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Which of the two? - Knowledge or time

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Knowledge and time, truth versus falsehood, unity versus dualism, these and the like are the subjects for philosophical discourse in the light of the two contrasting worldviews of unity of knowledge versus rationalism. The emerging formalism also leads to practical considerations in the circular causation model of unity of knowledge. The Qur'an is invoked in this formalism to build the arguments underlying the analysis that follows in comparative perspective. This cultural diversity of intellectual discourse unravels the realism of the arguments taken up here in respect of what delineates the primordial reality - knowledge or time? In the Qur'anic sense, knowledge and time are circularly interrelated within the episteme of unity of divine knowledge. But the functional ontology, which establishes the phenomenology of unity of knowledge, is an exercise in logical formalism. This is taken up here. The arguments proceed through a labyrinth of mathematical philosophical discourse combined with facts from the philosophy of economics. A quantification of the idea in respect of the viability of the model of circular causation between complementary (unifying) entities is tested out. The results establish the practical possibility of the phenomenological model of unity of knowledge, explained in terms of its internal dynamics in the context of the circular causation and the complementary nature of interrelationship between knowledge and time in the philosophical part of the paper. The concept of knowledge, time and spatial entities, jointly comprising the topological mapping of and between multi-systemic events, is developed technically in the paper. It is extended to a technical appendix as well.

Key words: Epistemology, methodology, formal systems, philosophy of science, *Qur'an*.

INTRODUCTION

We bring out the contrast between primitive precepts - knowledge and time, unity of knowledge versus pluralism as these conflicts emanate in the perspective of rationalism but not the Qur'an. We then pose the question, which of the two categories primordially explains total reality of the epiphenomena. The concept of epiphenomenon is meant in the sense of Husserl (Lauer, 1965) as the merging together of Kant's noumena with phenomena, thereby constituting an integrative and inseparable precept of reality. Such an attribute of unity of knowledge and its influence on the experiential world is our definition of reality. In the context of this meaning of epiphenomenon, if God is explainable in the concre-scent (Whitehead (Griffin and Sherburne, 1978) refers to the concre-scent also as 'concre-scent unison', 'unison of becoming' (p. 124).

"This community of concre-scent occasions, forming M's immediate present, thus establishes a principle of common relatedness, a principle realized as an element in M's datum. This is the principle of mutual relatedness in the 'unison of becoming'." (p. 124).

Human agency, then He is the true reality (Whitehead et al., 1978), although we do not perceive God. Likewise, if the divine law is the indispensable foundation of any and all episteme then it becomes a universal (Foucault et al., 1983). Foucault defines the term 'episteme' in the following way (author's editing).

"By episteme we mean ... the total set of relations that unite, at a given period, the discursive practices that give rise to epistemological figures, sciences and possibly formalized systems ... The episteme is not a form of knowledge (connaissance) or type of rationality which, crossing boundaries of the most varied sciences, manifests the sovereign unity of a subject, a spirit, or a period; it is the totality of relations that can be discovered, for a given period, between the sciences when one analyses them at the level of discursive regularities" (Dreyfus and Rabinow, 1983).

In regards to such implications writes Palan (2000) "... certain social categories, such as the 'nation', the 'people', 'God', which are admittedly hypothetical entities in the sense that no one has seen them, are matters of

faith rather than fact. And yet, it is impossible to deny that such hypothetical entities shape our social world to a considerable extent.”

Focusing on knowledge and time, the *Qur'an* brings out the circular continuity between these two entities in reference to entities of the world-systems in constructing the framework of reality. The divine knowledge and the law are set primal in reality in the *Qur'an* (6:59). In contrast, the human conception of time as a temporal flow is replaced by the conception of transcendental time as equivalent to the divine knowledge. Its impact on world-systems existed even before man was a recorded entity. (*Qur'an*, 76:1). But this ontological attribute is not shared by the temporal time flow. Besides, the human dependence on time as a primal and singular deterministic factor is equated with ignorance. (*Qur'an*, 45:24).

Objective

Our objective in this paper is to attempt an answer to the following questions. Which of the two - knowledge or time - determines the primordial state of all causation? Which of the two explains the dynamic processes of world-systems in which the human agency reasons, cognizes and constructs inferences from? We will answer these questions in the light of a phenomenological study of unity of divine knowledge and its unifying relationship with the world-systems. The concepts of knowledge, time, the world-system and events are thus developed.

We will proffer the answer to the above questions by investigating the two functional relations given below. From them we will deduce which one of the two representations constitutes the foundation of true reality. Note what we mean by true reality that reality which supersedes to explain the universal wholeness. Apart from the precept of true reality, knowledge and time form opposite realities in universal explanations. The latter is the core of the scientific research program moved by rationalism. The *Qur'an* considers this opposing dichotomy as the permanent nature of falsehood. But falsehood is explained by the opposite of truth. Hence truth, falsehood and reality are explained uniquely and universally by the divine law of unity of knowledge as the singular primordial existent.

Initial questions to consider

We pose the question. Is the true reality represented by the relation, $t = F(\theta \in \Omega)$? Here t denotes the flow of time; θ denotes the flow of knowledge as unity derived from the epistemic foundation, Ω ; F is an explainable function denoting an explanation of specific problems within the domain of epiphenomena. Or is the true reality represented by $\theta \in \Omega$ and $\theta = H(t)$? H denotes a functional relation explaining a construct of the same reality within the

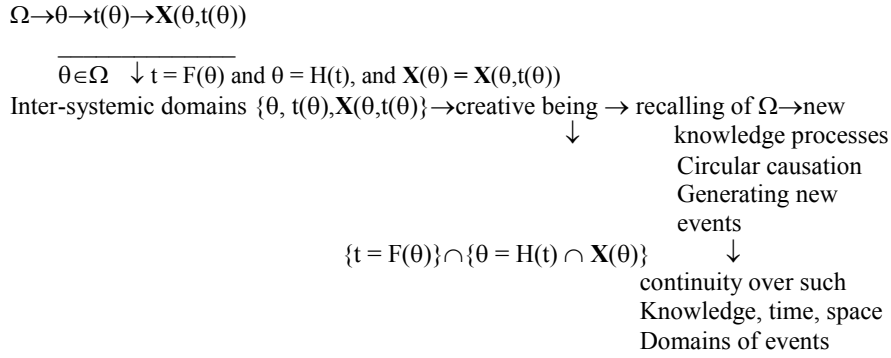
epiphenomena. The explanation of the non concepts of stock and flow of knowledge and the flow of time are taken up as the paper proceeds.

Other questions pertaining to these fundamental ones are the following: Can the two functions be recursively embedded in the context of reflexive experience? If so, then in what ways do these reflexive and recursive relations explain reality in terms of the concrescent epiphenomena? The latter is the ontological question of 'being'. It rests on the merging of the epistemic with the evidential. Imam Ghazzali (Marmura, 1997) remarked on this continuity in the light of unity of knowledge in the following words. "In brief, every event has a temporal cause, until the chain of causes terminates with the eternal celestial motion, where each part is a cause for another. Hence, the causes and effects in their chain terminate with the particular celestial motions. Thus, that which has a representation of the movements has a representation of their consequences and the consequences of their consequences to the end of the chain."

Analyzing the questions

In the context of economic theory, Shackle (1972) investigated such a question of primacy of episteme as novelty. It is caused by continuous learning. His emphasis on knowledge instead of time as the primordial determiner of events can be noted by his criticism of the neoclassical economic objectives of optimization and general steady-state equilibrium, as opposed to the concept of evolutionary equilibriums caused by innovation and learning. Shackle argues that novelty as the attribute of social dynamics ends where optimization and steady-state equilibrium are assumed. The pro-founder question is whether such assumed states of optimization and steady-state equilibriums at all exist? Shackle writes, "Equilibrium is a solution and there is, in the most general frame of thought, no guarantee that a problem which presents itself, unchosen and undersigned by us, will have any solution or that it will not have infinity of solutions. In either case, there is no prescription of conduct."

In the same trend of arguments Soros (2000) argues that reflexive experience between cause and effect within ever-expanding domains of causal interrelationships between observer and events make up the true reality. Soros exemplifies this case to be true and yet missed out of much of economic theory, financial theory and the explanation of historical change. Soros associates the missing place of knowledge as the cause of our social and financial disturbances. Consequently, the circular cause-effect argument centering on the reflexive nature of reality and the perpetual non-optimizing evolutionary equilibrium nature of a cybernetic universe engages the complex explanation of the circular causation relationship between knowledge, time and event. This is, that the consistent and explanatory reality in its totality, is established jointly by the reflexive and recursive expressions, $t = F(\theta \in \Omega)$ and $\theta = H(t)$, with $\theta \in \Omega$.



Scheme 1

At this outset of the philosophical discourse that follows we define the central nature of $\theta \in \Omega$. What is Ω and its interconnecting role in the recursive, reflexive and continuous relationship, $t = F(\theta \in \Omega)$ and $\theta = H(t)$, with $\theta \in \Omega$? Hence how does the continuously evolving domain of events in every world-system denoted by $\{\theta, t(\theta), \mathbf{X}(\theta, t(\theta))\}$ occur in experienced, observed and recreated reality in the world-systems? Bold \mathbf{X} denotes vector variable.

We characterize Ω as the super-cardinal topology (Maddox, 1970). It is non-denumerable, non-configurative and non-commensurate. Yet it is the abstract being that explains all causations. It is thereby the complete and absolute stock of knowledge that spans over all knowledge that arises from it and in relation to which, all entities acquire their attributes of being and becoming. The root of all explanations, the true reality, is thus the causation by the law emanating from the fundamental source, which is Ω .

Ω is explainable in terms of mathematical topology by its unbounded and open nature of the all-encompassing knowledge space in relation to time and the world-system. Besides, the mappings as relations that emanate from Ω , generate the entities as observed, measured and continuously learning variables of experience, existing in time, denoted by $\{\mathbf{X}(\theta, t(\theta))\}$. Now every pairs of elements (entities) in this vector are interrelated by the mathematical union and intersection of the sets generated by the mapping of the elements in diverse ways. Besides, the specific mathematical categories denoted by the whole space Ω , and the null space ϕ also belong to the domain of the totality of all mappings created by Ω .

Hence Ω is the domain of the divine law as the perfect, absolute and complete stock of knowledge spanning all laws, relations and the creative order of being and becoming. The property of openness and unbounded topological space that determines every other thing is the limiting space of all events. Hence, Ω is the super-cardinal manifold governed by the divine law. Rucker (1983) refers to this kind of super-cardinality as 'large cardinality'. It is an extension of the cardinality concept of numbered infinities in Cantor's theory of transfinite numbers (Cantor, 1955).

The occurrence in any world-system and thereby, multiples of these in complex relationships, each entity with many and many entities with one, in respect of any experience in reality, is denoted by $(\theta, t(\theta), \mathbf{X}(\theta, t(\theta)))$. This element of its vector bundle means that the super-cardinal topology determines by its embedded episteme of the divine law, the moment when an event occurs and is recorded. Moment and recording are the functions of time, once knowledge has opened up the gates of possibilities for the world-systems with their diverse issues, problems and experiences to be recorded in time. The learning point of the universe that spans 'everything' (Barrow, 1991) is an example of the vector bundle denoted by $\{\theta, t(\theta), \mathbf{X}(\theta, t(\theta))\}$. The space spanned by this vector bundle forms a complex nexus of interrelated entities, all explained in the primal sense by Ω .

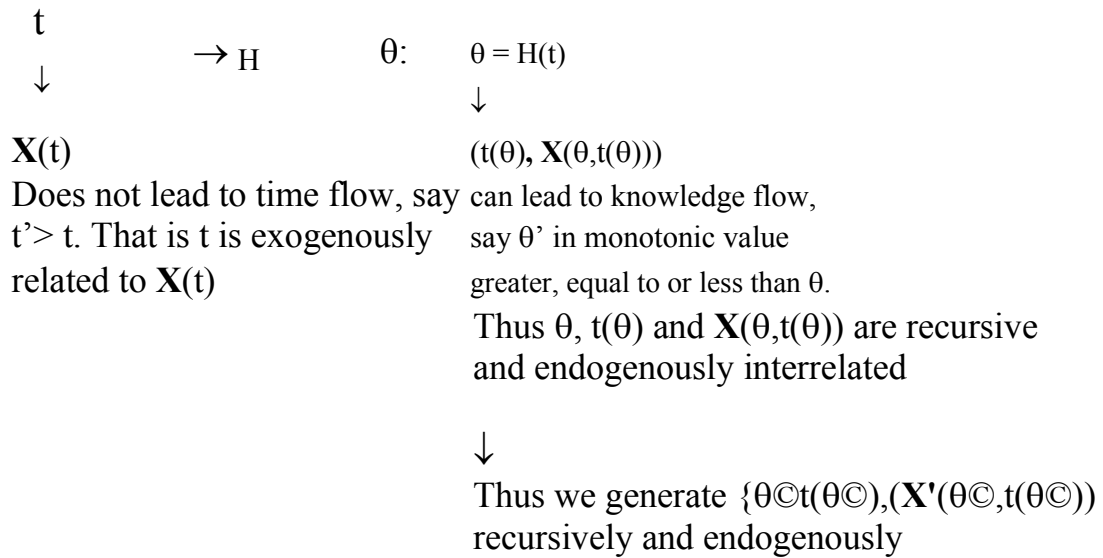
We write the recursive interrelations between θ and $t(\theta)$ that unravels the possibilities $\mathbf{X}(\theta, t(\theta))$ by the following chain relation, which can be generalized to multidimensional spaces (Scheme 1).

Knowledge as process

Like the above-mentioned authors, Choudhury and Korvin (2002) have shown that the time-dynamic solution of the optimal control theorem breaks down in the context of treating the following tuple, $\{\theta, t(\theta), (\mathbf{X}(\theta, t(\theta)))\}$ across overarching and evolutionary domains denoted by $\{.\}$, with $\theta = \lim_{i,j,k,\dots} \{\theta_{i,j,k,\dots}\} \in \Omega$, i denoting interaction; j denoting variables, k denoting systems etc. Ω is treated as a 'complete' topology (Maddox, 1970) in the large-scale universe, which is denoted by the open domain extension of fixed point mapping, $\Omega \rightarrow \Omega$ (Choudhury, 1993; Nikaido, 1989).

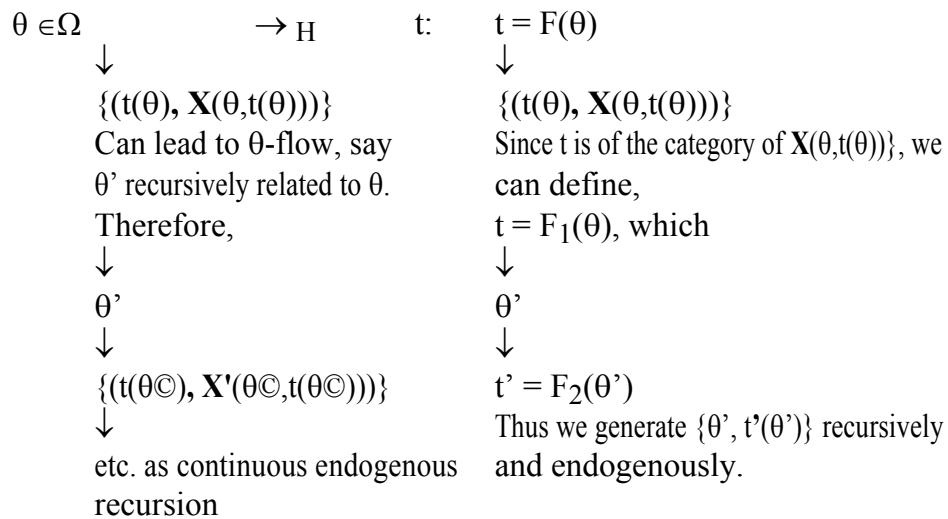
$\mathbf{X}(\theta, t(\theta))$ is a vector of socio-scientific and instrumental variables and their relations. While $(\mathbf{X}(\theta, t(\theta)))$ is defined over complex spaces of i, j, k, \dots yet in the limiting case it (is a convergent function of $\theta = \lim_{i,j,k,\dots} \{\theta_{i,j,k,\dots}\} \in \Omega$. This mapping is the cumulative result of all interactively integrated and evolutionary relations of the type, $\cup_{i,j,k,\dots} f_{i,j,k,\dots}\{\theta, t(\theta), (\mathbf{X}(\theta, t(\theta)))\}$.

Case 1.



If expression (1) was to be true then we would have,
 $t \rightarrow_{H_1} \theta: \theta = H_1(t)$; and independently, $t \rightarrow_{H_2} \mathbf{X}(\theta, t(\theta)): \mathbf{X}(\theta, t(\theta)) = H_2(t)$.

Case 2.



While each of the component $f_{i,j,k...}(\{\theta, t(\theta), (\mathbf{X}(\theta, t(\theta)))\}) \in [\Omega \rightarrow \Omega]$ has a finite cardinality, $\cup_i \cap_j \cap_k \dots f_{i,j,k...}(\{\theta, t(\theta), (\mathbf{X}(\theta, t(\theta)))\}) \subseteq \Omega$ is said to have super-cardinality rather than an infinite cardinality (Choudhury, 2002). This is for the reason that Ω being a topology, it must necessarily establish the relations that remain well defined by each and all of $f_{i,j,k...}(\{\theta, t(\theta), (\mathbf{X}(\theta, t(\theta)))\}) \in [\Omega \rightarrow \Omega]$. This characteristic of the relational order cannot be obtained in infinite cardinal structure (Bauer- Mangelburg, 1967). It now needs to be proved which of the following cases is the fundamental one from which the remaining ones

and itself can be derived and explained as a functional structure to make the emerging methodology and results applicable to an expanding class of problems of world-systems. The three cases are formally configured (Case 1) But since θ , $t(\theta)$ and $\mathbf{X}(\theta, t(\theta))$ are interrelated, 't' would have to be solved as a dependent variable between H_1 and H_2 to establish the relationship between θ and $\mathbf{X}(\theta, t(\theta))$. Hence a contradiction arises between the same t-value being once an independent variable and then again a dependent variable with out a process between this recursion. Thus the representations H_1 and H_2 are

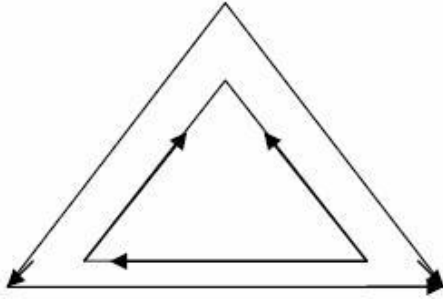


Figure 1. Circular causality in the knowledge-induced domain.

not valid in Case 1. Next we consider the reverse order (Case 2). Time is therefore an endogenous event that is simultaneously determined by knowledge flows within the context of recursion between θ and $\mathbf{X}(\theta, t(\theta))$ values. The two sides of Case 2 are therefore consistent with each other.

Since t is a member of $\mathbf{X}(\theta, t(\theta))$ -vector, the elements of which are also interrelated by endogenous recursion, therefore, t is also endogenously recursive with such elements of the vector as also with θ -values. Hence in this continuously recursive sense the following causality shown by two directional arrows in Figure 1 is true. The third case is treated below.

Time conception

What grounds the conception of time in the recursive causality as shown? Time is seen as the recorder of particular states of the knowledge flows and of the knowledge-induced forms. The vector, $\{(\theta, t(\theta), \mathbf{X}(\theta, t(\theta)))\}$ as shown in Figure 1 then recursively determines the time-flow as an entity. Such a recursive relationship may be linear, in which case θ and t have the same trend and $\mathbf{X}(\theta, t(\theta))$ is simultaneously recorded by the co-existing time flow. Otherwise too, in the case of non-linearity between time and knowledge flows the above-mentioned causality of Figure 1 becomes complex. Examples of such time concepts are relativistic and quantum time (Hawking, 1988) and the arrow of time (Prigogine, 1955).

The *Qur'an* refers to both of these kinds of times inseparably with knowledge values as created entities emanating from the divine roots of Ω , the perfectly unified worldview of the divine law (*Qur'an*, 103; *Qur'an*, 76:1). Since God is the perfection of all knowledge, therefore, only at this primordial level time and knowledge are synonymous. No process is possible at this level of the divine perfection. However, since $\{\theta\} \in \Omega$ as knowledge flow is incomplete, though it carries with it the essence of unity by complementarities between the diverse things, which is the *Qur'anic* principle of creation in pairs, therefore the relations between time and such knowledge flows and their induced variables remain in complex nexus of learn-

ing systems (Choudhury, 2003).

In the end we note the definition of time in the context of our formalism. At the primordial level time and the divine law are equivalent to the knowledge of God. This is the super-cardinal nature of time as the primal ontology (Heidegger and Hofstadter, 1988). But at the relational level of possibilities generated by the divine law, time as flow is embedded as a created entity by the primal causation of knowledge. In temporal experience, this derived flow of time emanating from the primordial ontological origin, is the worldly temporal time as flow. It becomes an entity only in relation to knowledge and the continuous recording of events in interrelated world-systems.

The functional ontology that so defines time as flow is $t = F(\theta)$. Yet the complete determination and explanation of the creative event is done by the functional ontology generating the circular causation relations with interaction, integration and creative evolution. This permanent character of the evolutionary entities learning continuously in knowledge, time and space is explained by $\{t = F(\theta)\} \cap \{\theta = H(t) \cap \mathbf{X}(\theta, t(\theta))\}$.

A further extension of the concept of time as topology in relation to its circular causation with primal knowledge and the contingent events of the world-systems is given in the appendix.

Another possibility for knowledge-time relationship

Next we examine the third possibility of the time-knowledge relationship. The following question needs attention. Can the epistemology of unity of knowledge be premised on any other than the divinely unified most perfect 'super-cardinal' manifold of knowledge, Ω ? If not, then what is the nature of the emanating relational orders that spring from the domain of rationalism and pluralism signified by the time and knowledge domains, being premised on individuated Ω_s , for $s = 1, 2, \dots$?

Competing and dissociated systems with their own independent episteme emerge. This is the case with Darwins (1936) natural selection evolutionism, Marx's (Resnick and Wolff, 1987) over-determination problem, Popper's (1988) refutation hypothesis, Buchanan's (1971) methodological individualism, Wallerstein's (1998) complexity out of chaos, etc. The evaluation of the pluralism of Ω_s , for $s = 1, 2, \dots$ is still done by exogenous criterion of unity of knowledge Ω against the rationalistic pluralism of knowledge domains.

Some contrasting structures relating to knowledge and time

Case 1 given above shows that, if Ω is not the epistemological premise, then t and θ are disjoint categories. Consequently, the following relations will yield the results as shown, which is contradictory in respect to determining the causality as shown by \longleftrightarrow , Inter-

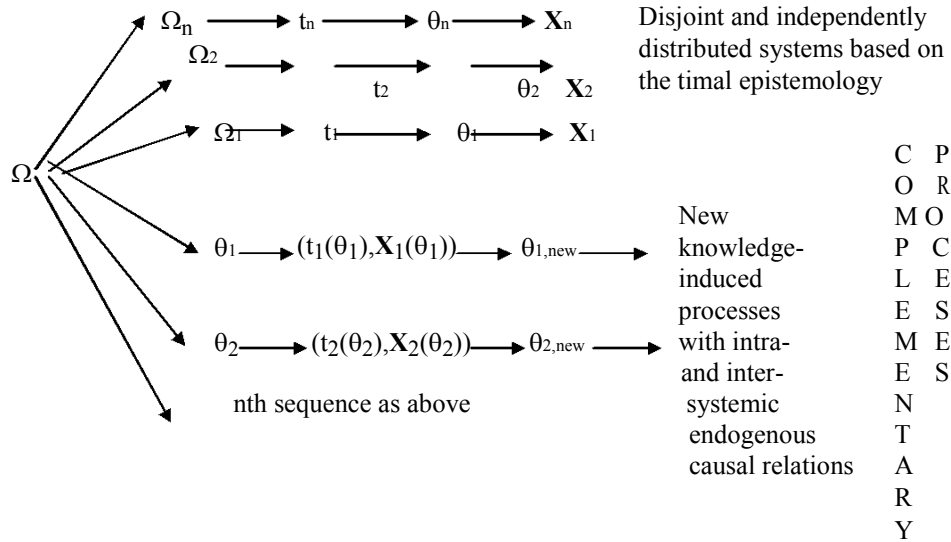


Figure 2. Unity of Knowledge-induced processes versus methodological independence of Timal relations

systemic causality and relationship is denoted by . Hereon, for reasons of simplicity and understanding that 't' is subsumed in the world-system vector $\mathbf{X}(\theta, t(\theta))$. Now leaving the primacy of knowledge in it, we denote $\mathbf{X}(\theta, t(\theta))$ be denoted by $\mathbf{X}(\theta)$ and so for its different cases.

$$t_1 \rightarrow_{H_1} \theta_1: \theta_1 = H_1(t_1); \text{ and independently, } t_1 \rightarrow_{H_2} \mathbf{X}_1(\theta_1): \mathbf{X}(\theta_1) = H_2(t_1).$$

$$\downarrow \quad \quad \quad \downarrow \quad \quad \quad \downarrow \quad \quad \quad \downarrow$$

$$t_2 \rightarrow_{H_1} \theta_2: \theta_2 = H_1(t_2); \text{ and independently, } t_2 \rightarrow_{H_2} \mathbf{X}_2(\theta_2): \mathbf{X}(\theta_2) = H_2(t_2).$$

Yet the above causality is true in the case of the knowledge-centered recursive methodology only, with processes of complementary relations being determined by the law of unity of knowledge governing $\{\theta, t(\theta), \mathbf{X}(\theta, t(\theta))\}$.

Corresponding to expression (1) vectors such as $\{t, \theta(t), \mathbf{X}(t)\}$ will move along independent time-dependent relations. Each of these relations will be premised on independent Ω_s , for $s = 1, 2, \dots$. As mentioned above, Ω_s , for $s = 1, 2, \dots$ is evaluated by Ω .

We delineate this bifurcation process of methodological independence between sequences as follows and refer to it as the intra-systemic endogenous property of independently distributed systems (Choudhury, 2000). Note that notations are simplified.

Between each of the strings of complementary processes there are intricate and extensive causal interrelations () showing the evolution of processes from one chain of the string to another as indicated by the emergence of $\{\theta_{new}, t_{new}(\theta_{new}), X_{new}(\theta_{new}), t(\theta_{new}, t)\}$ and also by the inter-systemic complementarities.

These are of the archetypes depicted in Figure 1.

Aggregation problem

We note the following types of distinct aggregation in the two kinds of realities, namely, unity of knowledge and methodologically independence (rationalism).

For methodologically independent system aggregation over processes is given by the independent summation of series. This is reflected as in the case of Harsanyi explaining all systems is shown by the same type of methodology of recursive (reflexive) evolution and intra-systemic coherence that every system imitates from the nature of

Ω episteme. The difference though is that the Ω_s episteme are independently and temporarily coherent intra-systemically. This temporary organism of its class is followed by continuous bifurcations into independent systems as time carries independent processes along. Such is the case of evolutionism by natural selection of the selfish gene (Dawkins, 1976).

The contrast between the two worldviews is thus shown by the pervasively unifying nature of the principle of complementarities across diversity of complementing entities versus the competing and rationalistic nature of methodological individualism and independence. Within this parting divide, all other details and methods, implications and inferences underlying the two contrasting methodologies, take shape, form and diversity of meanings.

On the other hand, no universal explanation of realities can be obtained by the primacy of time being embedded in its competing and pluralistic Ω episteme. This was proved earlier by the absence of causality of the type shown in Figure 1. However, if by the mystery of time we mean its recursive relationship with primal knowledge flows, then too, Figure 2 explains this within the unified worldview, as shown. Thus the principle of unity in divers-

ity and of rationalism entrenched in pluralism, the world-system constructs are opposite realities. They exist as truth versus falsehood in unity of knowledge and the rationalist worlds, respectively. One judges the other by its own criterion.

The *Qur'an* declares these opposing (5:48; 23:71; 25:33; 21:18) and unequivocal worldviews between truth (unity) and falsehood (rationalism) (2:42; 17:81; 51:10 - 11; 69:51 - 52).

Partial application of the circular causation model

In the light of the recursive (reflexive) circular causation model of endogenously complementary interrelationships that emanate from the phenomenological model of unity of knowledge, we consider here a developmental social well being function in the following variables. Human development index (HDI), human poverty index (HPI), gross domestic product (GDP) and gender development index (GDI). If there are to be complementarities between these as the sign of systemic unity between the variables then there must exist circular causation between them by virtue of the underlying endogenous processes.

In estimating the presence of causality we use log-linear regression equations between rates of changes in HPI, GDP, HDI and GDI variables in order to explain the elasticity coefficients of the dependent variables in terms of the remaining independent variables by means of the coefficients of the log-linear regression equations.

Let, y denote either HPI_k/HPI_{k-1} , HDI_k/HDI_{k-1} , GDI_k/GDI_{k-1} , x denotes GDP_k/GDP_{k-1} , $k = 1, 2, \dots$ being the sequential values of the countries in the selected group as they appear in the human development report (UNDP, 1997 - 2000).

The following results were obtained on estimating by multiple-OLS method the log-linear regression equations shown, using data on HPI, GDP, HDI and GDI (UNDP, 1997 - 2000). The data are for the 'medium-HDI countries'. This particular selection was prompted by the need for having sufficient data. The sample size comprised 50 selected countries in the entire group comprising industrialized, middle income and low-income countries.

The circularly interrelated estimated equations are given below (Equations 1-4).

The above estimated regression results reveal that the relationships between social factors and growth related factors are of a complementary nature individually taken in these groups. But the relations between growth-related variables and social variables are either too weakly positive to be accounted for any significant complementary relationship or are tradeoffs. The debate around the neoclassical tradeoff and thus the inability of such a premise to explain the human development perspective along with poverty alleviation, gender empowerment, entitlement and gender development through a complementary relationship between markets and institutions, is seen to appear for the medium human development countries.

We note from the structurally estimated equation that there exists complementary relationship between the rate of change in GDI (same as $\log(HPI_k/HPI_{k-1})$) and poverty reduction indicated by a negative coefficient of the rate of change in GDI. As GDI increases (decreases) HPI decreases (increases). We obtain similar interrelationships from the structural equations of the circular processes. We note that the social variables (rate of change in HDI, rate of change in GDI) are complementary to each other.

Complementarities among the growth-related variables are also found between the rates of change in HDI (as a function of GDP) and GDP but are very weak.

Tradeoff or weak relationship is shown to exist between the rate of change in HPI and the rates of change in HDI and GDP per capita. The relationship between the rate of change in HDI and the rates of change in HPI and GDP per capita is very weak. The rate of change in GDI is weakly related with the rate of change in GDP per capita, whereas the relationship with HPI is weak. The rate of change of GDP per capita has a tradeoff with the rates of change in HPI and GDI.

The reason for complementary relations between HDI, GDI and GDP per capita is the functional interrelationships among these variables, which all have the common variable, GDP per capita in them. When converted into rates of change, GDP per capita has the highest value among these variables. Thus a complementary relationship among these variables can be expected. Yet in the estimated equations we note that the relationship between the rates of change in HDI and GDP per capita is weak. A tradeoff appears between the rates of change in GDP per capita and HPI and GDI. The relations between the rates of change in the variables show a tradeoff between the rates of change in GDP per capita and of HPI and GDI, whereas a complementary relation between the rates of change of GDP and HDI. This result can be explained by the significant role of GDP per capita in the composite measure of HDI.

We also note that in all cases the results are accepted at high levels of significance of above 40% according to t-statistic. The circular relations among the variables are well specified in terms of the variables included.

However, the low values of R-square reflect that the log-linear form of the compound index model may not have been adequately specified in this form. This is a valid reason for circular causation according to the model of complementarities that negates marginal substitution among variables in favor of complex phenomena that are better amenable to estimation by simulation methods.

The above empirical results establish our case that the economic growth agenda of medium HDI countries being of the neoclassical type, significant tradeoffs or weak relations between economic growth and the social variables are found to exist. The efficiency and equity tradeoff or independence of relationship, is thus confirmed. The structural relations of circular causation in the composite index form a social well being index, establishing thus

$$\log(\text{HPI}_k/\text{HPI}_{k-1}) = 5.210\text{E-}02 + 2.709.\log(\text{HDI}_k/\text{HDI}_{k-1}) - 1.655.\log(\text{GDI}_k/\text{GDI}_{k-1})$$

t-statistics	(0.921)	(0.583)	(-0.619)
Significance levels	(0.362)	(0.563)	(0.539)

$$+ 4.966\text{E-}02.\log(\text{GDP}_k/\text{GDP}_{k-1})$$

t-statistics	(0.753)
Significance levels	(0.455)

R-square = 0.033
F-value = 0.517; Significance level = 0.672

Equation 1. HPI-GDP-HDI-GDI relationship

$$\log(\text{HDI}_k/\text{HDI}_{k-1}) = -6.630\text{E-}03 + 2.706\text{E-}03.\log(\text{HPI}_k/\text{HPI}_{k-1}) + 0.271.\log(\text{GDI}_k/\text{GDI}_{k-1})$$

t-statistics	(-4.367)	(0.583)	(3.619)
Significance levels	(0.000)	(0.563)	(0.001)

$$+ 2.148\text{E-}03.\log(\text{GDP}_k/\text{GDP}_{k-1})$$

t-statistics	(1.031)
Significance levels	(0.308)

R-square = 0.223
F-value = 4.412; Significance level = 0.008

Equation 2. HDI-HPI-GDI-GDP relationship

$$\log(\text{GDI}_k/\text{GDI}_{k-1}) = -1.75\text{E-}03 - 4.990\text{E-}03.\log(\text{HPI}_k/\text{HPI}_{k-1}) - 8.200\text{E-}03.\log(\text{GDP}_k/\text{GDP}_{k-1})$$

t-statistics	(-0.561)	(-0.619)	(-2.370)
Significance levels	(0.578)	(0.539)	(0.022)

$$+ 0.818.\log(\text{HDI}_k/\text{HDI}_{k-1})$$

t-statistics	(3.619)
Significance levels	(0.001)

R-square = 0.297
F-value = 6.491; Significance level = 0.001

Equation 3. GDI-HPI-HDI-GDP relationship

$$\log(\text{GDP}_k/\text{GDP}_{k-1}) = -6.120\text{E-}02 + 0.244.\log(\text{HPI}_k/\text{HPI}_{k-1}) + 10.504.\log(\text{HDI}_k/\text{HDI}_{k-1})$$

t-statistics	(-0.486)	(0.753)	(1.031)
Significance levels	(0.629)	(0.455)	(0.308)

$$-13.269.\log(\text{GDI}_k/\text{GDI}_{k-1})$$

t-statistics	(-2.370)
Significance levels	(0.0220)

R-square = 0.129
F-value = 2.265; Significance level = 0.094

Equation 4. GDP-HPI-HDI-GDI relationship

the importance of such a system that can bring out the developmental tradeoffs and complementarities, as the case may be.

Conclusion

Thus, which of the two is the primal reality - knowledge or time? Substantively they are different and opposite realities in the context of the divide between the epistemology

of unity of knowledge and the epistemology of methodological individualism and independence that together define the character of rationalism. This paper has shown that by virtue of the methodological universality and uniqueness of unity of knowledge, knowledge and time along with events appearing in the knowledge, time, space domains, are circularly and endogenously coterminous with each other in systemic continuums of learning processes. But in such learning process, arises

from the ontology of divine oneness of knowledge. This is then carried through by the constructed functional ontology of being and becoming into its effects revealing, quantifying and establishing the topology of knowledge-induced events arising from the richly complex world-systems. Because of the expanded domain of logical actions of knowledge inducing, all events in every world-system in reference to diverse issues and problems, the episteme of unity of knowledge becomes the ultimate foundations of true reality. Time is the abstract recorder of continuous evolution and change caused by knowledge in the first place.

TECHNICAL APPENDIX

Timal topology and the knowledge induced super-cardinal manifold (Choudhury, 2002)

Abstract and complete time as topology

This is as an element of Ω and is referred to here as Timal topology. It is described by the knowledge, time and space super-cardinal manifold as explained below. Note that we subsume time-flow 't' with $\mathbf{X}(\theta, t(\theta))$ and write the tuple as $(\theta, \mathbf{X}(\theta))$.

First, there is the mapping, $f(\cdot)$ of the simultaneous pair, $(\theta, \mathbf{X}(\theta))$, θ being knowledge value and $\mathbf{X}(\theta)$ being its induced cognitive socio-scientific variable, such that, $f(\theta, \mathbf{X}(\theta)) = 0$ is simulative in θ and $\mathbf{X}(\theta)$ values. Thus $f(\theta, \mathbf{X}(\theta))$

assumes values in \mathbb{R}^∞ , the infinite-tuple real space in the super-cardinal manifold of real values (Dewitt, 1992).

Secondly, the values of $(\theta, \mathbf{X}(\theta))$ assigned in such an infinite-tupled real space become contingency data to knowledge-based events (likewise, de-knowledge-based events). These contingency data are arranged and numbered by the underlying interactions. The interactions are pervasive in nature, since $(\theta, \mathbf{X}(\theta))$ -values are continuous in \mathbb{R}^∞ . This makes the topology, T , continuous.

We then have, 'Zero' $\in T$; T_1 (knowledge) and T_2 (de-knowledge) are disjoint subsets of T . Thus, $T_1 \cup T_2 = T$. $T_1 \cap T_2 \neq \emptyset \in T$ only temporarily in the presence of indeterminacy over the entire T , $T_1 \cap T_2 = \emptyset$. This happens firstly, when specific socio-scientific problems are taken up one at a time and thus indeterminacy, regarding them is removed as knowledge-flow evolves. Secondly, this relation is terminally established in the hereafter referred to as the great event in the Qur'an (*Akhira*) over the totality of all the nexus of trajectories.

Hence, we have natural timal systems of the type which follows: $f_i(\theta, \mathbf{X}(\theta)) \in \mathbb{R}^\infty$, i being ordered values in \mathbb{R}^∞ , denoting interaction corresponding to the attained values of $(\theta, \mathbf{X}(\theta))$ and hence of $f_i(\theta, \mathbf{X}(\theta))$. These values of i are sequential time values determined on the basis of knowledge formation. The timal topology can then be alternatively described as, $T = \{(t_i, t_j)(\mathbf{X}(\theta \cup \theta^-), (\theta \cup \theta^-)) \in \mathbb{R}^\infty\}$, θ^- is the opposite mathematical complementation of θ , such that, t_i

is sequentially measurable and observed ordered interactions, $i \in \mathbb{R}^\infty$; t_j are sequentially measurable but not observed interactions $j \in \mathbb{R}^\infty$. Timal topology as the evolution of knowledge or de-knowledge-induced history and future is thus extended to either the knowledge domain (θ) , or the de-knowledge domain (θ^-) , as the case.

This result thus proves the continuation of t_j even if by the end of temporal time t_i has exhausted itself. The events to follow the Hereafter, as in the *Qur'an*, are determined on the t_j scale of time. Here it is the optimal knowledge-induced enjoyment of *all* things taken separately that describes the optimal well being specific to the goods and felicity so enjoyed. The same argument holds for de-knowledge to the degree of optimality in its own domain of utter falsehood.

The time conversion problem in timal topology

The time conversion problem and its relationship to knowledge-induced well being acquires a central epistemo-logical meaning. Such a formalisation should enable one to positively define the timal problem of the socio-scientific order.

By definition, the flow $F_i(\theta)$ of knowledge at an interaction i is given by, $F_i(\theta) = dT(\theta)/d\theta_i$, where, $T(\theta)$ is the totality of the flows of knowledge $\{\theta\}$ derived from the super-cardinal manifold Ω .

Consequently,

$$\begin{aligned} T(\theta) &= \int_0^{\text{SC}} [F_i(\theta_i) d\theta_i] \\ &= \int_0^{\text{SC}} (\int_0^{\text{SC}} F_i(\theta_i) d\theta_i) di + \int_0^{\text{SC}} (\int_0^{\text{SC}} F_j(\theta_j) d\theta_j) dj \\ &= \int_{\{t_i\} \cup \{t_j\}} [F(i, j)(\theta = \text{SC}) di, \text{ or, } = \\ &= \int_{\{t_i\} \cup \{t_j\}} [F(i, j)(\theta = \text{SC}) dj \\ &= (\theta). \end{aligned} \quad (1)$$

Hence, at the penultimate event of the 'hereafter' we must have $i = j$. All sequentially observed time has been mapped onto sequentially unobserved but measurable time. However, if the above formalization is carried out once again in respect of infinite sequences of finite time horizons instead of over t , where $t = t_i \cup t_j$, then, $T(\theta)$ for each of the infinite sequences of finite time-dependent integrals. Now,

$$T(\theta) = \int_{\theta^*}^{\theta^*} [F_i(\theta_i) d\theta_i] di = \int_{\{t_i\} \cup \{t_j\}} [F(i, \theta^*) di], \quad (2)$$

given a suitable value of F as the integrand of $F_i(\theta_i)$ over θ -values. But $\{t_i\} \subset \{t_j\}$, because the period of cosmic experience far exceeds that of point-wise experience related to interaction in socio-scientific domain.

$$\text{Now, } \int_{\{t_j\}} [F(j, \theta^*) dj] > \int_{\{t_i\}} [F(i, \theta^*) di]. \quad (3)$$

Therefore, $F(j, \theta^*) > F(i, \theta^*)$.

Hence, for every well-defined interaction in the cosmic universe of matter and spirit belonging to timal topology, we can always well-define an observed sequential time. This is

always possible, as interaction j must always exist. Hence, there is always a well-defined relationship between t_i and t_j in timal topology. But since both of these are knowledge-induced precisely from the causal relation of j to i , they will both vary with the knowledge-value, $\{\theta\}$. Hence, for $t \in T$ (timal topology), such that $t = t_i + t_j$, each of the timal values will vary in T .

The implications from these results are that all realities are derived from transcendental time in the *Qur@anic* world-view of the socio-scientific order. With this in terms of the socio-scientific variables that can be induced in the above expressions, the principle of complementarities in its dynamic version must exist. It is the principle of complementarities as an intrinsic character of the epistemology of unity of knowledge and its world-system that conveys increasing well being and the endless reproductive capacity of re-sources in the system.

On the contrary, the same argument when extended to the de-knowledge plane shows that complementarities exists among the entities of de-knowledge trajectories. But there are no complementarities between entities in this system, as the trajectories become increasingly disjoint with the advance of de-knowledge flows and the realization of de-knowledge-induced entities. This delineates the permanent character of rationalism contrary to the episteme of unity of divine knowledge in the *Qur@an*.

Footnotes

¹ Whitehead (Griffin and Sherburne, 1978) refers to the crescent also as 'conrescent unison', 'unison of becoming' (p. 124).

"This community of conrescent occasions, forming M's immediate present, thus establishes a principle of common relatedness, a principle realized as an element in M's datum. This is the principle of mutual relatedness in the 'unison of becoming'." (p. 124).

² Foucault defines the term 'episteme' in the following way (author's editing).

"By episteme we mean ... the total set of relations that unite, at a given period, the discursive practices that give rise to epistemological figures, sciences and possibly formalized systems ... The episteme is not a form of knowledge (connaissance) or type of rationality which, crossing boundaries of the most varied sciences, manifests the sovereign unity of a subject, a spirit, or a period; it is the totality of relations that can be discovered, for a given period, between the sciences when one analyses them at the level of discursive regularities" (Dreyfus and Rabinow, 1983).

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