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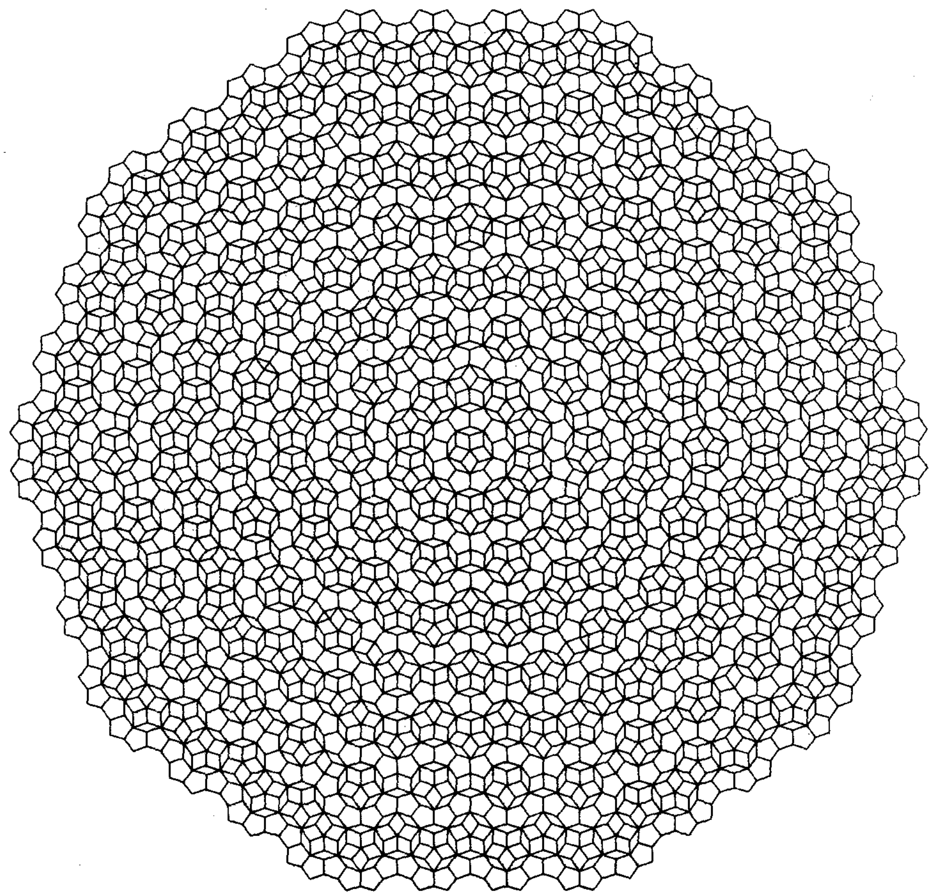

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SYMMETRY IN SYNCHRONOUS TIME AND INFORMATION IN ASYNCHRONOUS TIME

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Abstract: *Symmetries are discernible if time is taken to be globally synchronized. In contrast, information materializes itself in locally asynchronous time. Information also has the agential capacity of transferring locally asynchronous time into globally synchronous one, while constantly generating the asynchronous time to be transferred. Mechanics in globally synchronous time like Newtonian mechanics is simply a consequence of information in locally asynchronous time.*

1. INTRODUCTION

The role of time in the idea of symmetry is multifarious. Representing a symmetry of whatever sort assumes an operation that preserves the symmetry. The time coordinate along which the invariant operation proceeds is the one that has been so defined as to preserve the symmetry property as such (Wigner, 1964). Various invariant principles met in physics happens to be this case, in which time is taken to be homogeneous in that time possesses the symmetry that it is the same everywhere. The symmetry known as the homogeneity of time thus underlies whatever symmetries whose invariant representations may be claimed to exist. Despite that, the idea of the homogeneity of time is not a consequence of another symmetry lying on the much deeper level, but a theoretical proposition at best. The issue here is on how one could legitimize the notion of the homogeneity of time and on what ground.

Suggestive of the need for further scrutinizing the symmetries based upon the homogeneity of time is an occurrence of variations in symmetry properties as met in evolutionary processes both in nature and culture (Depew and Weber, 1994). Variations and breakings in symmetry in time are incompatible with the homogeneity of time in that the very homogeneity has been lost in time. One thus comes to face how time could become homogeneous on the one hand and inhomogeneous on the other. This problem is, of course, not new and goes back at least to the seventeenth century (Leydesdorff, 1994).

2. GLOBALLY SYNCHRONOUS TIME

From the absolute certainty of a thinking being who cannot doubt doubt itself, René

Descartes concluded the certitude of the external physical world that is exclusively mechanistic without direct reference to the notion of time while addressing the matter of compound motion and communication in external material bodies (Leydesdorff, 1994). This infallible conclusion on dualism, however, does not squarely face the issue of how the communication could actually proceed among those material bodies while restricting the capacity of perception only to Cartesian subject. In view of the fact that any communication proceeds in time, Gottfried Wilhelm von Leibniz phrased the difficulty Descartes met in the form of question of how to achieve synchronization of time between two separate clocks. In order to achieve the synchronization, Leibniz perceived only three alternatives of relying upon an intervening physical means, under the supervision of an immaterial agency, or due to the internal precision of each clock (Leibniz, 1698). An essence of Leibniz' question is in how to accommodate communication to mechanics.

Conflicts latent in the complex of communication and mechanics reside in that both proceed in time, while either one of the two is supposedly completely separated from and independent of the other. It is intrinsically impossible to answer the question of how material bodies move mechanistically while they are involved in communicating with each other. Passive and determinate motion in mechanics is simply incompatible with contingent motion in communication. Mechanics can remain legitimate only when it dismisses the issue of communication altogether. As a matter of fact, one great endeavor for dismissing the matter of information that may interfere with the operation of mechanics has been attempted by Isaac Newton, who came up with the notion of globally synchronous time without referring to any external reference. In his own words, Newton (1687) said:

> "I do not define time, space, place and motion, as being well known to all. Only I must observe, that the common people conceive those quantities under no other notions but from the relation they bear to sensible objects. And thence arise certain prejudices, for the removing of which it will be convenient to distinguish them into absolute and relative, true and apparent, mathematical and common.
>
> Absolute, true and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration; relative, apparent, and common time, is some sensible and external (whether accurate or unequable) measure of duration by the means of motion, which is commonly used instead of true time; such as an hour, a day, a month, a year."

That is Newtonian absolute time. Global synchronization of time guarantees equality between any mechanistic cause and its effect at every moment globally, in which no material means are required to communicate between the cause and the effect. Conflicts between mechanics and communication in temporal domain can exhaustively be lifted only in the limit that communication takes no time, and global synchronization of time at every moment is just a practical embodiment of the communication taking no time. Communication taking no time would, however, be a form of an instantaneous communication on a global scale, which Leibniz had absolutely rejected at the time well before it came to be known that nothing propagates faster than light does (Leibniz, 1698).

What would effectively be deemed to propagate at an infinite velocity in mechanics is force acting upon movable material bodies. If force is defined uniquely in terms of the coordinate of material bodies in motion as in the case of Newton's gravitation, the force thus defined would instantaneously follow the displacements of those bodies even if the latter displacements are transmitted at a finite velocity. Newtonian mechanics is not mechanistic enough in admitting non-mechanistic agency in facilitating an instantaneous communication of changes in force at a distance. This observation was due originally to Christiaan Huygens (1690). In this regard, Leibniz (1698) made a remark:

> "I have been amazed that Huyhgens and Newton assume the existence of empty space. However, this can be explained from the fact that they have persisted to discuss in geometrical terms. More astonishing is it still for me that Newton has assumed an attraction which does not work by mechanical means. When he states with respect to this issue that the bodies attract one another in terms of gravitation, then should this not be discarded — at least, with respect to the observable interactions among the large bodies in our world system — although it seems that Huyghens also does not completely agree with him."

The essence of the criticism on Newtonian mechanics by both Huygens and Leibniz is that force in mechanics is not mechanistic enough.

Needless to say, when Newton's mechanics is supplemented by the notion of force field, the resulting field theory could seem to resume, at least in its outlook, the mechanistic closedness as admitting the propagation of changes in force at a finite velocity. Field theory is undoubtedly grounded upon the availability of globally synchronous time, since time appearing in the expression of the interaction between material particles and their force field is a parameter allowing in itself a definite transformation to anywhere in the underlying space-time coordinate space. Time appearing in the field theory has the capacity of being synchronized globally if properly transformed. Even if Newtonian absolute time specific to Galilean transformation cannot survive in special relativity, Lorentz transformation certainly provides a means for how to globally synchronize those relativized times unique to their own local coordinate systems.

Nonetheless, field theory of interacting particles raises more questions than it could answer, since those interacting particles serve as both generators and detectors of the field of concern. In particular, detectors have been taken to be something that could go beyond mechanics in that they remain indifferent to whether they receive no signal or there is no signal to receive (Matsuno, 1985, 1995). Such intrinsic indeterminacy latent in any detector is foreign to mechanics because in the latter everything in motion is claimed to be determinate irrespective of whether or not detectors are there (Rössler, 1987). In order to be faithful to the spirit of mechanics, on the other hand, those generators and detectors formed internally have to be renormalized into mechanistic terms.

Quantum electrodynamics certainly provides such a possibility of renormalization with regard to both electron's mass and electric charge, of course, at the cost of separating time into the microscopic and the macroscopic. Renormalization of an electron's mass and electric charge in QED assumes an infinite time series of perturbation expansions. This implies an infinite time duration on the microscopic time scale, while the renormalized parameters are taken to be legitimate at every moment on the macroscopic scale. Compatibility of an infinite duration on the microscopic with an instant on the macroscopic underlies the feasibility of renormalization. The reverse, however, does not necessarily hold. Only when the compatibility of the two different kinds of time is guaranteed on some grounds, the renormalization scheme could work. Otherwise, the problem with detectors of internal origin could not settle solely within the framework of mechanics. At issue is a communicative nature of force to be met in mechanics (Matsuno, 1985, 1989).

Force defined in Newton's second law of mechanics by itself does not specify how force could be communicated, either instantaneously or sequentially in time. Of course, the second law expressed as $f = ma$, in which f is a force acting upon a material body carrying its mass m and a is the acceleration, indicates that the right hand side remains invariant against time-reversal because the acceleration is the second-order derivative in time, while the force on the left hand side remains indecisive about its nature with regard to time-reversal. Phenomenological irreversibility of evolutionary processes in nature points to the absence of time-reversal invariance with those forces that have been responsible for molding actual material participants in evolution. Forces that would lose time-reversal symmetry cannot be expressed in terms of those coordinates of moving material bodies, because in the latter the forces remain invariant against time-reversal. Difficulties with the notion of force reside within the lack of a definitive and decisive scheme for its description, since the degrees of freedom intended for describing forces cannot necessarily be identical to those of the coordinates of physical objects in motion.

One likely supplement for describing what force is all about is through its measurement with the use of an apparatus provided externally. Even if the coordinates of physical objects in motion are not good enough for describing the forces acting upon themselves, the external apparatus can provide an additional set of coordinates making external measurement of those forces feasible. This association of internal and external coordinates refers to a remarkable agency latent in the notion of force itself. Unless mechanistic stipulation letting force be a state function of the given coordinates of physical objects in motion is forcibly imposed, force defined in the second law of mechanics comes to maintain the capacity of creating or destroying the coordinates of motion even in the middle of motion itself. Globally synchronous time admits only the case that force is globally definable at every instant and the coordinates of physical objects in motion remain invariant.

3. SYMMETRY IN GLOBALLY SYNCHRONOUS TIME

One great advantage of assuming globally synchronous time as in Newtonian mechanics is a guaranteed self-consistency in describing the resulting dynamics. An invariant set of the coordinates of motion is taken to be a necessary and sufficient condition for defining and describing the force acting there. Any local part of the dynamics adapts to all the rest at every moment because of the guaranteed self-consistency on a global scale. Adaptation between parts and the whole is already implicit in globally synchronous time. Adapting and being adapted are symmetrical between the two because they are interchangeable, while the physical operation of interchanging adaptive parts still takes place in time. Adaptation in globally synchronous time underlies the symmetric operation that leaves the adaptation invariant. In other words, globally synchronous time can uphold various symmetries pertaining to adaptation between the local and the global.

Temporally translational symmetry of motion in mechanics, for instance, yields the invariant principle of the conservation of energy, in which globally synchronous time guarantees translational interchange of the temporal coordinate while maintaining the motion invariant. Likewise, the conservation of linear momentum is a consequence of spatially translational symmetry of the spatial coordinate. Global synchronization among all the participants in time can thus serve as a cause of symmetric operations and the resulting invariant principles. Symmetric operations refer to a topological relationship that leaves those mutually adaptive participants invariant. Mechanics certainly provides a case of global synchronization in time (Gunji, 1995). However, global synchronization is by no means limited to the case of mechanics.

Mechanics is grounded upon global synchronization of all the material objects involved in motion. In particular, such global synchronization has to presume a similar global synchronization in description, otherwise those material participants could not be identified as such. Prerequisite to mechanics is the descriptive scheme allowing global synchronization. In view of the fact that any legitimate description is supposed to be both internally consistent and uniquely definite, mechanics certainly provides such internal consistency and uniqueness of occurrence thanks to globally synchronous time. Nonetheless, mechanics is not the sole means for implementing global synchronization in description. Recorded historical events are another type of objects that could assume global synchronization in description, irrespective of whether or not their occurrence may be mechanistic.

Once events in the past are incorporated into the descriptive record, each one of them is taken to adapt itself to all the rest. Otherwise, the notion of the record would lose its integrity. When time is referred to in the record like in a chronology, its global synchronization has to be admitted (Rosen, 1991). Unless a globally synchronous time is available, no chronology could survive. Put differently, insofar as chronology of whatever sort could be available, a globally synchronous time would be a consequence. Moreover, the likelihood of such chronology presumes global synchronization in description in the first place. No objects failing in global synchronization in description could find themselves in the chronology. Descriptive history is always for the winners, not for the losers, because the losers cannot survive in the chronology with the winners in a synchronous manner. The losers cannot be descriptive objects that could participate in global synchronization in description with the winners.

Globally synchronous time in description can certainly serve as a vehicle for upholding symmetric operations that could survive in the record. Those survivors in the record are mutually adaptive in maintaining the whole descriptive integrity supporting the global consistency of the record. Geometrical symmetries exhibited by developing organisms such as a mirror symmetry of a biological body point to the stability of geometrical symmetric operations in developmental processes. Those geometrically symmetric operations are by definition mutually interchangeable through appropriate transformations belonging to the operations themselves. Globally synchronous time in description makes each descriptive object adapt to the context. Existence of a consistent context is a consequence of globally synchronous time in description, in the latter of which both arbitrarily local and global description coexist in a mutually consistent manner. Fitness of each local description to the context owes itself to globally synchronous time in description.

Consistency in the record is historically unique in the sense that the record could not be otherwise. Symmetries residing in historical uniqueness point to an occurrence of invariant structures to be extracted from and embedded in a uniquely historical context. Historical uniqueness, however, cannot be equated to mechanistic uniqueness, and in the latter globally synchronous time is claimed to persist even without referring to any external reference. Symmetries in mechanics survive in the manner being independent of the perspectives the concerned observers take, while those in the record survive only in the eyes of the historical winners. Moreover, the historical winners are at most contingent upon how historical development unfolds itself. There thus arises a conflict in symmetries whether or not they are contingent. In order to cope with the matter of contingency with regard to symmetries, the relationship between two types of globally synchronous time has to be elucidated; one is in mechanics and the other in describing the record. At issue is how globally synchronous time could come to generate and support itself.

4. LOCALLY ASYNCHRONOUS TIME

Symmetries could survive if globally synchronous time is available whether in mechanics or in the irrevocable record, but the globality of time is a consequence of applying a certain procedure to time itself. For the notion of time has historically been conceived of in relation to its external reference. It is of course one thing to claim globally synchronous time without any external reference, but quite another to justify its complete immunity and independence from external references. Although the hypothesis of absolute time without recourse to external references is completely legitimate theoretically, this theoretical legitimacy alone does not prohibit us from raising the issue of its empirical legitimacy. Noting that time has been conceived in the first place as a correlate with dynamics has been exhaustively relational in its implication. Time is identified in relation to changes in a moving body as much as the latter changes can be measured in terms of time. The mutual closedness between time and dynamics, though legitimate in its own light, does not however address how dynamics could proceed in time nor how time would behave in dynamics. In this regard, time in mechanics has paved the way for analyzing dynamics in terms of time without being entrapped by the futile self-circularity. Nonetheless, the cost for adopting globally synchronous time in mechanics is to deprive time of the capacity of relating itself to others.

Relational time compared to absolute one is strictly local in the sense that the act of relating one thing to another cannot be global (Matsuno, 1993; Matsuno and Salthe, 1995). Relational activity presumes the act of specification and identification. For instance, relating the movement of a clock to the passage of time there requires identification of the specific displacement of the movement that the clock exhibits. And the origin of agential capacity of identification is sought within relational time in itself. In other words, relational time materializes only in agential capacity of identification that is local. Once one admits that time is about empirical events more than anything else, it would first be required to elucidate how such agential capacity latent in relational time could come up with globally synchronous time in the record. Conversely, globally synchronous time in the record is the necessary condition for any empirically legitimate record to survive by itself. The issue now is how could it be possible to precipitate globally synchronous time in the record from local times that are necessarily asynchronous among themselves.

Globally synchronous time in mechanics is not conceptually closed in that force defined there is not mechanistic as evidenced in the critiques of Huygens and Leibniz. Although it is mechanistic in relating the action of force to the cause of a mechanical displacement of a movable body, mechanics is not mechanistic in seeking the cause of changes in force itself. This non-mechanistic stipulation upon force is, however, not the intrinsic property of force itself, but simply a consequence of applying the notion of globally synchronous time without recourse to any external reference. Force defined in the second law of mechanics does not exclude the possibility that force may also be due to other than those displacements of movable bodies the latter of which are unquestionably caused by the force. How force is caused in the first place is left open in the second law. Although it defines force, the second law of mechanics does not cause force. Further scrutiny of the causative factor of force has to be sought somewhere other than in the second law. One such candidate may be in the third law of mechanics (Matsuno, 1989).

The third law of mechanics stating the counterbalance of action and reaction refers to a unique property of force defined in the second law. Newton's own phrasing of the third law (1687) as:

> "To every action there is always opposed an equal reaction or, the mutual actions of two bodies upon each other are always equal, and directed to contrary parts."

is already implicit in allowing the communication between action and reaction. Of course, the actual communication may be dismissed once globally synchronous time is taken for granted, since the counterbalance between action and reaction is synchronous everywhere. Unless globally synchronous time is forcibly imposed, however, the third law addresses a communicative property between action and reaction. As a matter of fact, the communicative property latent in force is explicit in Newton's reasoning of the third law (1687) itself as seen in the following:

> "Whatever draws or presses another is as much as drawn or pressed by that other. If you press a stone with your finger, the finger is also pressed by the stone. If a horse draws a stone tied to a rope, the horse (if I may so say) will be equally drawn back towards the stone; for the distended rope, by the same endeavor to relax or unbend itself, will draw the horse as much towards the stone as it does the stone towards the horse, and will obstruct the progress of the one as much as it advances that of the other."

This explanation is quite pedagogical in figuring out the communicative nature of action and reaction.

In addition, the third law is demonstrated to hold even if those forces that are generative and causative are involved. The third law does not specify how forces could be generatively causative, but definitely points to establishing the counterbalance between causative actions and their reactions. Causative forces, whatever their generative origins may be, are local in the sense that each causative action is at one place at a time and not everywhere at once. Time conceived in the generation of causative forces is necessarily locally asynchronous because the generation is strictly local as dispensing with any means for global synchronization. Causative forces are just synonymous with the occurrence of locally asynchronous time.

Nonetheless, the absence of global synchronization among those local causative forces on the concurrent scene does not disturb realization of their global synchronization in the record. Establishing the record is through a global distribution of the recording apparatuses provided externally, and simultaneity of those distributed recordings is a matter of convention depending upon how each recording apparatus communicates with others. Globally synchronous time in the record is thus with those recording apparatuses provided externally, while it is locally asynchronous time that generates the former. Locally asynchronous time is causative in generating globally synchronous time in the record. The third law of mechanics on the counterbalance between action and reaction in globally synchronous time just points to a consequence of the generative agency latent in locally asynchronous time. In other words, the third law framed in locally synchronous time comes to address the internal activity towards the counterbalance between action and reaction, while the very same third law in globally synchronous time is about the presence of the counterbalance between the two and no more.

Once we admit impossibility of establishing global synchronization in time in a concurrent manner with Leibniz who recognized the similar difficulty more than three hundred years ago, mechanics in terms of globally synchronous time turns up deficient as a model of dynamics in lacking the dynamic capacity of how to come up with globally synchronous time while starting from locally asynchronous one. Any dynamics grounded upon the notion of globally synchronous time or its equivalent faces the similar malaise. Dynamic transference from locally asynchronous to globally synchronous time is beyond the notion of symmetry framed in globally synchronous time. An alternative can be sought in information, because in the latter a local perspective contrasting the known and the unknown is intrinsically laden in its own right.

5. INFORMATION IN ASYNCHRONOUS TIME

The third law of mechanics framed in locally asynchronous time is about the activity towards the counterbalance between action and reaction. This comes to imply that the third law in locally asynchronous time can cope with even those forces that are locally causative and generative like a horse pulling a stone as in Newton's case. Although there is no room for locally causative forces within the scheme of globally synchronous time, the third law does not require it for its own sake. Precisely for this reason, Newton succeeded in devising a convincing explanation of the third law by recruiting a horse that is certainly locally causative when it draws a stone. Only when it is supplemented with globally synchronous time, the third law would come to comply exclusively with potential forces that are globally consistent at every moment. Otherwise, there is no prohibition of those locally causative forces to participate in the third law. The only reminder we have to have in this regard is that forces can have the capacity of acting upon themselves. When an arbitrary local force acted upon by another local force is causatively generative, the third law would imply simply that when globally synchronous time is established in the record, any reaction found in the record counterbalances its counterpart of action also to be found in the record.

Force acting upon a force that survives in locally asynchronous time now allows in itself a certain extent of indefiniteness in the sense that how those causative forces are generative is not pre-determined (Matsuno, 1989). There is lawful indeterminacy about forces to be generated, but those forces transferred to the consistent global record assumes their lawful determinacy instead, because those once recorded remain persistently as they are in an irrevocable manner. There arises an agency connecting lawful indeterminacy to lawful determinacy. That is information (Matsuno, 1984).

Information as an agential capacity is always more than what the capacity has already brought about. Information is indefinitely causative as a mode of dynamics under the scheme of locally asynchronous time, because the transference of locally asynchronous time to globally synchronous one does not stop once got started. Locally asynchronous time with regard to Newton's third law is generatively relational in that each local reaction for the sake of the third law constantly disturbs the otherwise synchronized counterbalance between action and reaction in the neighborhood in local time. Locally asynchronous time is thus constantly associated with some physical activities such as the generation of forces. No instant is conceivable within locally asynchronous time, otherwise its relational activities would be lost.

Lawful indeterminacy in locally asynchronous time is intrinsically dynamic, while lawful determinacy in globally synchronous time is static because in the latter the synchronization refers to each instant in time. Information in locally asynchronous time is about the dynamics of how time would make its own procession. Although it is so deep in our culture to conceive time as something that makes its procession without recourse to any external reference, information addresses itself to the dynamic underpinning of the very procession of time. This distinguishes information from symmetry in that symmetry is only about lawful determinacy in globally synchronous time. Information can generate symmetry as much as locally asynchronous time can do globally synchronous one in the effect, but not vice versa. Lawful indeterminacy in motion intrinsically goes beyond lawful determinacy in stasis.

As far as the finished lawful determinacy is concerned, globally synchronous time in the record enables to furnish its descriptive consistency on the global scale. Each local part adapts to all the rest in the record. The interchangeability between adapting and being adapted guarantees a consequent symmetry. However, once one takes each local part to be a representation of an actor which is responsible for constantly transferring locally asynchronous time into globally synchronous one, the actor would turn out to be an internal agent carrying the capacity of doing measurement, of course, in locally asynchronous time.

The case of internal measurement would duly be dismissed if only globally synchronous time is taken. As a matter of fact, even if one may say that replicating DNA molecules appearing in the biosphere on the earth are doing nothing other than promulgating themselves, this does by no means imply that those DNAs would be internal agents striving selfishly for their own sake (Dawkins, 1978). Quite the contrary, those DNA molecules are simply a representation of some local parts found in a globally consistent description of the biosphere in globally synchronous time. Once the term replicating or replication is accepted in a globally consistent description of whatever sort, those replicating fastest would naturally come to dominate over other alternatives.

The situation, however, would drastically be changed if DNA molecules are the dynamic participants in locally asynchronous time. They would become internal agents for transferring locally asynchronous time into globally synchronous one. This agential capacity is seen at least in realizing various invariants that are synonymous with establishing globally synchronous time as with Newton's third law on action and reaction or the principle of the conservation of energy. Locally asynchronous time makes the material participants appearing there to be internal agents carrying the capacity of doing measurement internally (Matsuno, 1989).

A similar relationship between locally asynchronous time and globally synchronous one is seen in competing individuals and their fitness landscape (Kauffman, 1993). Since the notion of fitness landscape assumes the possibility of global description in globally synchronous time, the landscape itself would remain legitimate even if it varies in the global time. It would be legitimate to say that as those individuals move, they change everybody else's fitness landscape while everyone's motion changes their landscape. However, once one switches from globally synchronous time to locally asynchronous one as the basis of evolutionary dynamics, the notion of fitness that has to be global can be no more than a derivative of local dynamics in asynchronous time. Fitness and its landscape could remain legitimate only in globally synchronous time.

Selfish genes and fitness optimization are thus examples of extremely economical expression for the global consequence of information in locally asynchronous time. As following the similar line of argument in essence, Shannon introduced information in globally synchronous time by positing the agential capacity of doing measurement outside the descriptive scheme. A greatest advantage of information in globally synchronous time is that it enables us to cope with information globally at every moment. It is possible to assign information to the state of a system in which no agential capacity is allowed to survive. But, the cost is dismissal of the generative capacity of information, because globally synchronous time cannot be generative from within. Shannon's information certainly distinguishes lawful determinacy from lawful indeterminacy in its conceptual framework, while there is no bridge between the two because of the forcible elimination of agential capacity of doing measurement internally. Only when time is taken to be locally asynchronous, information could attain fuller implication that it deserves.

6. CONCLUDING REMARKS

Contrast of symmetry and information urges us to re-examine the nature of time, because it underlies both. If globally synchronous time as envisaged in Newtonian absolute time is taken to be most fundamental and irreducible, the notion of symmetry would also remain invincible as the basic category for describing various objects in the outside world. Moreover, critical philosophy of Immanuel Kant endorses the absoluteness of Newtonain time by associating it with an *a priori* category for us that makes our perception and description of the outside world feasible. Time in mechanics that could be describable is consistent with time as an *a priori* category prerequisite to any external description. In other words, appraisal of locally asynchronous time is to go against the mechanistic tradition that has survived Kantian critique.

At issue is whether globally synchronous time could be the only legitimate scheme of time for describing the outside world in dynamic motion. What we have observed in this regard is that globally synchronous time is a sufficient condition for realizing such legitimacy, but not a necessary condition. Even if globally synchronous time is a consequence of something else, descriptive consistency could be maintained. For any description refers only to what the act of describing has completed. It is this posteriority of globally synchronous time that makes locally asynchronous time also legitimate. Information is just the capacity of transferring locally asynchronous time in the making into globally synchronous one in the record, and symmetry is to be found in the latter synchronous time. A legitimate contrast of symmetry and information can be made only in the recognition that symmetry in globally synchronous time is a derivative of information in locally asynchronous time.

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