologically grounds a holist approach in the social sciences. Indeed, it grounds the study of human societies in the role of structural constraints, whose "meaning" depends both on the broader system's activity and in the historical context of their emergence. The present account of the dynamics of early urbanisation and State genesis aims to illustrate this approach.

0 – Introduction

The core argument of this article is that States can be (and should be) understood as hierarchical control systems, essentially similar in their core physical architecture to brains (Badcock et al., 2019; Hipólito, Ramstead, et al., 2021). Such control systems are constituted by a nested ecology of (Markov-blanketed) Active Inference agents, which synchronise with their environment in a way that allows them to maximise the predictibility of their sensorimotor flow, effectively enacting adaptive control (Bruineberg, Kiverstein, et al., 2018; Hipólito, Baltieri, et al., 2021; Ramstead, Kirchhoff, et al., 2020). Importantly, this drive toward optimal grip is related (although somewhat informally) to the maintenance and self-creation of the structural identity of the agent (K. Friston, 2013; M. Kirchhoff et al., 2018; Kiverstein, 2020). It therefore constitutes the grounding of an emerging multi-scale theory of adaptation in biological systems (Hesp et al., 2019; Ramstead et al., 2018, 2019).

In his outstanding books, *Against the Grain* (Scott, 2017) and *Seeing like a State* (Scott, 2020), the social anthropologist James C. Scott has provided important insight both on how States emerge and on how they understand the world. I argue these books collectively provide a solid ground for a naturalist and multi-scale understanding of the nature of States as enactive agents. Indeed, the red line permeating Scott's work is the deep relation between how States maintain their structural identity and how they exert control over their (sociocultural and material) niche. This question can clearly be reframed in terms of embodied intelligence: how is the understanding of reality enacted by States grounded in their material structure? The discussion hereby will revisit the anthropology of States in these terms, by drawing heavily from the enactivist and Active Inference (ActInf) paradigm to understand the dynamics underlying State constitution and cognition.

If this account is correct, then human societies display the same kind of complexity that biological entities display – they are, in fact, biological entities as characterised by the central criterion of operational autonomy (Moreno & Mossio, 2015). This means that all attempts to understand and control societies from the scale of individual agents are just as absurd as the attempt to predict human behaviour from the activity of single neurons. Such a realisation has a deep resonance with the politics of the early Anthropocene, as characterised by the urgency to build a post-carbon society before we lock our planet in an unlivable stable state (Steffen et al., 2018). If the collective intelligence is driven by the cultural niche it embodies rather than individual behaviour, then it is the cultural niche itself we must alter to understand how to build a livable future (Gowdy & Krall, 2013).

The argument will proceed in three parts. First, I will expose the precise nature and commitments of the conceptual background I am recruiting from. Most of this

discussion will bear on the (enactivised) Active Inference paradigm, and how it relates the material structure of organisms to capability for skilled agency – ie, how it conceptualises embodied intelligence. Second, I will draft the dynamics underlying the constitution of urban systems, understood as large scale settlements with high level of economic interdependancy and political hierarchy, in human history. Third and last, I will discuss how (enactivised) ActInf helps us reconceptualise key aspects of this transition, and ground the study of City and States as enactive agents. This discussion will overall demonstrate that an integrated understanding of life, minds and culture is in our reach, and expose its core insights for the social sciences.

1 – Embodied intelligence in nested minds

The purpose of this section is to show how and why the Active Inference framework allows embodied intelligence research to extend beyond the scope of what we would intuitively think of as biological systems – single organisms with defined biochemical boundaries. "Intelligence" refers to the general ability for a system to understand the world, either in a reflexive / propositional way or as enacted in their ecological activity. Therefore, embodied intelligence refers to the ability for understanding / adaptation that is imprinted in an agent's physical structure rather than in some general computational ability. Although this idea has motivated an extremely productive line of research in cognitive robotics (Braitenberg, 1986; Brooks, 1991), the most integrative research program relating mind to body in the life science has emerged from the proposition to understand "living" and "thinking" as two complementary dimensions of a single process of self-creation (*autopoïesis*) (Varela et al., 2016).

Research on autopoïesis has opened the way for a new understanding of mind and life, which was called the enactive approach due to their accent on how cognitive agents "enact" (rather than represent) the world they live in (Di Paolo & Thompson, 2014). Although they conserved the core commitment of studying life and cognition through their common grounding in the self-creative dynamics enacted by an organism, enactivists and associated systems biologists have refined the somewhat esoterical notion of autopoïesis into the much more physically grounded notion of autonomy (Di Paolo, 2008; Di Paolo & Thompson, 2014; Montévil & Mossio, 2015a; Moreno & Mossio, 2015; Thompson, 2010). Autonomy refers to the property of operational closure under precarious circumstances, ie to the capability of biological systems to continuously maintain and recreate their own structural identity as a result of the collective activity of their constitutive process [1].

1 A basic definition of the concept goes as following:

Interestingly, nothing in the concept of autonomy suggests that this structural identity should be imprinted in the specific carbon-based substance which constitutes woodlice and humans. If the network of constraints (understood as a slow physical process orienting the flow of faster processes) constituting a system is able to regenerate and recreate itself under normal metabolic activity, then the system is autonomous (Montévil & Mossio, 2015a) and should be understood as an enactive agent. In principle, this concept could apply to patterns of fluid dynamics (as speculated in Damasio's fantasy novel *La Horde du Contrevent*) or to the material and cultural constraints embedded in human sociality. Yet, enactivists have mainly focused on the sensorimotor grounding of animal life, and their rare incursions into the realm of sociology have lacked the domain-specific knowledge to meaningfully engage with existant litterature on sociocultural organisation beyond interpersonal synchronisation (see eg (Dumas et al., 2014; Froese & Di Paolo, 2011)).

I hereby speculate that, beyond the historical grounding of enactivism in the life sciences, this fact can be explained by its lack of formalisation of the dynamics underlying intelligence. Indeed, while formal criterion for basic life have been devolopped by enactivists and systems biologists since the 2000's (Montévil & Mossio, 2015b; Ruiz-Mirazo & Moreno, 2004), cognition is essentially understood as an activity grounded in adaptive behaviour and sense-making (see Froese & Di Paolo (2011)). In the absence of a more explicit criterion for cognitivity, enactivism relies on intuitive judgements about teleonomy to decide whether a given system "thinks". Such judgements should be expected to heavily favorise human-like entities, and conversely overlook the potential cognitive ability of systems whose structure is not imprinted in flesh. To fully assess the ability of enactivism to integrate the study of social systems, we should therefore introduce a formally integrated model of what "cognition" means.

Such a model has recently emerged from physicalist approaches to the cognitive science, which we will hereby call "Active Inference". Active Inference constitutes a formal ontology assimilating cognition to the process by which an agent minimises its (expected) variational free energy (VFE), an information-theoretical construct constraining the unexpectedness of its future states under ergodic assumption (K. Friston, 2010, 2019). In other words, ActInf agents strive to maximise their grip on their environment by continuously anticipating the sensorimotor flow they experience

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"An autonomous system is defined as a system composed of several processes that actively generate and sustain an identity under precarious circumstances. In this context, to generate an identity is to possess the property of operational closure. This is the property that among the conditions affecting the operation of any constituent process in the system there will always be one or more processes that also belong to the system. And, in addition, every process in the system is a condition for at least one other constituent process, thus forming a network." (Di Paolo, 2008)

(Bruineberg & Rietveld, 2014), mutually constructing their niche and the nature of their expectation regarding said niche (Bruineberg, Rietveld, et al., 2018; Constant et al., 2018). In virtue of this self-evidential dynamic, any system that has individuated sensorimotor states (a Markov Blanket, formally speaking) should be expected to revisit the same core set of expected states, therefore resisting thermodynamic dissipation and enabling their survival and reproduction (Constant, 2021; K. Friston, 2013).

The concept of Active Inference derives from a formal result known as the Free Energy Principle, which states that the synchronisation dynamics between a Markov-blanketed system and its environment entails the minimisation of VFE (Da Costa et al., 2021). Since VFE is a classical measure of Bayesian model fitness, this enables an epistemic / semantical interpetation of self-organisation in cognitive systems (Constant et al., 2021; Ramstead, Friston, et al., 2020). The attraction of the agent-niche system toward its most probable regions can therefore be interpreted as "self-evidencing" (Hohwy, 2016), in the sense that it constitutes an epistemical activity by which the agent proves that their world is indeed what they expect it to be. Because this synchronisation drive the agent's activity and structure to incorporate statistical features of their niche through behavioural and evolutionary time, they come to embody models of the world they enact (Ramstead, Friston, et al., 2020; Ramstead, Kirchhoff, et al., 2020; Ramstead, Hesp, Tschantz, et al., 2021).

The relation between Active Inference and the enactive approach remains controversed, mainly because it is grounded in predictive processing and similar neurocentric approaches - as was widely noted in the discussions between enactivists and ActInf theorists (see eg Di Paolo et al. (2021); Hohwy (2016)). The notion of prediction appears to suggest that an ActInf agent would mentally represent the outside world, and to think in a way that is detached from its body (Hohwy, 2016). However, there are deep differences between the predictive motors of an ActInf mind and the kind of semantically ladden, purpose-neutral representations hypothesized by historical cognitivists. Indeed, an ActInf agent functions by adaptively anticipating future course of action and enacting them (Bruineberg, Kiverstein, et al., 2018; Hipólito, Baltieri, et al., 2021), which recruit their own body and material niche as core drivers of the very way they understand reality (Clark, 2013, 2017; Nave et al., 2020).

While this conceptual similarity between Active Inference and the enactive approach was widely noted, the deep complementarity between their respective formalisms remains a somewhat underground topic. Formal models grounding enactive autonomy are purely syntactical (ie they're interested in the structural properties of the system *per se*, see eg Aguilera & Bedia (2018); Montévil & Mossio (2015b)), while the formalism of Active Inference shows how semantical content (ie meaning) can arise from basic synchronisation between an organism and their niche (Ramstead, Friston, et al., 2020; Ramstead, Hesp, Tschantz, et al., 2021). This simple feature provides a clear grip on how

agents can come to embody knowledge about their ecological niche, and leverage this knowledge by enacting a meaningfully integrated reality. In other words, Active Inference both grounds the enactive concept of meaning and explains its emergence by showing how basic life can integrate a structural identity, which they can consequently maintain and recreate under precarious conditions (M. Kirchhoff et al., 2018; M. D. Kirchhoff & Froese, 2017; Kiverstein, 2020).

Importantly, the dynamical landscape in which Active Inference occurs is emphatically not a statespace in the usual physical sense, ie a complete representation of all variable relevant to the system's evolution[2]. The dynamical flow defining Active Inference indeed stems from the agent's Markov blanket (Da Costa et al., 2021), and therefore corresponds to statistical properties of its eco-cognitive niche - physical reality as perceived by the agent (Ramstead, Hesp, Tschantz, et al., 2021). This level of descripton is not causally closed, as events outside the scope of the statespace description (eg a novel mutation, cultural recombination, or temporary exposure to a new niche) can affect the actively inferred dynamical landscape by creating novel affordances. Conversely, biological agents may turn their subjective expectations into a physical reality by enforcing expectations entailed by their structural identity into their material niche (Constant et al., 2018) - a process known by evolutionary scientists as niche construction (Laland et al., 2016).

Therefore, even though Active Inference is a formally conservative framework conceiving of agency as a perpetual return toward a characteristic non-equilibrium steady state (Da Costa et al., 2021), it can ground our understanding of the self-creative processes central to the enactive approach (Di Paolo et al., 2021). Indeed, a basic mind is operationaly conceptualised as a structurally stable hierarchy of Markov Blankets (M. Kirchhoff et al., 2018), where the non-ergodic (although conservative) dynamics at any scale can alter the dynamical landscape both upstream and downstream. This process is a possible explanation for the phenomenology of creative evolution, where multiscale fluctuations enable the endogenous creation (or unfolding) of the physical symmetries defining biological systems (Longo & Montévil, 2013). Active Inference therefore draws the picture of the biosphere as a nested ecology of basic minds working continuously to enact the world entailed by their structural identity (Hesp et al., 2019; Ramstead et al., 2019), and thereby integrating meaning into the physical fabric of reality.

As stated previously, the network of constraints defining the structural identity of basic life needs not be printed in flesh, it only needs to influence faster processes so as to

2 "A phase space is the space of the pertinent observables and parameters in which the theoretical determination of the system takes place. As a result, to one point of the phase space corresponds a complete determination of the intended object and properties that are relevant for the analysis." (Longo & Montévil, 2013)

continuously recreate itself (Montévil & Mossio, 2015b). Such constraints can be embedded in the informationally rich sociocultural niche which enable the human ecology by affording adaptive coordination and the development of complex skills (Boyd et al., 2011b; P. J. Richerson & Boyd, 2020). For exemple, expectations can be imprinted as well as retrieved into this niche through immersive participation of individual humans in culturally patterned activites, a process formalised in Active Inference under the name of "thinking through other minds" (Veissière et al., 2020). This echoes existing lines of research about the collective nature of cognition, and the way humans societies enact through their sociocultural activity something akin to a "collective brain" (Falandays & Smaldino, 2021; Muthukrishna & Henrich, 2017).

However, the possibility that collective cognition enacts anything beyond the activity of individual humans has never been seriously investigated, including from an Active Inference perspective. If there is such a thing as a collective brain, we do not know how it is implemented, we do not know what kind of niche it entails, and we certainly do not know what sort of biological individuality it is embeded into. We will now leverage the broad framework we articulated above, which grounds the study of intelligence in the way an organism maintains their structural autonomy, to formally assess the collective brain hypothesis. More specifically, we will discuss how the coevolution of top-down control and cultural niche construction in the deep history of the human species enabled the emergence of the City-State complex, how such collective organisations work to maintain their structural autonomy and what is the kind of world they enact.

2 – The deep history of cities and States

The human species is currently dominated by a very specific ecology of dense urban settlement dominated by anonymous (often market-based or otherwise institutionaly mediated) interactions, and centrally controlled by hierarchical administrative structures known as "States". This situation is extremely recent, as it can broadly be traced to the global takeover of Western states circa 1800 and the ongoing rise of the capitalist economy. Although we lack archeological evidence to conclude on the precise timing of the emergence of Statedom (Singh & Glowacki, 2021), we do not have clear trace of their very existence before the early Holocene – approximately when climate warming enabled the rise of large-scale agriculture (P. J. Richerson et al., 2001). We will hereby articulate a broad picture of how and why urban systems and hierarchical administrations came to emerge and dominate the human species, ie draft a deep history of cities and States[3].

3 The term of *deep history* typically refers to the history of the distant past of the human specie, or in other word to history before history – as the discipline of history is classically

As a preliminary remark, I should mention that the goal of this discussion is specifically not to explain the full history of how our societies came to be. Such a task would be impossible given the complexity and ambiguity of the historical and archeological evidence. In addition, there is no reason to believe that a more complex, nuanced discussion would result in a better understanding of the target phenomenon (Healy, 2017). The goal of this discussion is to expose what kind of dynamics were necessary and sufficient to get us where we're at, and to highlight key operational concepts that will serve as a basis to articulate an enactivised understanding of human societies. It will heavily draw from from Scott's work on the influence of States on historical patterns of cultural niche construction (Scott, 2017, 2020), as mentioned in introduction, and will also call onto an earlier, richer synthesis of the relevant literature in cultural evolution & historical anthropology (Guénin--Carlut, 2020).

The core dynamic resulting in the evolution of cities can be accounted for with no references to agriculture, States, or even to cities themselves. Indeed, denser settlements allow for both more economic codependency, and the development of nested social communities (enabling the evolution of complex cultural traits (Migliano et al., 2020; Romano et al., 2020)). Consequently, denser settlements enable the development of deeper economic/functional specialisation, which consequently allow these settlements to develop an efficient export-oriented industry and capture central positions in long distance trade and migration flows (Thomas, 2012) – priming autocatalytic growth in both size and power. The growth of cities was however constrained by the agricultural capability of the backland they relied on for food production. As grain can be stored much longer and transported affordably over much longer distances than other staple crops (Scott, 2017), the development of cereal monoculture essentially lifted this constraint for the early cities of the Fertile Crescent, Indus Valley and Yellow river basin.

Scott's *Against the Grain* (Scott, 2017) discusses in much more depth how agriculture interacted with the emergence of early States. His central remark is that while cereal cultivation allows for an unparallel productivity per unit of land, it shows poor performance in productivity per hour of human labour relative to earlier forms of horticulture (see also (Bowles, 2011)). Cereal farmers were additionally locked into their dense settlement due to the extreme labour intensity of field work, which (compounded by their reliance on a main crop for subsistance) exposed them to extreme material insecurity through epidemics and famine driven by crop failure. Most importantly, sedentarity of farmers, predictibility of crop harvest, and transportability/storability of

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understood to refer to the study of events posterior to the invention of writing. It is here used as a shorter, more intuitive term for what is typically referred to as *histoire de temps long*, ie the study of deep structural determinants of human history typically acting at very long time scales. The term of *cliodynamics* could also be used, although it suggests a stronger accent on dynamical systems methodology.

grain made cereal monoculture an ideal target for captation by armed outsiders. All these properties made farming an extremely fragile niche for a tribal society to adopt, which certainly explains why non-urban societies typically prefer to rely on hunting or mixed horticulture.

However, those very same properties also explain why agriculture would later succeed and even become the globally dominant mode of food production. First of all, the sedentarity of farmers indeed make them vulnerable to famine and illness, but it also allows much faster reproductive growth than nomads could afford. Second, the viability of agriculture effectively depends on social institutions which could reward long term investment on resources that would be easy to appropriate. This entails the development of efficient communal organisation for niche construction (or at the very least for defense against outsiders), which grain farming could piggy back on over the course of human history. Third, urban centers critically depended on cereal imports to survive, and had ample opportunity to support the development of agriculture by trade and - most importantly - by coercion. Scott indeed documents that early States would routinely coerce population into providing agricultural labor, either through taxation, corvée, deportation, or slavery.

The capability of those States to enforce anything relied on an intricate array of material, economic, normative, and symbolic means. The concentration of resources and population, and economic codependancy characteristic of urban systems indeed affords a lot of ways for aspirant elites (be they rich merchants, appointed officials, or a warrior caste) to build grip over society. They could leverage communal institutions and control over the inflow and distribution of grain to organise rituals legitimising their rule, build monuments to their own glory, and generally alter the urban landscape in any way they see fit. However, these very same features meant that a general strike or insurrection could bring the regime down in a matter of days if it tried to enforce unpopular decisions or appeared to lose control. A key prerequisite to enforcing State control over urban systems is consequently to build acceptation in their population through perceived competency, wealth redistribution, or symbolic legitimacy.

It is therefore entirely unsurprising that the earliest documented form of dominant institutions in the history of cities, the Levant temples, have seemingly emerged around a dual economic and religious mandate. The historical role of Levant temples in helping organise agriculture (Thomas, 2012), as well as the contemporary analogue of Balinese water temples (Lansing, 1987), suggests more specifically that those institutions may have emerged as a tool for building a socio-ecological niche adapted to agriculture. Communal redistribution of the crop, added to the inscription of social norms in a collective identity and sacred values built through religious ritual (Atran & Norenzayan, 2004; Purzycki & Sosis, 2013; Sterelny, 2020), indeed grounds the kind of efficient large-scale coordination necessary for landscaping cereal fields. Temples are

therefore well equipped to catalyse the growth of human settlements into urban centers, help coordinate their more complex organisation, and to assume *de facto* rule over their population without any form of coercion.

However, those same institutions that helped organise collective action could also serve to institute coercive rule and labour extraction, and so they did. Indeed, temples were pivotal in legitimising the secular rule of the warrior caste, although they tended to regain domination in periods of peace (Thomas, 2012). Most importantly, they have introduced a form of debt decoupled from interpersonal relations: lending with interest (Graeber, 2011). Lenders could extract labour from borrowers through high interest rates and debt slavery, and become immensely powerful due to the multiplicative effect of lending. More importantly, the control they collectively exerted over monetary flow / creation canalysed economic development toward activities which could ensure a sufficient return on investment to meet interest rates. This mechanism catalyses the emergence of institutions priorising wealth extraction over human well-being or sustainability, and (when financial elites successfully infiltrate the State) drives the development of European-style imperialism.

Debt provides a key exemple of how extractive institutions can develop in relatively democratic societies such as early Levant City-States. As settlements grow beyond the size where each resident roughly knows each other, their stability come to depend on coordination at greater scale than is practical by the means of face-to-face interactions only. This offers an opportunity for the evolution of mediating institutions capable to generate adaptive decision-making from aggregate anonymous interactions. Therefore, the very process of urbanisation entails the shaping of the urban niche - be it the material infrastructure of cities, or the social norms they enforce – by supra-human agency. Such agency can exert tyrannical rule over population as Scott suggests early States did, or can result from recognisably democratic institutions (Graeber & Wengrow, 2021). In any case, its constitutive mechanisms (or what we could call the logic of their activity) start shaping urban development and other political decisions, feeding back onto every level of human activity.

However, there is no prior warranty that those mechanisms allow an accurate perception of the consequences of their own activity on human life, or on society at large. Effectively integrating information beyond the scale afforded by interpersonal relations entails the development of new forms of communications, which implies new constraints on what information can effectively be transmitted. The necessity of perceiving and enacting decisions at scale has repeatedly driven the development of writing (or close analogues such as quipus) in urban systems, and of the administrative, accounting, and legal technologies it afforded (Goody, 1986). But any information that does$ not fit into their forms is essentially useless to any instutions that work on the basis of adminstrative systems. The same technologies that enabled Levant temples to

keep track of debts and manage economic activites did not allow them to see concrete living conditions in the backcountry, and understand how the threat of bankrupty could drive the erosion of living standards, political stability, and soil productivity.

Consequently, States have historically devoted huge amounts of energy to attempt to build a social and material environment they could manage. This process of course includes landscaping for cereal agriculture, and the construction of material infrastructure (such as roads and aqueducts) underlying urban metabolism. But most importantly, it includes attempts to engineer human societies itself from the top down, as documented in Scott's *Seeing like a State* (Scott, 2020). Indeed, States have routinely attacked communal institutions so as to atomise society and/or bring it under the control of State-sponsored institutions. The Bolshevik imposition of collective farming, as well as the process of enclosure that created the worker class fueling early English capitalism, provide two examples of how the law effectively imposed direct control of the elite over farmers. However, this process could also retroactively shape the material landscape of the urban system itself by physically preventing any social life outside work and family, or displaying State power through monumental architecture.

This discussion did not highlight a typical trajectory for the development of urban systems, because we have no reason to believe there exists one. It did however gave a coherent (although complex) picture of what drove the development of cities and States in human history, and what kind of transformations accompanied this process. We saw how cultural niche construction allowed humans to alter their socio-cognitive ecology, in a way that allowed extensive functional specialisation and the evolution of supra-individual agency through mediating institutions. We saw how specific technologies, mainly cereal agriculture and writing, allowed States to build their niche by enabling the development and control of urban systems. We will now turn back to the (enactivised) Active Inference paradigm we articulated in the first part of this paper, and try to understand whether human societies actually are enactive systems, and how exactly they understand their world.

3 – From the urban metabolism to the collective mind

In this part, we'll finally turn to the fundamental question of this article: what kind of intelligence is displayed by City-State systems, and how is it embodied within their structure? Answering this question in terms of (en)active inference entails revisiting our account of the urbanisation dynamics as the results of City-States systems actively managing to get a grip on their world - ie minimise their (expected) Variational Free Energy. As the collective mind is effectively constituted of whatever process modulates the activity of human sociocultural organisation so as to sustain its integrity,

developping a principled understanding of its purpose, mechanisms and material grounding entails the study of how City-State systems actively produce their own structural identity under precarious conditions. We will therefore turn to the basic metabolic activity of urban systems and work our way up the nested hierarchy of adaptive constraints to finally explain what it means exactly to be *thinking like a State*.

As we saw earlier, the process of urbanisation follows the polarisation of human activites around specific settlements which manage to grab a central position in the flows of products, cultural traits and political power. This core dynamic is what simultaneously enables the developpement of mediating institutions, and the wide cooptation of whichever forms of organisation manage to control those flows efficiently. These flows of informations and ressources, collectively underlying the activity and maintenance of urban organisation, are strongly reminiscent of metabolic activity in carbon-based life. Basic autonomy is indeed formally defined as operational closure, or more precisely the capability of a network of constraints to canalise faster processes (ie metabolic flows) into maintaining and (re)creating itself (Montévil & Mossio, 2015a; Mossio & Moreno, 2010). Since the material and sociocultural landscape of urban systems canalises human activities so as to maintain itself, the process of urbanisation clearly entails the constitution of cities as basic life.

In fact, the deep history of urban systems display much stronger signs of the emergence of cities as biological individuals. The emergence of new forms of individuality, commonly studied in evolutionary transition theory (Szathmáry, 2015), occurs when a group of biological individuals cooperate so closely that they progressively become dependant on each other. The collective progressively becomes an adaptive unit, where each individual fullfils a specific function as imposed by emerging regulation mechanisms enacting supra-individual agency within the collective organisation (Stewart, 2020). A full fledged evolutionary transition typically entails the emergence of new forms of information systems mediating regulation at the collective level and/or the heritability of collective traits (Jablonka & Lamb, 2006). The emergence of City-States, with their professional classes and their mediating institutions based on writing technologies, constitute a clear case of such a transition – especially in the case of the late agricultural civilisations (Gowdy & Krall, 2014).

To be fair, the entire history of the human species is best characterised as a continuous process of evolutionary transition. The human ecology is indeed chararacterised, from their early evolutionary history, by eusocial cooperation, reliance on social learning, and language. All these capabilities have probably emerged from a system of collective regulation through embodied coordination, evolved so as to extend our cooperative abilities beyond what is possible (Dunbar, 1998; Shilton et al., 2020). They rapidly allowed the emergence of an inheritance system orthogonal to genes, capable of evolving adaptive knowledge (Boyd et al., 2011b) and group-level norms (Boyd et al.,

2011a), with drastic feedback on the ecology of human individuals (P. J. Richerson & Boyd, 2020). This process enabled an explosive scaling of human cooperation (Boyd et al., 2011a; Chudek & Henrich, 2011), and most importantly the emergence of group-level organisational traits selected at the scale of human collectives (P. Richerson et al., 2016; Smaldino, 2014).

In this sense, urbanisation only constitutes a prolongation of preexistant human tendancies, which agriculture-driven scaling was accidentally enabled by the Pleistocene-Holocene climate change (P. J. Richerson, 2001). This quantitative change in scale however entailed a qualitative change regarding the status of human agency. Cultural evolution in humans typically entails inter-individual synchronisation through active inference in the collective sociocultural niche (Veissière et al., 2020). This allows the definition of the "collective brain" (ie collectively enacted cognitive activities) as the emerging structure of individual-level innovation and diffusion patterns of socially acquired cognitive traits such as language, crafting skills, or even social norms (Muthukrishna & Henrich, 2017). However, the material constraints embedded in urban systems canalyse human activities at a structural scale, and direct collectively enacted decisions so as to maintain and (re)create their own collective structure - for exemple by weighting for a road network fitted to a city's interests (Fulminante et al., 2014, 2017).

It is worth noting here that each structural constraints developped throughout human history effectively act as an ActInf agent. Indeed, constraints are causally effective in virtue of shaping faster processes (Montévil & Mossio, 2015b), and therefore enforcing specific expectations over the activity of system components. Additionally, they are "structural" in the sense that the expectations they enact happen to directly map onto the system structure, by helping produce its constitutive constraints. The system's architecture itself is therefore constituted of "nested minds", although in a somewhat figurative sense since simple ActInf agency does not entail cognitive abilities (M. Kirchhoff et al., 2018). However, if the nested hierarchy of regulation systems enables adaptive behaviour at the system's scale, it effectively enacts a collective mind – regardless of whether system components retain their cognitive ability (Sims, 2020). In other words, the process of evolutionary transition entails the constitution of a collective mind embodied in the concrete mechanisms of its adaptive regulation.

The closest analogue of our intuitive picture of a mind in urban systems is their most disembodied mechanism for adaptive regulation: administration. Indeed, just like neuronal cognition, it entails the top-down regulation by a specialised population with the help of a specific-purpose information system. Most importantly, Scott's work has shown that administrative systems restrict their interests to specific observables which are informative for their specific purposes (generally resource extraction, taxation, or drafting) while being tractable by their cognitive means (ie standardised written

documents) (Scott, 2020). In other words, they distinctively implement a form of predictive processing, an cognitive architecture which corresponds most directly to the mechanical implementation of the abstract principle of active inference (K. Friston et al., 2016). As predictive cognition is an intrisically embodied and contextual activity (Hipólito, Baltieri, et al., 2021; Nave et al., 2020), the question of embodied intelligence in urban systems reduces to the documentation of how constitutive traits prolong or support the activity of administrative systems.

The deep history of urban systems we articulated above incidentally provides us with numerous instances of administrative systems externalising their expectations, which directly corresponds to the core theme of Scott's *Seeing like a State* (Scott, 2020). An obvious example is of course the way cities and States have worked to impose an ecological niche they knew how to exploit, both in the deep history of cereal agriculture in Neolithic societies and in modern attempts to manage forest at the advantage of military industry. But more importantly, cities themselves have been shaped to enforce State-sponsored social organisation. Scott provides the extreme exemple of Brazilia's urbanism, explicitly meant to segregate family, leisure, and work, and therefore promote productivity for dominant institutions at the expense of serendipity. The same logic operates far back in time with the role of monumental architecture in the legitimation of power and the promotion of dominant norms.

Importantly, the externalisation of admistrative expectations does not limit to the alteration of the material niche by States. Indeed, the institution of State-sponsored legal codes affords a way to directly transcribe administrative expectations into individual minds. Because it consists of a publically available set of social norms expected to apply to all, and to regulate decisions of the State itself, the law modulates behaviour at a slower time scale (and independantly from) any individual executive or judicial decision (van Rooij, 2020). Consequently, it affords top-down social engineering by the State [4] through the enforcement of novel sociocultural constraints *ex nihilo*. Most importantly, those constraints define the affordances the State has in its interaction with the wider society – such as taxation, drafting, or economic management. Rule of law is therefore a core tool by which States create their world through building the basis of their own intelligent behaviour into their sociocultural niche.

This discussion should have established that the normal cognitive activity of States is prolonged in the structure of the landscapes and sociocultural constraints they interact with. However, talking of landscapes or sociocultural constraints as bearers of

4 This best describes civil law systems, where State legislative institutions have the monopoly over the definition of the law, and judges are only allowed to define it. In contrast, common law systems recognise a legally binding role to judicial precedents, therefore allowing individual judges to make law. As judges remain State officials, I don't consider this distinction to be critical here.

“embodied intelligence” implicitly entails that they are not passive recipients of an external cognitive agent’s expectations, but constituant part of its organism. It is worth noting here that our notion of intelligence is based on Active Inference, a scale-free framework applying to any system with individuated boundary states. That States define implicit expectations through their activities and offload them onto their environment is therefore insufficient to make them the proper locus of urban system’s cognitive activity. As urban systems build structural constraints into their world (like an agricultural landscape or a civil code) and become dependant on their maintenance, they integrate those constraints themselves into the boundaries of its operationally closed socio-ecologic structure, and their life goes on.

We can finally turn back to our central question, what it means to think like a State. By our account, the cognitive activity of States is defined mechanically by the standardised administrative systems they use to understand and manipulate their world, and functionally by their drive to build and enact grip over their material and sociocultural niche. As it ultimately relies on a form of predictive processing, their phenomonology must consist of a “controlled hallucination” made of the expectations they build in the course of their ecological activity (Ramstead, Hesp, Sandved-Smith, et al., 2021). This activity is of course determined by their administrative mind, but it is also deeply coloured and oriented by the broader cognitive and metabolic activity of the broader self-producing structure of the urban societies they emerge from. Therefore, a naturalistic account of a State’s mental activity cannot circumvent a motivated analysis of the structural identity it participates to enact.

We have now exposed how the historical development of urban systems can be described as a process of (en)active inference, and how this process affords the integration of adaptive knowledge in their material and sociocultural structure. This discussion should establish that the collective mind does not directly emerge from interindividual interactions, but from slower evolving dynamical constraints which supervene on (but do not reduce to) human activity. Therefore, the proper scale of analysis of collective cognition is the integrated activity of entire urban systems, and should more specifically be grounded in the broader processes by which they maintain and (re)produce their structural identity – understood as an operationally closed set of constraints underlying their metabolic, cognitive and ecological activity. This perspective enables a unified understanding of the historical emergence of urban societies, where the progressive evolution of a basic form of life entailed the development of increasingly complex forms of regulation.

4 – Conclusion

We have hereby articulated an account of embodied intelligence as adaptive knowledge integrated into an organism's structure, and explained how this account could apply to human societies. By recruiting a formal notion of inference as synchronisation across a Markov Blanket, therefore applying to any scale that displays individuated boundary states, we were able to motivate a unified understanding of the nested scales of sociocultural evolution as a single process of active inference. Accordingly, we exposed how urban systems infer adaptive knowledge through behavioural, developmental and evolutionary time, and integrate this knowledge into their material and sociocultural structure so as to effectively constrain their activity to metabolically and ecologically viable domains. Our (en)active inference account relates in a principled manner the subjective understanding of their world States enact to the historical development of the objective structure that enables their activity, by showing how both processes participate in the maintenance and (re)production of the structural identity of urban systems.

This discussion is meant to introduce and illustrate a proposal to articulate active inference and the enactive approach in a single framework drawing from their conceptual and formal synergy. Both understand cognition as a fundamentally multiscale and relational process, permeating all forms of biological organisation. While the enactive approach grounds its study of cognition in the way an organism enacts its structural identity, Active Inference formalises the relation between the structural architecture of a cognitive system (ie what constraints define it) (Hesp et al., 2019) and its functional architecture (ie what world it enacts) (K. J. Friston et al., 2017). This feature allows us to understand extended intelligence as the externalisation of an ActInf agent's expectations as constraints in its environment. As this ActInf agent can consequently integrate these external constraints in its structural identity, or even be a mind acting upon its own body (rather than an individuated organism), this also provides us with an explanatory mechanism for the emergence of embodied intelligence.

The ability of (en)ActInf agents to constantly redefine their boundaries and recreate their structure makes it difficult to identify the proper scale of analysis for the study of human societies. Indeed, we have showed that they display an autonomous structure, which could either be understood in enactive terms as an operationaly closed set of constitutive constraints, or in ActInf terms as an implicit world model they embody and adaptively work to evidence through their activity. Both entail a multiscale approach encompassing the whole autopoietic structure rather than a single arbitrarily chosen trait (such as cereal agriculture) or scale (such as the activity of individual humans). Importantly, nothing entails that a single structural identity could account for the activity of any human society, as symbiotic multiscale integration (eg between cities and States, or individuals and organisations) remains a distinct possibility. This

provides a critical argument for the necessity of importing in the social sciences the integrative multiscale approach characteristic of the life sciences.

In particular, I argue that it is critical to adopt what is traditionally understood as a holistic approach by replacing the study of structural traits in the context of the broader system's activity and of its historical emergence, as is standard in the evolutionary science (Bateson & Laland, 2013). While I have focused my argument on early urbanisation dynamics, when the most determinant features of later urban societies arguably emerged, a lot of structural traits have since disappeared from or emerged in human societies. In particular, the modern period has been the pivotal moment when European institutions of early capitalism and State control emerged, and consequently took over the world. The study of its dynamics should provide key insights into the prospective of our socio-political trajectories in the early Anthropocene era. The (en)active inference framework I have hereby introduced, motivated, and illustrated could facilitate such an integrative historical demarch by providing a core formal ontology for describing in a unified manner the metabolic, behavioural, developmental, and evolutionary timescales of the system's dynamics.

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