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Article

A New Form of Time Hegemony: Some Thoughts about AI Advancement in the Varieties of Capitalism

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Abstract: The paper discusses the temporality of artificial intelligence (AI) and its hegemonic position in the evolution of capitalism. Based on the theory of varieties of capitalism, I consider forming a coupling nexus as the temporal purpose of AI advancement in developed economies. Furthermore, by complexifying the nexus, I show the possibility of settling the unsettled purposes in developing economies.

Keywords: temporality; AI synthesis; comparative study

1. Introduction

In pre-capitalism, temporal signs presented by the celestial objects or terrestrial phenomena were intimately related to the economic activities of production, distribution, or consumption. Religious and governing figures often acted as a medium through whom advice or prophecy was sought for those temporal signs. One of the landmarks of capitalism is the institutionalisation of time for capital accumulation. Clocks and calendars informed the temporal signs, and the medium of supervising the timing practices became various market institutions set by firms, industries, or states. Institutions rationalised the timing practices as an intellectual act of capital, differentiating the values of the activities by orders to pursue efficient productivity in time, a temporal form of rationality.[1] Ellul (1964) wrote, "technique is the totality of methods rationally arrived at and having absolute efficiency (for a given stage of development) in every field of human activity." The essence of technical efficiency is to compel the qualitative to become quantitative, and in this way to force every stage of human activities and human beings themselves to submit to the numerical calculations based on time.

Time is realised by and through social practices, time systems, and the architecture of temporal relations. The relationship between conceptions and practices of time, more broadly the relationship between ideas and working contexts, varies from one society or historical period to another, see, e.g., Goff (1982); Braudel (1992). Time is always socially mediated in human experience, encompasses a multiplicity of economic phenomena, and constitutes various political spheres. The timing practices in capitalism, the realisations of different economic activities, came to be regarded as possessing a hierarchy.

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[1] Rationality in the temporal form is considered as such because of the assumptions that time is scarce and that the institutions advocating efficiency maximises the utility when making a rational choice between available options with respect to time. However, the temporal form of rationality is violated once the concern of efficiency does not stand for the primary interest. For example, a person may prefer to walk even if the route has been covered by a faster transportation means. The time-consuming mode, in this case, provides better utility to the person for whom well-being is the primary concern.

Like money, time expresses the relationship that exists between economic goods or services, and itself remains stable with reference to the changes in relationships. Hierachising the temporal relationships in capitalism expresses and reproduces economic relationships. *Temporality* is a signifier for the time-related understanding of a class of relationships. In capitalism, the hegemonic position in the hierarchy of various temporalities is the temporality that exposes the utmost efficacy in economic relationships, a class of rational temporal relationships that reflect the homologous economic activities demanding the minimum operation time. The hegemonic temporality endows the acceleration of modernisation and globalisation in society (Rosa and Scheuerman, 2009).

The time hegemony attempts to ally new techniques with capitalistic rationality. Any technical evolution based on the temporal form of rationality selects from the various techniques at its disposal with a view to securing the ones that are the most efficient, the best adapted to the desired end. Thus, the multiplicity of techniques tends to submit to one: the most efficient. And here, the time hegemony appears clearly in the guise of technical efficiency and rationality. This alliance, as a return, can reinforce some collective, institutionalised entities for which efficiency is of primary interest, manifesting a new possibility of time hegemony in capitalism.

A new form of time hegemony will be a collective realisation of numerous tendencies in technological advancement. It will reconfigure social relations, set limits, and exert pressure on the human individual and collective agencies. Since AIs can provide efficient operations in multiple critical tasks, it seems natural that the advancement of AIs will embody a new form of time hegemony.

Although any new technological development must react to the economic milieu and tend to shape it, AIs, unlike traditional techniques that are fully controlled by human beings, are not "deterministic." It means that the reaction of AI advancement to the economic milieu will be intricate. The impacts of AIs, like those from the existing technology establishment, seem to be able to compress the temporal structures of various economic relationships. Unlike the deterministic mechanical products mainly used in substituting physical labouring activities, AI products are probabilistic, anthropomorphic, and have the potentials to be included in decision-making processes. The intelligent outputs of AIs, in this case, are more critical to human beings while likely containing uncertainty and risk. The institutions and economies supporting AI advancement need a more complex framework for planning the corresponding evolution.

Such complexity in the evolutionary path violates the usual monotonous tendency of compressing the temporal structure, the efficiency of rationally volarising AI's temporalities. If efficiency does not rationally imply better qualitative change, then the time compression or the acceleration of social practices will not be a collective rational choice. Imagine that an evolutionary path appears to us as an absolute force that incompletely fulfills our wills, and appears as multiple universalities converging on likely contradictory outcomes between the needs of the masses and the needs of capitalist industry. It will be irrational to solely speed up the movements over this evolutionary path paved with treacherous variations ahead.

The monotonicity in the temporal structure is not enough for rationally considering AI advancement. AI advancement does not merely stand ready to do the bidding of any random doctrine or ideology. It tends to examine the possibilities of more extensive and less rigid experimentation. Thus, the evolutionary path of AIs can behave rather with its own specific weight and direction, possessing its own "purpose" that urges it into several possible orientations, some of which may be contrary to human wishes.

The intervention of AI operations with the rational concerns of temporalities may have important consequences. The temporality of a new technology would be better conceived of as a socially mediated relation between humans and their perceived, parallel economies with such a technology. This mediation will be shaped by the social, economic, political institutions, and will shape them in return. The advancement in AIs depends on the "collective dreams" of society. These collective desires prepare for the forthcoming

techniques: an "intelligence" among machines. Thus, we can expect that the new time hegemony will be dedicated not only to the fabrication of material goods but also to the satisfaction of imaginary needs from the "collective dreams" of society.

To realise the collective imagination, people will have to trade time efficiency against pragmatic operations. The temporal form of rationality can be presented in a dualistic structure. In this paper, the dual structure will be derived from the prototype used in the theory of varieties of capitalism (Hall and Soskice, 2001; Hanchke et al., 2007). The theory provides a dualistic structure to study the comparative institutional advantages in developed economies. For AI advancement in capitalism, the dualistic structure can evolve into two different institutional spheres, supporting two reciprocal purposes: acceleration and deceleration. Moreover, the two purposes can forge a coupling nexus with mutual complements and reinforcements.[2] The nexus allows for adaptable or even controllable valorisation of an AI's temporality and renders stable evolutionary paths for the associated economies.

For a single temporality with two opposite tendencies, the coupling nexus provides the only option for governing its temporal relationship. The nexus can consider the polytopic character of AI's temporality, promoting reliable AI-based innovations in governance, legislation, strategy, management policy, etc. The hegemonic position of this nexus should be confirmed if its ubiquitous influence determines the other AI's temporalities.

Complex mutation in the evolutionary path of AIs will be likened to "noise" disrupting the advancement, provoking a "stir" in the constitution of the new purposes. By placing the dual-core at the principal optimal position, I complexify the nexus to allow new purposes or "noises" to emerge within the peripheralised temporalities, provided that AI advancement singularises the sub-optima for the developing economies. Some of the "noises" may bring threats instead of benefits to the evolution of AIs. In the paper, the state role of generating "noises" will be discussed.

The complexification also offers a perspective of viewing the coupling nexus in terms of the spatial integration-disintegration struggle in the global AI advancement. The complex global AI network can constitute a kind of "matrix" that orients and governs the functions of connected economies and interdependent political spheres. In this way, the global economy could be cyberneticised. The key element of this cybernetic explanation is a self-organising order of multidisciplinary actors, a very intimate mixture of order and disorder. The "ordering" tendency statically reigns at the bistable level, and the "disordering" tendency improvisationally reigns at the level of elementary units. This mixture is beneficial to the growth of coordinated phenomena, particularly those contributing to the global advancement of AIs.

2. Temporality, Intelligence, and Institutions

2.1. Temporality in Capitalism

Temporality provides a deep ontological confluence of social entities. Through time, the evolutionary processes of these entities, their observable input-output relations, and particularly the recognisable underlying structures unfold.

As for capitalism, the social labouring temporality, delineating the length of labouring input, occurred historically in parallel to the emergence of the modern labour market, where workers sold their labouring time as a commodity. The wage contract is an agreement in a temporal arrangement and context made between a supplier and a buyer of the

[2] Here, "coupling" is to emphasise the necessity of having one over the other.

labour input. The usage of the length of labouring hours to measure the homogenous labouring inputs was becoming a representative institution in capitalism since it forged a dominant relation in the labour market, wage, and labour (Martineau, 2015).[3]

Time, in particular clock time, therefore, was becoming a symbol of capitalism's social institution, through which the modernisation process was able to put constraints on an individual's life pattern and afterward synthesised different individual habitual actions into certain qualities of being.

Rationality is one of the most representative qualities in the capitalistic market. As Weber (1992) wrote,

> "It might thus seem that the development of the spirit of capitalism is best understood as part of the development of rationalism as a whole, and could be deduced from the fundamental position of rationalism on the basic problems of life."

Rational utilisation of capital means that firms or economic institutions have the adaptation of workers and devices to meet some standard criteria, such as maximising profits, minimising costs or efficient management, etc. Optimisation (maximisation or minimisation) or efficiency explicitly requires things to be numerically measurable because the profits, costs, wastes, and productivity all need to be recorded in numbers. The clock time is also represented by numerical symbols. Correspondingly, time plays a natural role as a synethsiser to represent all the different forms of rational actions. Workers are expected to have sufficient skills to finish the qualified pieces of work in shorter periods; firms are expected to apply necessary instruments to shorten the production time; managers adopt Franklin's famous claim that "time is money." A hierarchy of temporalities has fused into the spirit of capitalism.

Rationality in the temporal form can be understood as the pursuit of achieving the goal in the shortest time period because people's time is scarce, and one would like to maximise one's utility. An image of time hegemony can be considered as the spreading of the consciousness of rationality by homogenising the individual's recognisation, cognition, or perception of the utilisation of time. Through the wage-labour relation, capital is able to homogenise various social temporalities; then, through the market, capital can valorise these temporalities, and finally absorb these concrete temporalities into the abstract monetary system.

> "All industrial time practices depend on time first being created to human design, that is, as abstract decontextualized and quantifiable clock-time. Built on the foundations of clock-time a time economy could flourish and the connection between time and money be established. Time could become commodified, compressed and controlled. These economic practices could then be globalised and imposed as the norm the world over." - Adam (2004)

2.2. AI and Artificial Temporality

Timing is an intellectual act of synthesis, putting in relation to two or more different series. These series can be very different from one another. They could be a series of the movement of celestial bodies, the simultaneous growth in different nations, the transforming network of intra-relationships in a social group, etc. However, one common factor exists amongst these series if they are in synchronisation. This common factor is the objects' *temporal orientation*, indexing the series' progression. When the same time index records all the moving objects, a specific time point indicates all the instantaneous movements of these objects, pointing out the relative positions of the objects in relationship to the past

[3] It is noticed that the labouring temporality in capitalism is different from the social-natural temporality in feudalism. The latter is mainly characterised by the seasonal and agrarian cycles or specific, inhomogenous working contexts.

and the future.[4] Temporal orientations are also built into the operations of economies, polities, legal systems, and transnational organizations.

Deforming original temporal orientations and changing the temporal structures of some critical social entities often marks an epochal change in economic history. For example, the initial integration of the world economy between 1860 and 1930 was contingent upon the global transportation and communications expansion. The new technologies at the time, such as the steam trains, steamships, and telegraph networks, significantly shortened the time of communications and modified the temporalities of several social groups, such as railway systems, shipping companies, and imperial powers who needed to synchronise their timetables in the integration (Hope, 2016).

The previous example is called *technology acceleration* (Rosa, 2013) in sociology. New technologies compress the temporalities of the objects, accelerating the speed at which objects fulfill their duties, i.e., transportation and communications. The compression attaches faster forms to the objects. The emergence of new, faster forms is a rational progression to the social entities that prefer acceleration. The faster and perhaps more complex forms contribute innovative features to the objects.[5] The development of AIs, in this sense, is innovating multiple entities because compared to human beings, AIs are able to provide sophisticated outputs in a shorter time with less sufficient information of inputs. However, it is worth noticing that the temporalities of AIs, though they roughly coincide with the social labouring temporalities, do not acquire exactly the same temporal orientation as human beings. That is to say, an acceleration in AIs' temporal structure may lead to a deceleration or even construct a stationary maze for human beings. The following subsections will formulate a temporality of AIs and will show its similar and possible conflicted features with the social labouring temporality.

2.2.1. Artificial Temporality

Wang (2019) refers to intelligence as the capacity of an information-processing system to adapt to its environment while operating with insufficient knowledge and resources. I modify the simple formal framework of AI operations in Wang (2019) to emphasise the role of time.

Let x denote an input signal, and y denotes an output signal. The state of a signal comes from a set, namely the collection of signals. Let X, Y denote the corresponding sets of signals at the input and output stage, respectively. The superscribe H or C indicates the attributes belong to human beings or computers. For example, the set of input signals for human beings is X^H. Any input signal received by human beings, say x^H, belongs to X^H. The capacity of processing the input set to the output set, namely the "intelligence," can be understood as a relation such that

$$y^H = f^H(x^H, t^H), y^C = f^C(x^C, t^C)$$

for any $x^H \in \mathrm{X}^H$ and $x^C \in \mathrm{X}^C$, where the first relation f^H stands for the human's intelligence, and the other f^C represents artificial intelligence. The time inputs t^H and t^C express the required time of the specific intelligence to reach the desired output.[6]

[4] From a philosophical perspective, being is a construct of time and space. Therefore, any change must invoke the idea of time.

[5] The conservative and "destructive" features in the time context correspond to maintaining and slowing down the transits.

[6] Turing Test is to test whether the verbal behavior of computer systems is indistinguishable from that of a human. Passing the Turing Test is the case when X^H is similar to X^C, namely $\mathrm{X}^H \sim \mathrm{X}^C$, one would have

$$\mathrm{Y}_H \sim \mathrm{Y}_C$$

Given the inputs x^H and x^C, if two types of intelligence arrive at the same output y

$$Y = f^H(x^H, t^H) = f^C(x^C, t^C)$$

but AI costs less time $t^H > t^C$, then AI can accelerate the pace of the operation in producing y. The temporality of AI and that of labours overlap. The structure of AI's temporality here is analogous to technology acceleration.

Apart from the technology acceleration, AIs also have the capacity to generate *singularities* in the outputs. Singularities accompany new technology and may result in double-edge products, for instance, nuclear energy. AIs are different from traditional products because AIs can be included in a decision-making process. When a decision contains incomprehensive order for human beings, the temporality of the decision-making process becomes distinct from what human beings experience.

Former World Chess Champion Garry Kasparov was quoted in the March 1996 Time Magazine as saying "a new kind of intelligence" sitting across from him at the table. In 2017, IBM's AI system transition to health care ran out of steam as the system missed diagnosing some obvious symptoms (Marcus and Davis, 2019). The current AIs have abilities that are far more capable than a typical human on some domain-specific tasks but may perform some ridiculous tasks that toddlers wouldn't commit.

The above situations show that the output sets of AIs may contain objects that human beings would hardly generate, some better, some worse. To characterise the incompatibility, let the object y^* in Y^C not exist in Y^H such that

$$y^* = f^C(x^C, t^C_*) \notin \mathcal{Y}^H.$$

Suppose any human's intelligence cannot generate the output y^*. So accordingly, y^* will be a *singular* output, and the time value y^* will not have any counterpart value t^H in the human forces. In this case, the temporalities of two bits of intelligence are incomparable to each other.[7]

For any $y^* \notin Y^H$, to speed up or slow down the corresponding temporal argument t^C_* does not initially belong to the realm of temporality understood by an adult mind. The values of t^C_* underscore a distinct role of AI's temporality, an *artificial temporality*, a relation concerning the progressions and recessions of anthropomorphic operations that may be outside human recognition. The artificial temporality may eventually consist with or be integrated into the social temporality when society trusts the singular value-added outputs. Only by then can AIs be expected to substitute the human forces to perform the required tasks, and only by then can the valorisation of $f^C(x^C, t^C_*)$ be realised.

2.2.2. AI Valorisation of Capital

Value-forming labour in production may result in an increase in value from labouring input to the final output. This procedure is known as valorisation. Through investment in AI enterprise, capital is able to deploy various AIs in real-world productions. Capital transforms artificial temporalities into abstract value-forming AI computations, pursuing anthropomorphic outputs that are comparable to or beyond those conducted by human forces. This capitalised process of artificial temporalities follows the *logic of valorisation*.

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where $Y^H = f^H(X^H, t^H)$ and $Y^C = f^C(X^C, t^C)$. Whether the current computer program can pass the Turing Test is still controversial because the wordbooks in X^H contain numerous ambiguous meanings, and the intelligence of making a conversion f^C needs complex interpretations of those inputs. However, even if the computer passes the Turing Test, one cannot assert that the AI is equivalent to human's intelligence, namely $f^H = f^C$. It only says that two types of intelligence have similar input-output relational structures, $f^H \sim f^C$.

[7] The incompatible case is different from the case $f^H(x^H, t^H) = y^C$ with t^H is significantly larger than t^C, namely $t^H \gg t^C$. For example, t^C maybe a few minutes while t^H could be years.

To see this argument, notice that if f^C produces the same output as f^H under $t^H \gg t^C$, AI will accelerate production as a result of the increase in productivity. In addition, if f^C leads to singular output y^*, and y^* *is accepted as a better alternative*, then y^* represents an increasing valued output. So in both cases, the production valorises the artificial temporalities.

The purpose of capital in the AI industries is to valorise artificial temporalities. The investment in AIs must come with the interest of accelerating the computational time t^C, shaping the industries to synchronise more artificial temporalities, exploiting more singular outputs, providing guidance to attract the users, etc. How to institutionalise these interests become crucial to AI valorisation.

2.3. Institutional Responses to AI Advancement

AI valorisation needs institutions. Because y^* does not belong to the human's recognisable Y^H, how much value or how many benefits y^* stands for is ambiguous. The design of the AIs structure allows its intelligent function, namely its input-output relation, to be easily synchronised in different forms and applied to multiple disciplines. One artificial temporality intrinsically exists across multiple disciplines and induces nontransparent operations that may be incomprehensive to ordinary operators. Meanwhile, the training of AIs comes with massive collections of input data that may contain sensitive information. All these operations become serious threats to the public trust. The acceptance of the trust of the singular AI's outputs, the large-scale applications in multiple sectors, or the construction of gigantic databases all need collective or institutional approval on the side of human beings.

Institutional responses to AI advancement should be able to deal with the side-effects of AI's temporal accelerations, the consequence of singular outputs regardless of the specific features in any sector, and the emergence of distrust towards the situations with the growing complexity caused by the AIs' participations. In addition, institutions should regulate the development paths of AIs, guide the AI industries to quest social interests, afford social responsibilities, and avoid ethical and moral threats.

The institutions in the political economy are constituted by multiple actors. Each actor seeks to advance the interests in a rational way while maintaining strategic interaction with others. The actors are with considerable autonomy. They can be a group of authentic individuals, a union or an association of members, a network of cross-shareholding, firms, or governments. They are assumed to influence the institutional configuration from multiple levels, from individual to regional, organisational, federal, national, or transnational.

Institution theory often posits a three-level structure. Here I use the term *micro-meso-macro*. First, the formal and informal *macro*-level rules such as the judicial system, cultural norms, and kinship patterns constitute the exogenous institutional environment. These macro rules give the fundamental institutions that can deal with the social acceleration caused by AIs and control, monitor, or sanction general AI activities - input collections and anthropomorphic output generations.

Second, the formal and informal *micro*-level rules, such as laws, contracts, organisational rules, and procedures, on the other hand, constitute the endogenous institutional environment. These micro rules are the secondary institutions that devise specific duties or regulate specific societal problems, such as building up individual trustworthy AIs[8], protecting customised AI information, etc.

The actors who are constrained by the current exogenous institutions are supposed to reproduce the institutional framework at the macro-level. Nevertheless, given the external forces of singularities and technology acceleration, some actors may be inclined or be forced to initiate the endogenous changes in micro-level logics, to support the new exogenous institutional environment. Last but not least, the *meso*-level is an "*institutional*

[8] These rules allow the intelligent f^C to be accepted at the individual level.

filter," consisting of adaptive adjustments based on the mixture context between macro- and micro-level rules. The institutional filter determines the extent to which specific micro-environmental demands are compatible with the macro system of norms, values, and external forces and should therefore be adopted.

3. Evolution of Varieties of Capitalism

The process of pricing the products congealed in outputs is at the very basis of the value formation in capitalised AI industries. The invested capital is valorised when the added value has been created, but the value-increase process is not fully realised until the output products are traded on the market. Various market institutions, social-political systems, and economic conditions mediate the imperative exchanges of AI outputs with the existing capital and labour inputs and will compose different purposes for advancing the anthropomorphic input-output relationships.

The realisation of invested capital will diffuse the institutional adaptation of AI's singularities and technology accelerations to the relevant actors. Varieties of capitalistic interests condense into institutional purposes for equilibrating the economies. The institutions evolve according to the equilibrium purpose. The nature of various interests for the actors can produce quite different sets of relationships between capital and labour, resulting in acting or counteracting the AI progression. Two specific institutional purposes regarding artificial temporality acceleration and deceleration - will be discussed. Temporal relations between AI development and social reality will be expected to forge a series of comparative institutional advantages and complementarities, on which varieties of capitalism will coordinate the corresponding evolutionary paths.

The probabilistic feature of AIs places uncertainty on the anthropomorphic outputs, which may generate a deficiency in the logic of AI valorisation. The institutional actors without sufficient information on resolving the fallacies may be stuck at a sub-optimality, iterate with their controversial, unambiguous interests, and develop the "unstable" purpose towards AI advancement. Filtering the promiscuous array of deficient beliefs is likely to assign the economy a different, new purpose in its evolution.

3.1. Varieties of Capitalism, Revisit, and Development

Capitalist market economies are systems of production, distribution, and consumption in which companies and individuals invest endeavors in proficiencies and competencies and exchange inputs and outputs according to market prices or strategic interactions.[9]Nation-specific conditions and histories result in distinct institutional factors and

[9] Production in capitalist market economies relates to the contribution from the sources of input. For example, the principal input elements, capital and labour, characterise the standard Cobb-Douglas production function

$$y = \lambda x_L^{\alpha} x_K^{\beta}$$

where y is the total output of the production, xL and xK stand for labour input and capital input, respectively; α,β,λ are parameters for the function. The output y is supposed to be consumed by the demand side. The distribution of inputs and outputs in these economies relates to the demand and supply in the markets. Market prices are instruments expected to solve the quantitative system of demand and supply relationships. The distribution of the elements is guided by price signals. However, prices as real-valued numerical instruments can only handle the relationships with a modest degree of complexity. When the real-valued pricing signals fail to reflect the complex information contained in the relationships, other derivative forms of exchanges can occur, interfering with the pricing mechanism and coordinating the strategical interests of the participants.

shape the behavior of nation-specific actors. One way to understand the theory of varieties of capitalism is to factorise the capitalist market economies by deriving comparative advantages from various institutional infrastructures. The institutional infrastructure of a particular political economy provides actors with advantages for engaging in specific types of production and distribution activities. The institutional supports allow actors to coordinate their endeavors and deliberate on how to achieve their strategic interests with the available institutional advantages.

By differentiating the investing preferences between the two fundamental elements - capital and labour - one can obtain a dichotomous view of capitalist market economies: Some actors have more interest in boosting capital input while others have more interest in improving labour input. The differentiation also happens in the production and distribution patterns: The pricing mechanisms function more efficiently in fluid than stationary markets. Nationspecific actors facilitating the institutional infrastructure on the capital market will gain the institutional advantage in fluid transactions. In comparison, the nations with institutional advantages in entailing extensive relational or incomplete contracts comply with the stationary attributes of the labour because labouring power is less fluidic and relies on a great amount of coordination and unionisation.

The dichotomy results in two types of capitalist market economies - liberal market economies (LMEs, represented by Anglo-Saxon economies) and coordinated market economies (CMEs, represented by Western and Nordic European economies). Actors in LMEs and CMEs develop distinctive strategies and structures to capitalise on institutional advantages (Hall and Soskice, 2001). The fluid market settings of LMEs encourage investment in switchable assets, while the dense institutional networks of CMEs enhance the attractiveness of investment in specific or skillful assets (Hall and Soskice, 2001). In LMEs, the fluidic structures come with hierarchical and competitive market arrangements, such as enforceable formal contracts. The principal institutions form the arm's-length strategies in these markets, providing a highly effective means for coordinating the endeavors of economic actors. The institutional power conferred on particular actors through formal sanctions and incentives can efficiently mobilise the resources. Leaders and policy-makers in hierarchical systems are expected to have such forms of power. In CMEs, the stable structure comes with collaborative and extensive nonmarket arrangements where a set of institutions secure the coordination and construct core competencies. The networks in CMEs are stabilised by the exchange of private information and reliance on collaboration. These networks result in a matrix of sanctions and incentives by which the relevant actors are guided to their strategic paths that are presumably foreseeable in the presence of specific institutions.

Apart from the ideal typology of CMEs and LMEs, Hanchke et al. (2007) suggest other "midspectrum" economies, such as mixed-market economies (MMEs, represented by Mediterranean economies) and emerging market economies (EMEs, represented by Central and Eastern European economies). These economies mix market regulation with some elements of coordinated regulation as well as state-compensating coordination. The hybrid systems in these economies are absent from the ideal complementaries in the LMEs-CMEs division, and therefore they are considered to be sub-optimal. The supports of these sub-optimal institutions come from the elite actors, especially the state actors, who wish to retain their stakes in the status quo (Hanchke et al., 2007).

To develop appropriate input-output relationships for the production and distribution patterns of the "mid-spectrum" economies, I consider a further factorisation of

capital-labour division by some *market deficient resources*.[10] My premise is that some important resources in these economies - either natural resources or human resources, or both - do not come with the proper pricing mechanisms and coordinated regulations. The presence of suspicious market signals or weak coordinated labour forces can threaten institutional consistency. The intervention by state actors or other elite actors is able to monitor or suspend the treacherous exchanges, compensate for the consequent weakness of economic coordination, and, therefore, sustain the current macro-institutions. All markets in capitalist economies are assumed to have some deficiency in their systems, but the institutional support for dealing with deficiency is not distributed evenly across nations.

The new way of division allows us to extend the scope of varieties of capitalism beyond developed economies. The BRIC (Brazil, Russia, India, China) economies, for instance, all have rich human resources and natural resources. The ongoing modernisation or capitalisation in these nations is shattering the original networks weaved by the traditional religion, cultural values, or social structures. Dislocation of rural populations, political upheaval, urbanisation, industrialisation, etc., these social traumata breed uncoordinated spirits. They also provoke opposition mindsets that constitute the institutional interests of contradicting the ongoing process. On the other hand, the dependence on raw materials in the process makes these fast-growing economies sensitive to complex signals from the commodity markets, which the new-found institutions are immature to meticulously decipher. The wrongly pricing signals would make the elite actors suspect the market institutions and may encourage extensive intervention.

The new factorisation assumes that actors located within any political economy face a set of market and coordinating conditions that cannot fully valorise some inputs. The particular situation offers the actors opportunities to add new architectures and construct strategies to resolve the deficiency. More specifically, the new factorisation stimulates AI advancement to institutionally filter the acceleration and singular effects. Suppose that AI valorisation fails in some market deficient resources. Then institutional actors couldn't fully specify the trustworthy AIs because the outcomes are too complex to be predictable and because most actors generally lack the information needed for constructing an appropriate set of strategies. In this case, the institutions for the market deficient resources would seek functional compatibility and flexibility and the strategic coordinating sets for emerging actors, which constructs the appropriate common ground for institutional filters.

3.2. Evolution of Complementary Structures in LMEs and CMEs

The complementary structure in LMEs-CMEs tells that LMEs have strength in coordinating capital endeavours by market signals, while CMEs have stable institutional infrastructures to coordinate labour endeavours. The applications of AI aspire to accelerate contemporary transaction speeds in financial and economic markets.[11] Such an acceleration favors the relatively fluid institutional structures in LMEs. On the other hand, too

[10] We can have a general form of the previous Cobb-Douglas production function by the factorisation

$$y = \lambda(x_{1,L}^{\alpha_1} x_{2,L}^{\alpha_2})(x_{1,K}^{\beta_1} x_{2,K}^{\beta_2})$$

where y is still the total production, $x_{1,L}$ and $x_{1,K}$ stand for coordinated labour input and marketable capital input, $x_{2,L}$ and $x_{2,K}$ stand for weak coordinated human resources and poor marketable natural resources. CMEs and LMEs are more "efficient" than the mid-spectrum economies in the sense that the parameter values α_2 and β_2 in CMEs and LMEs are relatively small ($x_{2,L}^{\alpha_2}$ and $x_{2,K}^{\beta_2}$ are closer to units).

[11] Traders who conduct high-frequency trading rely on algorithms to process information and switch trading strategies so that they can gain a slight advantage in transactions per second.

many processes of acceleration and abstruse singularities cannot sustain the whole logic of AI valorisations. The deficiency in logic inherently leads to a ceaseless increase in economic complexity and the growth of the public mistrust of AIs, particularly among the labour forces, which destabilises the corresponding institutions.[12] Without public support and stable institutional frameworks, AI advancement would be suspended, like what happened in the AI winter (the 1960s). CMEs can provide stable institutional infrastructures for breeding trustworthy AIs as the trustworthiness sprouts from the soil where arduous and time-consuming activities, such as identification, formulation, and representation of collective interests, can be cultivated.

It is known that the inclination of hesitation and termination often accompanies accelerating operations due to the worries of unanticipated consequences. Therefore, I consider the complementary roles of LMEs and CMEs in AI advancement to evolve into "accelerators" and "brakes," forming a reciprocal temporal relationship between acceleration and deceleration.

The LMEs can orient toward short-term interests in boosting AI industries; the CMEs, in contrast, can orient toward long-term interests in forging the trust of AIs. This layout is able to convey the logic of AI valorisations to a dualistic institutional structure, separated by two institutional purposes. In section 2.2.2, I discuss that the general institutional purpose of the capital concentration in the AI industries is to valorise artificial temporalities. The AI valorisations cannot be complete if the products of AI are not trustworthy. The labour inputs in the AI industries are expected to invent new programs and testify how reliable the programs are.

Two different institutional cores supporting the reciprocal purposes are better than squeezing the controversial purposes into a single core. Because the twofold expectation can be resolved into two separate institutional spheres since the institutional support for one purpose involves the conflicting interests of the other purpose in many fields.[13] For example, the institutions supporting the deceleration may suppress the accelerating tendency in labor market regulation, education, and training, corporate governance, etc. Blending the institutions that encourage precarious creations with the ones that vitalise meticulous examinations not only delivers incoherent values but also loses the opportunity of manifesting comparative advantages.

3.2.1. Quantitative Alienation and Trust

AI industries in capitalist economies are structured around quantitative knowledge. The AI industrial chain can be uncoupled from many traditional workforces. Also, AI products are consumed by people who do not experience or even know much about the programs. The impersonal AI input-output relationships seem to generate a sense of *quantitative alienation.* The labour forces involved in production, consumption, and distribution no longer have a transparent vision of the outputs that were used to be produced by humans. This alienation could let small contamination in institutional spheres grow progressively out of control.[14]

[12] The stable frameworks for socio-economic actions in LMEs and CMEs are endowed by the legislation possesses. The process of human-lawmaking is time-consuming. Legitimate decision-making, interest mediation, and relevant knowledge acquisition are necessarily deliberate to comply with public interests, and thus they cannot compete with the speed of machines.

[13] Soskice (2007) points out that the institutional complementarities in political economies originated from class and industrial conflict and are supposed to resolve conflict by distributing power and in pursuit of particularistic sectoral interests under different institutional spheres.

[14] The concept of alienation has its roots in the critical analysis in sociology. The state of alienation is driven by social stratification and leads to the powerlessness of specific individuals and groups.

The financial crisis in 2008, for example, was a quantitative catastrophe because the immensely increased transaction speeds in the financial markets completely uncoupled some derivatives from their real economic values.

A trustworthy quantitative foundation with good practices should be mandated by a set of formal institutions so that society can have a necessary precondition for attaining the relevant information in contexts of coordination.

> "[T]he more power we hand off to AI, the more it becomes critical that AI use that power in ways that we can count on. ... A short-term obsession with narrow AI and the easily achievable 'low-hanging fruit' of big data has distracted too much attention away from a longer-term and much more challenging problem that AI needs to solve if it is to progress: the problem of how to endow machines with a deeper understanding of the world." - Marcus and Davis (2019)

The advancement of AIs needs to synchronise with the institutional knowledge that reflects the nations' temporal and spatial ideas, the common senses, and the institutional actors' interests in the physical and social worlds. In this complex multidimensional core of knowledge, any advancement of the artificial temporality is not simply a process that quantitatively increases in the desired dimensions and leaves the nature of the other dimensions unchanged.

Forging the trust of AI products at a slow speed should be as important as coping with the exponential growth of quantitative innovations. The "brake" is as important as the "accelerator."

3.2.2. Relevant Actors

The market in LMEs and CMEs is a politically and economically constructed institutional matrix, a set of prerequisites associated with networks of actors. For the complementary structures of AI advancement, I am interested in those actors who provide structural coupling institutions as building blocks for the temporal dual-coordination in LMEs-CMEs: the actors who can instill a particular set of norms or attitudes to form a complex interlocking set of temporal causes in two types of capitalistic economies.

The fast-growing networks in the AI-related fields consist of relatively unregulated, private spheres. The actors involved in the structural coupling schemes are often relatively invisible but may interconnect with large, visible institutions. That is to say, these non-transparent networks are subsystems embedded in the general global institutional system. The actors are unions and associations of engineers and researchers, international high-tech firms, communication groups, higher education institutes, non-governmental organisations, etc. These actors can influence the corresponding orientations and practices of AI advancement and can inculcate the general ideas of AI temporal orientations into the public.

The characteristic nexus of structural coupling institutions is formed by the actors with the qualities of "accelerators" and "brakes." Institutional coupling subsystems would shape the evolution of political economies and would mutually complement and reinforce each other. The nexus should have relatively symmetric institutional and organisational factors related to complementary and reinforcement strategies.

The actors belonging to the "accelerators" aim to seize the ideal economic-scientific-technological rate of innovation and establish the political capacity to advocate innovative effects. These systemic actions and the resulting AI tempos will be unavoidably transferred back to the actors themselves, encouraging them to accelerate the innovation speeds through the growing institutional power. The actors support the interests of acquiring massive information across the social spheres, seeking political-moral protections on innovative activities and practices, establishing the best possible supplies of material resources and personnel, etc. The "non-stop" acceleration will also increase the complex-

ity of the economies, enhancing the demands of distinct commercial channels and diversifying the supplies of alternative goods and options. A more complex economic structure can evolve from the multiplication of such growing distinct possibilities.

The actors belonging to the "brakes" are intended to coordinate the temporalities in economicscientific-technological spheres and those in the socio-legal-political spheres to consolidate the intrinsic rhythms led by human nature rather than computational speed. The interests of the actors are to avoid any escalation of desynchronised accelerations that emerge in the innovative processes and to eliminate the temporal side effects caused by the changes in some subsystems. Several institutional components fall under pressure to keep pace with AI engines, e.g., politics, legislation, education, ecology, etc. Actors will form a defensive alliance to avoid political steerings and legal regulations caused by AI advancement. Firms, although they are compelled to engage in volatile markets, will be encouraged to coordinate with socio-legal-political paces. The "slowing-down" brakes will maintain the components of contemporary economies integrated and synchronised, and be compatible with the constantly growing social complexity.

The "accelerators" and "brakes" provide flexible strategies to the globalised institutional structure so that it can shift at will between global strategies of acceleration and deceleration. The engagement of institutional actors with two complementary roles also provides the continuation of evolving the current comparative advantages in the LMEs-CMEs framework, and minimises vulnerabilities of existing weak cooperations in the seamless maintenance of international operations.

3.3. Evolutions in the "Mid-Spectra"

Unlike LMEs and CMEs, the "mid-spectrum" economies have no significant institutional comparative advantages and may need to process input-output market resources in a "noncapitalistic" way, which is inefficient from the market perspective. For example, China does not provide full support for the logic of capital valorisation, but rather, in some sense, for principles of needs. Not being at the institutional optimal equilibria in the LMEs-CMEs structure indicates that a "mid-spectrum" economy either has a tendency to converge toward one of the two ideal institutional models or remains at its sub-optimal steady model, anticipating that the steady status would progress toward a new type of institutional optimality under the exogenous evolution. The uncertainty of the tendency may be amplified if the AI advancement complexifies the immature institutional milieux in the "mid-spectra."

Under the AI's temporal orientation, the complementary characteristic will endow the LMEsCMEs structure with two stable strategic purposes, "accelerator" and "brake." The *bistability* allows the LMEs-CMEs structure to be flexible over the changes in the exogenous and endogenous institutional environment as it can store two opposite market opinions and develop the strengths of both of them.

On the other hand, the purpose of "mid-spectrum" economies toward AI advancement is unsettled. The modernisation and capitalisation processes in these nations must please the interests of the elite actors that are driven by the economic and political quest to accumulate and preserve power. Their market institutions are in the transitional stage. Their sub-optimal equilibrium statuses are sensitive to perturbations. The established models of LMEs and CMEs attract the "mid-spectrum" economies to approach. However, leaving the equilibria transforms the institutional structure and spontaneously creates the forces resisting the transformation. The abundance of controversial interests from the actors will be more prevalent as the economies grow larger. The persistent potential of removing the sub-optimal equilibrium statuses makes the institutional structures in the

"mid-spectra" *metastable*.[15]

The cause of metastability takes root at the "schizophrenic" micro-macro institutional level. The ambiguous, unsettled purpose from the macro-level inspires incoherent and stochastic searches of interests at the micro-level. The synthetic trend implanted in the AI's temporal orientation aims to integrate multiple disciplines. The "mid-spectrum" countries with fewer cooperative and coordinated protocols and a promiscuous array of market values are likely to experience organisational shuffles and reshuffles during the AI synthesis. It is hard to predict what will be the consequences of such perturbative activities. However, it is foreseeable that the repetitive organisational shuffles must be conducted by the meso-level institutional filter, covering a continuous scale of tendencies for the actors who are willing to integrate or separate different, probably the opposite, interests in the micro-macro divergences. Although the shuffles may randomise the progress of AI advancement, the repetitive integration-separation process likely equips a nation with one dynamical, flexible, and continuum configuration for its institutional filter.

Two possible settlements of the metastability may coexist in the reshuffle process. 1. Driven by the external attraction - adapting to a stable purpose in the "accelerator-brake" coupling nexus. 2. Driven by the internal repulsion - advocating a new purpose to stabilise the organisational oscillations. The interplay between attractive and repulsive tendencies makes the shuffle process the basis for formation and switches among different operational networks. The singularities of AI products are critical stimuli allowing sudden connections or disconnections to emerge within and between segregated networks. In response to the stimuli, the institutions need to be filtered at a certain "frequency," consent of the repetitive necessary network structures and dissent from the occasional redundant ones. When the institutional filter adaptively forges a configuration that will stably support AI progress, the economy will find out its new equilibrium.

The first case, the "accelerator-brake" settlement, is a mapping of the "accelerator-brake" coupling nexus onto the "mid-spectra" institutions. Two concurrent processes will sustain a sequence of movements on fulfilling the mapping with different temporal orientations: a faster disturbance of the dynamic stationary state and a slower relaxation towards its restoration. The artificial temporalities in "mid-spectra" have to adapt the institutional configuration to follow, correlate and synchronise with the one in the coupling structure.

On the other hand, the spontaneous new purpose for the emerging associations and networks can also settle the interplay between external influence and internal conduction. In the second case, if a purpose synergises the original internal characteristics and the reciprocal intentions from the external coupling nexus, then this purpose would satisfy the prerequisite for establishing new motivation for its existence.[16] The institutional filter in "mid-spectra" formats the selective networks of the possible settlements, coordinates their activities, and adaptively examines the relationships so that the institutions can converge to a new equilibrium. By then, the institutions will be constituted by different novel interests: a consequence of selection and generation.

3.3.1. The Emergence of New Actors

The integration and differentiation in institutional segments direct our attention to in what manner new actors would appear to support the filter. The new pilar must be able

[15] Metastability in thermodynamics describes a phenomenon for the system close to a discontinuous phase transition. Instead of undergoing the phase transition, the system goes over continuously into a sub-optimal equilibrium phase (low energy) rather than the optimal equilibrium phase (the lowest energy). The segregated liquid and gaseous phases coexist at the saturated vapour pressure, which is one example of metastability.

[16] A statement that can resolve two contradictory statements is a new statement. So is the institutional purpose.

to cope with singular events and flexible with the artificial temporal variations. The distributed clusters of networks selected by the "filter" should interact intensely with each other and, at the same time, be quite distinct and differentiated from the traditional ones. The uncategorised resource inputs can serve the "candidate pool" for the new actors because the existing market does not function well for the associated labour and commodities.

The market factors regarding these deficient resources are almost unstructured and are not constrained by many market and political institutions. The functional connectivities of these factors shift rapidly. It is difficult to characterise either quantitatively or qualitatively the movements. Therefore, actors can advocate actions with seemingly opposing tendencies of differentiation and integration of those resources and can condense multiple purposes into a fleeting special-purpose action.[17]

In this deficient "candidate pool," new actors can quickly come onstage. The deficiency means that the existing divisions of capital and labour meet the bottleneck. To break the bottleneck, existing actors have to investigate the unstructured factors and recruit new participants to deal with the deficiency. The market networks full of new participants are only loosely connected. Those new actors with strong connectivity and synchronicity will quickly seize the market power. By constituting fleetingly connections, the temporary principal actors can gain access to a transient political capacity that serves to integrate the competing but uncooperating market deficient inputs. Some of their transient interests may vanish by the arrival of other new actors, but some may be adaptively collected and filtered, forging the base of a new institutional purpose afterward.

At each time point, few chosen principal actors can encompass the major features of the deficient markets. They voice their interests through the temporary network. The continuous creation and dissolution of connections across different sectors constitute a series of temporal networks. The interests of the dynamical networks are adaptively filtered by forward-looking and backward-looking institutional power. The continuous filtering process stops when certain singularities trigger the qualitative stability of the evolutionary interests as a whole. At this critical point, the continuous flux of fleeting interests will coalesce into a new purpose, and a new equilibrium of institutions will emerge.

3.3.2. Imaginary Interest in Stirring

It may be easier to understand the emergence of a new purpose for the metastable institutions if we consider an imaginary type of interest for some actors. The imaginary interest is purely about stirring complementary structures in the political economy, namely an attempt of shuffling. Such an interest is separated from the real interests of actors that affect their utilities. The imaginary interest, on the contrary, only concerns the frequency of the shuffles. That's to say, even though the shuffle may deviate the purpose from equilibrium, actors' imaginary interest does not care about the utility loss because, for the rotation, there is neither a so-called better nor worse frequency. However, it is reasonable to consider that the imaginary interest will tend to vanish if a better-off equilibrium purpose emerges. Therefore, I assume that the frequency of shuffles decays once new optimality occurs. The imaginary interest can be interpreted as a decay rate of metastability.

The singularity of AIs should affect the imaginary interest. The normal interest needs the trust of AIs because AI's singularities do not always have positive impacts on human society. However, since the imaginary interest cares only about stirring, it may also accept the bad singularity. In this case, a suspicious singularity must come with high intensity of

[17] The search engine companies provide us with a good example. The action of integrating as much online information as possible is hard to be institutionalised. It is even harder to foresee how many interests will involve in integrating or disintegrating the navigators of social perceptions.

conflicts because the imaginary interests and real interests contradict each other. While for a good singularity, the actors may unanimously agree on trusting the output. Suppose that a good singularity was suspected at first and caused a sequence of shuffles at the original equilibrium. And then suppose the trust is built in a gradual way. In that case, we should expect the imaginary interest in stirring to decrease, the shuffling process to converge, and a better equilibrium purpose to emerge. Figure 1 illustrates the procedure.

3.3.3. Threats of State Integrable AIs

The hybrid system of market-state coordination sustains the emergence of sub-optimal institutions in the "mid-spectra." The weak, inconsistent institutional supports for market deficient resources give opportunities to the new actors in these economies. The controversial interest of new actors may drive AI's evolutionary path to depart the bistable "acceleratorbrake" settlement.

Since new AI applications are able to rapidly reach the masses, the states would no longer remain disinterested in these applications. The applications of AI techniques are extremely expensive, and AI synthesis requires large-scale economic and political coordination, both of which provide new actors opportunities to transform their original sphere of activity from a public-driven to a state-driven one. Thus, some new actors involved in AI advancement are likely to become state actors.

A stronger group of state actors does not in itself create a different type of capitalism nor a new institutional milieu. However, since the state provides a special kind of coordination alongside various regulations for the markets and social actors, the state actors, without proper supervision, often tend to exploit techniques to a greater or lesser degree.

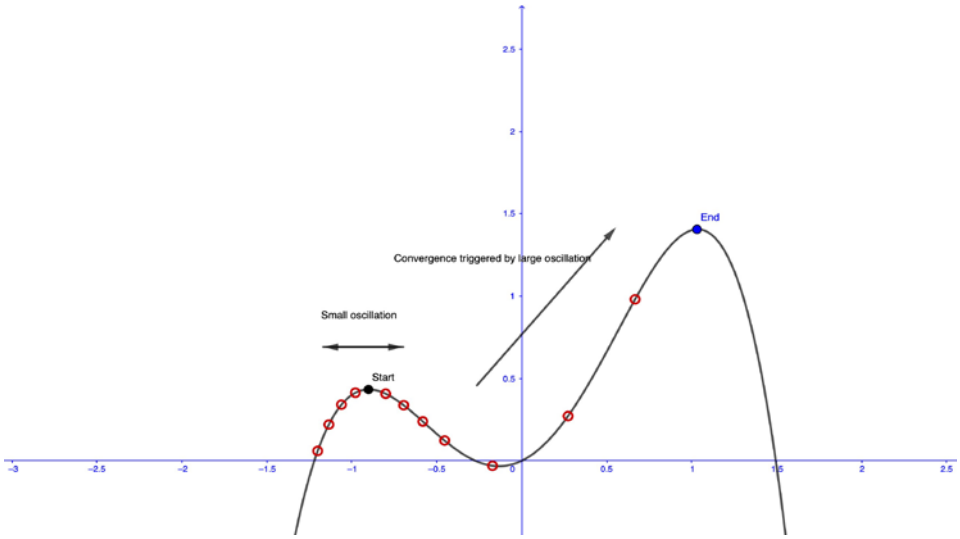

Figure 1. The shuffles (red circles) indicate that the institutional purpose leaves the suboptimal equilibrium (black point). Once a better-off direction is found, bigger but less intensive shuffles push the institutions to find out a new equilibrium (blue point). The imaginary interests in shuffling will cool down when the better-off purpose is constituted.

The state actors can potentially erect and change evolutionary, habituated, and volitional processes of AI development, set up the legal foundations of related economic activities. Although these actions could offer new architectures and constructive strategies to resolve the market deficiency, the maintenance of institutional inconsistency and the exploitation of market deficiency through state-of-the-art AI techniques might fit the interests of most new actors, especially the state actors among them.

That's to say, the immaturity of the institutional milieux in the "mid-spectra" may be preserved rather than improved when AIs advance. However, the aplastic milieux should not universally exist in the states within "mid-spectra."

Within "mid-spectra," MMEs or EMEs have state actors who are so active that they do not fit well into the ideal type of either LMEs or CMEs. For example, Italy and Spain maintain pervasive direct state intervention in production regimes and welfare systems (Molina and Rhodes, 2007); France has significant state influences on the hierarchical logic of interaction between firms and labour (Schmidt, 2016). Although the bigger cleavages across different state-driven spheres distinguish the French, Italian and Spanish models from the ideals in LMEs-CMEs, the strategies for AI development in these countries do not necessarily differ from those in the "accelerator-brake" coupling nexus. Because the countries in MMEs or EMEs generally have small territorial cleavages from the cores of LMEs-CMEs, which means that they will experience stronger spillover effects in technological, judicial, and political spheres than the developing economies in "mid-spectra" such as BRICs. Thus, the state actors in MMEs or EMEs will have less incentive to suppress or misguide the healthy evolution path of AI industries.

> "Teleology can only create a stir for a short time as an instrument of propaganda; but it is far from certain that such propaganda can give character to socialism, which more and more is losing its specific reality as a result of technique." -Ellul (1964)

Without the proper institutional milieux, threats in "mid-spectra" are some new actors who tend to be conscious of the possibilities of exploiting emerging AI techniques and consciously desire whatever advantage can be drawn from them without limitation of any sort. The economies with traditional democratic heritage in MMEs or EMEs, like France, Italy, and Spain, on the other hand, suffer fewer threats of such consciousness, for the state actors in these economies have to consequently dwell on their development scruples concerning the maintenance of a facade of public and private morality.

4. Global AI Advancement

Temporality and spatiality are related. The distances can be represented by the time that an object needs to pass through them at a certain velocity. When the artificial temporality is about to accelerate or decelerate, it is reasonable to think that the changes in AIs' speed also couple with spatial arrangements in the global economy. AIs' temporal orientation is an intrinsic capacity possessed by AIs' synthesis. Such an orientation in the abstract time series can spatially relate to the coordination and synchronisation of various transnational actions.

4.1. Artificial Spatiality

The primary spatial feature occurring in the intelligent's input-output relation is that spatiality allows for various heterogeneous forms. The spatial perception of human beings is constituted by concrete physical recognitions of surroundings.[18] The spatial ordering for AIs is established by algorithmic or programming operations that run through multiple interconnected networks in cyberspace and assemble real-world activities in the terminals. So it is natural to assume that intelligent spatial relationships are the cyber networks that can be projected onto the real world. This ***artificial spatiality*** is about the diffusion of outputs in the cyber networks to diverse physical locations.

The economic representation of artificial spatiality is about the competition of multiple AI input-output forms. When facing the different input-output relationships, the capital has the spontaneous intention to select the best of them, which can initiate the trend

[18] "They [Ways in which reality can be structured] extract reliable units and relationships from the input, ..., thereby becoming capable of principled, systematic generalization over those units – the epitome of sophisticated cognition. Distilling spatial and temporal patterns in the stream of experience makes prediction of events and actions possible." - Goldstein et al. (2010)

of homogenising the differences, causing competition.[19] In a capitalist world, if time is money, then space is competition. Therefore, the integration of the global market provides heterogeneous artificial temporalities the largest scale opportunity to compete for the hegemonic position.

Globalisation shows us an extensive form of competition. From the temporal aspect, globalisation is a purpose of coordinating multiple temporalities given the fact that each of them has constraints with respect to the regional schedule, local lifestyle and knowledge, etc. From the capital aspect, the valorisations of capital occur on various spatial scales since profitable opportunities exist through integrating the production and consumption processes of diverse economies and exploiting the complex, strategically entangled distributions across these economies. Globalisation, in this sense, relates to the purpose of yielding the profits of scales. The formation of the global market through broader governing architectures and synergistic standards helps to institutionalise these purposes.

AI valorisation of capital on a global scale is to compete in capitalising multiple artificial temporalities.[20] If a superior intelligent input-output relationship can be found on the global scale, then the superiority will establish the unitary authority. The unitarian attribute not only meets the synthetic tendency in the AI industries but also pleases the utilitarian desire chased by the capital. Therefore, the global market becomes the ultimate horizon of profiting from AI achievements and coordinating various market versions of AI products, which is the basic logic of constituting a capitalistic model for global AI advancement.

Artificial temporalities in the global AI competition will be spatially accelerated to a larger extent. The emergence of superiority in the global market will ultimately cause the acceleration of all relevant, intelligent processes because the competition will put pressure on the process of capitalising AIs products. Since the capitalisation of multiple processes is based on the complex transnational network, AI industries would mobilise the spatial resources and labour with general attempts to modify micro-level institutions and the local environment for the interests of AI valorisation. In other words, spatial spreads of AIs applications will result in the acceleration of social temporalities as a whole.

On the other hand, although cyberspace accommodates the synchronic requirements of artificial spatiality, the human space on the terminal sides of the synchronisation is restricted by physical conditions. These restrictions can breed the defensive market perception against coordinating or synchronising the artificial temporalities in the global market. The local market may be confused with multiplicity and fail to institutionalise the transnational patterns that support coordination or synchronisation. On the demand side, the consumption and distribution process has to extract trustworthy features accepted by the local customers and then associate the novel derivative results with the locally existing ones. On the supply side, the firms have to detect the common constructions and incorporate them into their production process. Both these processes involve collective mastery of novel knowledge, assembly of proper industrial chain, exchanges with asymmetric operations, etc. Economies worldwide vary greatly in terms of the legal and political systems related to cyberspace, but national market institutions need time to regularise contingent issues when coupling multiple artificial temporalities and, once consolidated, set up cru-

[19] Suppose that there are N nodes in a cyber network. If we let $y_i^C = f_i^C(x^C, t^C)$ represent the output for the i-th console, then the competition is about establishing the superior input-output relationship of the set $\{f_i^C\}_{1 \le i \le N}$.

[20] Let $y_i = f_i^C(x^C, t^C{}_i)$ and $y_j = f_j^C(x^C, t^C{}_j)$ have the same value as the outputs. The comparison of $t^C{}_i$ and $t^C{}_j$ can display the artificial temporal difference between the two input-output relationships.

cial preconditions for the realisation of them. Since intensifying the competition may result in global acceleration, the purpose of deceleration must contain ways of moderating the competition on a global scale.

4.2. Beyond the Sovereign Comparative Structure

The valorisation of globalised AI industries is to integrate multiple artificial temporalities and to establish a hegemonic computational order so that the supreme intelligent unit can take advantage of the rest of the units. This notion seems to implicitly advocate an AI-type interconnected input-output global economy, which may cause the worries of *sovereign alienation,* a logic behind sovereign responses that ignores or fails to capture the complexification of the competition among multiple artificial temporalities.

The global economy, including changes in trade, migration, security and development aid, etc., links with transnational actors and is a complex system commonly described as more than the sum of its parts. States are embedded in this complex system. Each state has an internal understanding of the system rules. The characteristics of the complex system cannot be directly derived from knowledge about the state's actors. Similarly, actor characteristics in the states are not deducible from knowledge of the global complexity. The logic of complexity entails the coevolution of actor understandings of the context of the system environment.

The complexification of the "accelerator-brake" nexus relates to ideological chaos on the acceptance-rejection of the temporalities initiated by some artificial superiority. Ideology is an important component of cognitive institutions that energises the behavior of many actors from AI-related sectors. Cyberspace, as an "ideological vacuum," provides the perfect soil to brew the doctrinal opinions that are different from the clerical ones. In other words, the appearance of the "winner" in the multiple temporalities can morph the collaborative "accelerator-brake" structure into a chaotic structure of two different attitudes on whether integrate or disintegrate with a global capitalistic input-output relationship mediated by superior artificial roots. The dichotomy in "integration-disintegration" cannot result in a nexus because it involves the conflicts of taken-for-granted assumptions, beliefs, and collective value systems. Thus, the stability of the "accelerator-brake" nexus cannot obstruct the "integration-disintegration" struggle. On the contrary, the struggle can easily infiltrate the nexus. Because any stable nexus may also contain the seeds of its own destruction - too much stability may lead to "boredom" and "atrophy" for the "imaginary actors" who are willing to stir up the stability.[21]

Since cyberspace is a territorial-free concept, it is normal to assume that the high-level ideological network in cyberspace is carrying the integration purpose of the global economy that is underpinned by other capitalistic networks such as transportation, communication, utility services, etc. The ideological networks at the state level, namely in the physical space, most likely contain the networks of multi-lateral resistance to the movement of integration unless the local AI industries have dominating advantages in the competition. The delicacy of governing such a complex global system with local resistance is the necessity of holding the states at the edge of chaos so that neither chaos (the "integration-disintegration" struggle) nor rigidity (the stable "accelerator-brake" nexus) prevails at the zero-sum expense of the other.

Complexity regulation of multiple artificial temporalities must involve the development of solutions or policies that do not necessarily fit within sovereign institutional cat-

[21] When the global fact and domestic institutions of the states mismatch, states' behaviors driven by domestic institutions would fail to valorise the local AI temporality, and some actors would adapt to new temporality if they negatively evaluate the evolutionary path of their current tracks. Then they would act on this new temporality and participate in the negotiations of institutionalising it within the nexus, which erodes the stability of the nexus.

egories or levels. The state may be unable to easily modify its internal institutions - particularly in terms of its beliefs about what is possible - to accord with the realisation of global evolution. But some actors, who transcend their territorial constraints, can assist the states in adapting to the new complexity. The governance of global AI advancement needs not only the involvement of international bodies such as the UN or bodies created for intergovernmental cooperation such as the EU but also local firms, civil society, and non-governmental organisations as well as private enterprises who can synchronise the multiple temporalities.

4.2.1. Multidisciplinary Actors

In this section, I will explain to what extent we can speak of sovereign alienation and develop a more concrete expectation of the necessary actors dealing with the complexification of global AI advancement.

The more integrated the world market, the greater the acceleration of the competition. Conceptualising the local experiences by cyberspace's information and eliminating the physical presence of labour, customising the regional features by visual specification, is just a means of sovereign alienation. The sovereign alienation, the quantitative alienation on its largest scale territory, would intend to establish global production and distribution flows immaterial to the local constraints, allowing the artificial superiority to identify and institutionalise any smaller scales of actions and temporalities, forming the capacity for binding different temporal orders or rhythms.

The temporalisation of complexity produces a fundamental compulsion to act. The escalation from the competition in multiple temporalities endangers the temporal and spatial capacities of social coordination and orients to the reorganisation of sovereign affairs. The multi-lateral resistance to sovereign alienation will be against the integration, attempting to split up the global market into separate domestic networks, each of which could be exploited by a particular artificial temporality. Conflict often leads to or stems from a reconfiguration of coalitions and alliances. The disintegration would rely on the friction arising in the conflicts of artificial temporalities. The friction can reshape the global trade flow into different circuits and can maintain the separation status by increasing both complexity and flexibility in the circuits.

In this "integration-disintegration" struggle, the driving force can be represented by transnational actors of globalised interests while the friction by the domestic actors of nationalist and regional interests. Both domestic and transnational actors in normal disciplines would be too slow to mobilise the other side to cope with the increasing complexity on their own side. For example, domestic economists may think of themselves as having been provided with an arsenal of technical means that enable them to observe and sometimes predict economic reality in detail. However, the temporality of the progression is, in fact, led by international technicians and synthetic techniques in the global AI industry. Generally speaking, artificial superiority convoluting different spatial scales will stimulate temporal changes across disciplines.

To smooth the struggle, we need some multidisciplinary actors to hold the dual perspective of the rival relationship so that they can keep the transnational actors posted about the discordance of most, if not all, AI-related disciplines and facilitate the sovereign powers in dealing with the focuses of any one of them.

For example, an alliance on training the individuals to face the AI challenges is proposed in Mariotti (2021, 2022). The alliance can allow the sovereign powers to estimate possible disciplinary scenarios in relation to the contemporary and future society and cultivate transnational institution powers in multiple disciplines, to absorb the advancement of AIs in pedagogy. By progressively penetrating the educational milieu, the alliance can reform the traditional pedagogic system that has been stabilised since the state nationalised education and adopted the Jesuits' technique, the system that at present renders the whole edifice questionable.

These multidisciplinary actors should be empowered in the complexity regulation, holding recognition in order to understand global complexity and convert the unbiased evolutionary paths into local trails to avert sovereign alienation. The role of a multidisciplinary actor is similar to, in multiple spatial scales, an "institution-softener" who can raise the interests in different jurisdictions simultaneously, set in motion the rigid framework of the core elements of the state, and play the dual role of disclosing thoughts, opinions, and perceptions of the regulation. The actors should be positivism, with a general focus on factors such as knowledge, information, and expertise, which can rationalise the regulation and define a clear involvement of experts in policymaking. They should also hold no objective evolutionary strategies, treat artificial superiority as probabilistic knowledge and as incompleteness when handling new and emerging problems, and let the evolutionary path of AI advancement precisely reflect power imbalances in society.

4.2.2. Pendulum System vs. Complex System

> "The two-body problem (as the earth, moon or sun) can be solved to a high approximation by time reversible laws. But, already the three-body problem introduces some aspects of irreversibility. If there would be a cosmological influence then it should likely act on all systems in the same way. Our problem is to distinguish dynamical systems which are reversible from systems which present irreversibility." - Prigogine (2000)

The ideal "accelerator-brake" nexus clearly unfolds a plot of the pendulum system, a classic prototype for the two-body problem. The purpose of establishing a controllable artificial temporality is to endow some degrees of reversibility to the nexus so that when fallacies occur in AI's evolution, there would be a means of reversing the process and correcting the errors. However, the break of metastability in the "mid-spectra" shows the possibility of having new purposes. These new purposes, together with the generating artificial temporalities, could serve as the main force in complexifying the "accelerator-brake" nexus, causing ideological chaos and turning the pendulum system into a complex, irreversible system of many bodies.

An interesting property of a complex system is that the states close to equilibrium and the states far from equilibrium react quite differently to perturbations. When the states close to the equilibrium receive perturbations, the whole system goes back to equilibrium, like when one perturbs a pendulum. But this is not the case when the states stay far from the equilibrium (Prigogine, 2000). According to this property, when a new purpose can ideologically integrate with the "accelerator-brake" structure, the supporting institutions should be able to sustain the system under perturbations because the emerging equilibrium is not "far" from existing ones. On the contrary, if the new purpose is too "far" to be achieved inside the "accelerator-brake" coupling nexus, it would be harder for the institutions to recover the global system from perturbations.

Thus, even though the global AI advancement may be the absence of "accelerator-brake" complementaries, the general interests of maintaining sustainable institutions should compel the multidisciplinary actors to regulate overly assertive pursuit of the new purposes and to set up a set of new institutions on the periphery of the dualism.

4.3. Society-Nature Dualism

Theories of time are often said to evolve in their own structure with regard to society-nature dualism. The cultivation of social and natural elements is in different temporalities. With modern technology, social roles such as communicators, travelers, and workers can adapt their schedules to faster speed, but the human body and the formation of intelligence, as the result of natural evolution, have their intrinsic natural paces. Nature requires longer time windows to reproduce its resources or regenerate itself.

The reciprocal pair, "accelerators" and "brakes," though they give the purposes of AI temporal practices, has not yet established clear connections with the natural spheres.

As a representative of a deep, perhaps the deepest, cause of forming many social temporalities, the natural temporality may also foster the artificial temporalities. We can expect that some AI temporal practices will be embedded in some natural, ecological processes and will bear responsibility for maintaining these relationships.

While the AI advancement for society is capitalised under economic institutions, the AI advancement for nature could be mediated by institutional constitutions involving other concerns, such as biological, ecological, environmental, geographical, healthy, etc. The new collaboration may provide other purposes to fill in the periphery of the coupling nexus. For example, the purpose of building an ecology-friendly society is to force the capital to respect the natural rhythms and tempos and to prolong the "lifespan" of capitalism by suppressing the inherent compulsion of profit optimisation.

5. Conclusion

To conclude, the paper demonstrates the temporal influence of AIs on the evolution of varieties of capitalism. The singular and accelerated attributes of artificial temporalities drive capitalistic economies to an evolutionary path with two reciprocal purposes: acceleration and deceleration. The paper also shows that other purposes can possibly be stimulated around the dualistic structure, among which the valorisation of AI's temporalities by state actors is given some attention. The multiplicity evolved from the dual provides a path for capitalism to fully engage in AI advancement and govern its global struggle against maladjusted temporalities.

Further research about the temporality of AIs and its effects on economic activities will align multidisciplinary actors with the line of constructing the new Babylon complex. The world of intelligence contains and tolerates a lot more disorder than the world of machines. Therefore, the multidisciplinary actors based on AIs can form a more developed class than the mechanic ones, as they develop with anthropomorphic reasonings and experiences beyond empirics. In other words, disorder and order act incrementally on each other at the heart of the emerging complexified class.

The idea of effectively isolating while maintaining disciplinary advancement is purely utopian. AI synthesis requires interrelated economic, political, social, and engineering disciplines. Economics, which by its very nature is inside the organ of the current AI synthesis, can simultaneously participate in selecting AI evolutionary paths. The temporality of AIs, therefore, will exclusively centralise various complex views in the edifice of capitalism and will breed multidisciplinary actors who guard "decrees" that provide the serious basis to predict the appearance of new arbitrary and incomprehensible singularities. These actors will prepare the "intelligent cleavage," which seems inevitable in the advancement of AI, for healthy and aesthetic maintenance.

Keynes said, "The social object of skilled investment should be to defeat the dark forces of time and ignorance which envelop our future." In the advancement of AIs, the anthropomorphic, dark force can be embodied in artificial time and segmentalised ignorance. The former refers to the treacherous artificial temporalities; the latter is about some limited areas of reality, excluding the highest level of the truth, brewing the schism between the capitalistic division of knowledge and AI synthesis. To defeat the new form of the dark force, the varieties of capitalism need a "self-control" paradigm in their institutional termini and a multidisciplinary script for their actors.

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