**Means of cognition and the shifty split between subjective and objective**

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*As the process of formation of knowledge is a perennial concern of philosophical investigation, any systematic study of philosophy, irrespective of Eastern and Western origins, starts with a thorough assessment of our valid means of cognition. Needless to say, that our means of cognitions play a crucial role in scientific knowledge formation also. But the question of delimiting clearly the objective means of cognition from the subject of cognition continues to stimulate epistemological troubles. This has been dramatized after quantum mechanics. Founding fathers of quantum mechanics as well as the philosophers of science continued to reflect upon the enigmatic dividing line between subjective and objective. It was tried to give a purely logico-empirical objective foundation of the whole spectrum of our knowledge including the scientific. This attempt failed! Here we will give a brief overview of the problem area and the current standpoints - whether we have reached any reasonably better consensus nearly after 2000 years of debate on this*.

**1: *Principle of Objectivation* and the troubles inherent in it**

Physicists concern with the *means of cognition* was very clearly formulated by Schrodinger -

“ By this [ i.e., by the principle of objectivation] I mean the thing that is also frequently called the “ hypothesis of the real world ” around us . I maintain that it amounts to a certain simplification which we adopt in order to master the infinitely intricate problem of nature. Without being aware of it and without being rigorously systematic about it, we exclude subject of cognizance from the domain of nature that we endeavour to understand. We step with our own person back into the part of an onlooker who does not belong to the world, which by this very procedure becomes an objective world. ” [1]

Schrödinger’s formulation is actually referred to the epistemological difficulties related to quantum mechanics.

*Principle of objectivation* in its simplest version holds that there is a *real* world objectively *out-there* which is independent of employment of *our* means of cognitions, but this can be known reliably employing *our* generically inherited means of cognition – primarily the sense organs instrumentally augmented or not .But this simple looking principle of *objectivation* has been recognized to be a source of insuperable troubles right from the beginning of what can be marked as philosophical investigations.

Let us have a quick overview of the spectrum of troubles.

**1.1: What is wrong with this obvious looking principle?**

Nothing seems to be seriously wrong with the *hypothesis of real world* so far knowledge about our everyday world of experience is concerned. At least this is what lies at the heart of our everyday way of living which was taken *intact* in our understanding of *scientific realism*. We do believe in a *reality* which is objectively out-there and can be known with the *mediation* of our sense organs.

Philosophers however had never been happy with this naïve realistic attitude. We are not going to reiterate here the arguments philosophers continued to develop right from the systematic beginning of philosophical discourse which can be dated safely back to the beginning of Christian era. Almost all Indian philosophical traditions – notably the *Vedantins* and *Buddhists,* raised doubt about the *reliability* of our standard means of cognition. This is effectively a permanent question mark on *our* attitude about *objective* reality. We need not get here into the prolific details of the Indian Philosophical standpoints regarding *realism,* but only outline a snapshot of the huge Dialog that took place among them regarding the *unreliability* of our intrinsic means of cognition.

In fact the basic issue is about the *way* we access anything we come to know through the *mediation* of something – sense organs, recorded data … whatever. Nothing *is directly observable* even if we have chance to have a direct sensory access to the *object of cognition*. This may sound absurd. How can we disbelieve our built-in sensory mechanism coupled with a cognitive process? This is the very basis of our everyday actions and decisions.

However riddle always resides in the obvious! Philosopher’s argument begins with the fact that we can never have direct access to the *pristine level* of reality, as all knowledge is outcome of *mediation* of something – which is very generally speaking the sensory input followed by a *linguistic network* coupled with some *innate* or *ascribed* (conceptual) meaning. The wide domain of knowledge captured by this network – from everyday common sense reality to the domain beyond, actually bears the signature of this network. Of course the realistic attitude is to acknowledge the role of this *mediating network* as no more than scaffolding - which can be categorically decoupled from the final outcome of knowledge. Of course the mediating network can, in principle, be considered to be a part of means of cognition rather than the *knowledge itself*. But the *knower*, *knowable* and *knowledge are* distinct trio*.* And effectively the *split* between *Knowledge* ( the final and finished product ) and the *means of procuring it* seems to be unambiguously fixed and settled . The dividing line between the *object of cognition* and *cognizer* is not *shiftable*.

However, modern Physics, more prominently after quantum mechanics stimulated a huge debate on these all naïve realistic standpoints – the *split* seems to be *shiftable* and the classical theory of knowledge doesn’t seem to be reliable any more. But there is a brief 19th century prelude to these all …

**2. Late 19th Century reactions against Metaphysics from the physicists**

Late 19th century in the history of Physics is marked by the development of Theory of Heat as well as the Classical Electromagnetic Theory .This was also the time when statistical mechanics in its classical version was drafted for the first time.

 However, amidst all these giant strides, late 19th century European science also developed some typical adolescence syndromes being introspective to the *metaphysical foundations of scientific* realism itself. A few scientists, led mainly by Ernst Mach and Gustav Kirchhoff started bolstering the claim that Physics should not go beyond the domain of *phenomenological* experience. They had derived their ideological guidelines mainly from Kantian concerns about ‘How Metaphysics is Possible? ’**[2]**

 “The *Critique of Pure Reason* ’’, Mach wrote in his *Popular Scientific Lectures* (1896), “ banished into the realm of shadows the sham ideas of the old metaphysics. ” Mach and his followers tried the same surgery upon the then 200 years old Mechanics! A Mechanics or any scientific Theory , they argued , going beyond experience – by speaking , for example , of ‘ Force ’ , ‘ Atom ’ , ‘Electric Fluids’ ….and like , are failing to perform its proper task. Theoretical concepts like these were largely held by them as convenient or conventional constructs, which can be *replaced* by another set leading to same empirical results**.**

 In effect, this was for the first time - nearly after two hundred years of beginning of classical Physics, the paradigm of knowledge itself was questioned from epistemological points of view within Neo-Kantian framework. Effectively this was a question more about the *reliability of the standard means of cognition* in physics. This was a question of critically assessing the very process of *Theory building* itself in physics out of empirical data. What should be accepted as *real*? Or does *real* make any more sense than conventions of different orders? **[3]**

However, the whole issue can be seen to have revolved around the question of how a *guiding metaphysics* configures itself in any physical theory through formalism.

Stated differently - is it really possible to build up the whole body of knowledge of the existing Physics on the basis of an altogether *different set of conceptual schema* as *Macheans* advocated*?* Is it really possible to decouple metaphysics altogether from our theoretical understanding, given the way our *biological nature* had developed as cognizing animals through evolution?

Is it all and essentially about capturing formally the sense of *is?*

Analytical philosophers and the mathematical logicians also took their lead but ultimately ended up in a blind alley**.[4]**

**2.1. Retrospective of a misleading episode of Analytical Philosophy**

 "Moreover, in the Fregean framework, we can't talk about changing Universe; Fregean Universe consists of all that there is and it is fixed."

 *Jean van Hejenoort*, *From Frege to Gödel* , 1966 .

For the philosophical logicians it was a question of providing the concept of ‘is’ a logical room. Following the recognition that Kant's distinction between *existential is* and predicative *is can’t* simply be inferred as a part of the force of *predicative* *is* , Frege introduced *object -concept* divide - *predicates* are concepts that can add something to the notion of *being,* but not always in *existential* sense. As is well known that the main point of Kant’s criticism of ‘ontological argument’ was to show that every *predicative* *is*, *presupposes* its *predicative* sense. ‘*Being’* is obviously not a real predicate, that is to say, it is not a *concept* which could be added to the notion of something. So Frege’s logic *presupposes* the existence of subject; every predicate carries with itself the claim for existence. Frege's view of *existence* is Kantian in that way which implies that we can't talk about objects and their existence directly independent of properties of objects. In fact, in view of the difficulties *to capture* the totality of notion of *EXISTENCE* within the framework of positional logic, Frege hadconceptually split apart the different meanings of ‘*is’* in terms of ‘*is* of *existence,* of *predication,* of *identity,* of *Class-membership,* and of *Class*-*inclusion*/*subsumption,* as the primary ones.

As a continuation of his program of providing logical room of *is*, Frege *reinterpreted* *subject-predicate* logic**,** *replacing* the subject-predicate divide in terms of *object-concept divide* with predicate applicable not to the level of *objects* in isolation, but to concepts designating *class,* and this strategy was implicitly committed to the concept of Set as an extension of predicate in Cantorian sense. This was precisely " the *newness* of the new Logic or its re*-wording* ” which started providing motivating grounds for the analytical philosophers . But as Hejenoort observed that all the late 19th century provisions to accommodate '*is'* in standard first order logic are essentially referred to our *everyday experience* conditioned basically by slowly varying environment of moderate temperature .

This attempt can *be seen* as *one of the final footnotes* to Plato ! In fact, in *the* West, though the *concept of being - as entity with determinate identity*-*condition, has* been criticized by many [like Nietzsche, Heidegger] their criticisms failed to make a clear logical sense.

**2.1.1. Russell's strategy of dispensing with individuals or the level of *re-identifiable permanent* objects.**

Young Russell tried to develop a *classical Theory of knowledge formation*  on the basis of Frege's logic.

But this was fraught with an inherent contradiction. Cautioned by Frege’s treatment of providing the notion of ***is*** a logical room, Russell tried to develop an *alternative* language of description (*Event* Language) not committed to the level of Thing (*-in-itself,* being faithful to Kant's caution that this level is *inaccessible*). Logic was expected to faithfully capture the level of *phenomena* only after the submission of sense data to our perception. This amounts to say that the ontological priority of *individual* was *dispensed with* in favour of implicit epistemic priority.

But the inherent circularity was in what *Hejenoort* mentioned that- “ ... in the Fregean framework, we can't talk about changing Universe; Fregean Universe consists of all that there ***is*** ( stress mine ) and it is fixed." !

So Fregean logical tools can’t be employed to talk about a *changing* universe, as this is faithful to *ontological priority* of unchanging individual itself. This is presupposed...How should one talk about *change* within a framework essentially meant to talk about something *fixed!*

However, *interestingly enough ,* this strategy still continued to provide misleading grounds for Russell to accept Cantor's set theory (securing of course it from paradox of *self reference* which he outlined with Whitehead in **PM** 2008**[5 ]** ) as the basis of his *theoretical epistemology* to make sense of his brand of *Theory of concept -* the way our cognitive knowledge or conceptual universe are developed within our skin boundary simply as a matter of algebra of class forming classes or series of particulars ( sense data) which he even thought possible to be assigned properties which physics assign to matter ! Russell expressed categorically his *Cantorian* legacy.

" ... classes or series of particulars collected together ...on account of some property which makes it convenient to be able to speak of them as wholes , are what I call logical construction or symbolic fictions . The particulars are to be conceived not the analogs of bricks in a building but rather on the analogy of notes of a symphony. The ultimate constituent of a symphony (apart from relations) are the notes each of which last s for a very short time. We may collect together all the notes played by the instrument; these may be regarded as the analogues of the successive particulars which common sense would regard successive stages of one thing. But thing ought to be no more real or substantial than, for example, the notes of a trombone. "

 [Russell, *Ultimate constituents of matter*, 1915]

So, the root of his conviction can probably be traced to what invariably follows our exposure to 'external world' - something which is not an arbitrary *kaleidoscopic* sequence of sensations, but a distinct *ONE* $≡$ *object* (It naturally reminds one of Cantor’s view which defined a Set as *"MANY* which allows itself to be thought as *ONE* ") leading to an awareness of individual as epistemically *prior.*

This was precisely the root of conviction based on various heuristic considerations during the end of 19th century that mathematics can possibly be reduced into logic with Cantor's set theory as its logical basis.

So, for Russell, primarily the strategy was simply to *replace individuals* by possible *logical constructions.* This was expected to be good enough for him to avoid *Individual* as a part of final ontology and at the *same* time admitting its epistemic *priority* as he explicitly claimed:

"... Showing that out of such materials, as are provided by our senses, it is possible to construct classes and series having the properties which physics assigns to matter. Since the argument is difficult and technical, I have not marked upon it in this article." [Russell, *Ultimate constituents of matter*, 1915]

 In fact this was a strategically recurrent theme for Russell as well as Whitehead.

In foreword to the German translation ( made by Paul Hertz , 1926) of *The Problems of Philosophy* Russell wrote *- “* This Book was written in 1911 , but since then my views on some of the subjects discussed here have undergone a significant development. This development results almost entirely from the application of a principle of which my friend Whitehead and I made use in *Principia Mathematica* . In that work we presented grounds for the view that such objects as classes and numbers are merely logical constructions. That is to say , the symbols for such objects have no denotation of their own , but there is merely a rule for their use ; we can define the meaning of a statement in which these symbols occur , but what is meant includes no constituent which corresponds to these symbols .Thus we were led to a new application of the principle called Occam’s Razor , according to which the number of entities is not to be multiplied beyond necessity. Whitehead convinced me that the concept of matter is a logical fiction of his superfluous type , i.e. a piece of matter can be treated as a system of connected events in various parts of the space-time continuum . There are various methods of carrying this out between which it is so far very hard to choose. Whitehead followed one way in his *Principles of Natural Knowledge* and in his *Concept of Nature*; I followed another in my Book *Our Knowledge of the External World*. ”

Though advocated with his usual vigour and speed, Russell did not pursue his program of logical construction to any desired extent it was actually intended for. As a probable reason of this , people usually refer to Wittgenstein's criticism as contained in the ***Tractatus*** *,* 1917.

**3: Russell's Program in Carnap's hand also overlooked this fundamental contradiction**

After Russell gave it up *Carnap* carried this program forward until, as late as the 30s of the last century, it was shown to be untenable.

However, Carnap picked up the thread and carried on Russell's program which resulted famously in *Aufbau(1928).* In***Aufbau*** *(On the construction of the world*, 1927) Carnap tried a full scale application of the logical apparatus he derived from Russell! He tried to show that, how the *whole concepts of science* could be constructed with the help of the logical apparatus of PM on a *Phenomenalistic* basis referring to *elementary* experience. The basic underlying philosophy was of course in the traditional track of Hume and Mach.

Subsequently, Carnap's program being reduced in its *physicalisitic analogue* (1930), looked more like an attempt to construct the code of criteria of valid knowledge, subsuming events, phenomena... and even *Human behavior,* speakable within a full-scale working model of *nominalistic* language devoid of any metaphysical reference. But the program in such an ontologically neutral form diverged greatly , at the same time, away from any semantic possibility; that is to say, from possibility to be endowed with an interpretation to match with the *real physical world* as originally expected by Russell.

This way, Russell's program in Carnap's hand, while being dressed in a formidable formal look, missed many essential features pertaining to Russell's original version of *foundationalism.* It remained doubtful to assess, whether Carnap's formal arrogance left any scope to appreciate the basic underlying *Process* *Realistic flavour*ofRussell' and Whitehead’s program!

Carnap moving further along the formal track, announced in his *Syntax Book* (1935), that philosophy can be replaced by logic of science which is nothing but *logical Syntax* of language of science. [*Logical Syntax of Language* is the title of Carnap’s book.]

**3.1: Gradual decline or failure of different orders to develop a pure Theory of Concepts!**

But within about a decade, the Positivist group having been dispersed in the meantime, Carnap and others felt the need to *liberalize* empiricism with semantics. But the clear sharpness of the program is thought to have been lost by that time. During this period, Carnap realized, chiefly by conversation with Gödel and Tarski that there must be mode, different from *syntactic* one, in which to speak about language. What Gödel did was precisely to have shuttered the *underlying presupposition of Carnap's program in* logically precise terms. Moreover, in the meantime during 1931, Ramsay in *Theory* made it clear for the first time that scientific concepts can't be explicitly defined in terms of *observational reports* as suggested by Russell and by Carnap in his *Aufbau.* Gradually, Carnap himself realized some basic difficulties of dispositional *(Nomological) statements.*

This way the ambitious *reductive ideal* of translating the statements of science in terms of *Logic and observation* can be said to have turned from bad to worse until finally in 1951 Quine, in his celebrated paper *Two Dogmas of Empiricism****,*** made clear what was fundamentally wrong with the original program of Carnap. In the same year, Nelson Goodman, in his *Structur*e *of Appearance, 1951****,*** also showed the particular defects with which Carnap's program was beset.

Developments of logical calculus in Carnap's hand showed how *excessive stress* on formal precision could lapse into new form of scholasticism leading to the blind alley of an epistemic utopia, creating an unbridgeable gap between syntax and semantics. As such, the positivists program was unfortunately based on several large mistakes and misunderstanding, as over the sense of analyticity, role of mathematics as a model of science and like. "The eminent group of Viennese ..." exclaimed Wang, "guided by the confused equivocation of tautology, overlooked the glaring difference between elementary logic and higher order logic including mathematics and thought the complicated physical world to be reducible into first order logic ."[Hao Wang, 1980]

A modest way of putting all these is perhaps to say that any satisfactory way of negotiating between materialistic ontology and empirical epistemology seems to be logically *undecidable — the* route connecting formal or perceptual with its material origin is not logically re-constructible.

**3.1.1: What was finally left as a residue of this philosophical debate?**

It can be easily recognized that the debate revolved around the perennial question – what counts as the ultimate constituent of reality and how to express logically their sense of *is*? Are they *objective atoms of reality* like individual with diachronic identity (enduring objects) or *throbs of experience* as held by Whitehead?

However, admitting throbs of experience immediately calls for the question that “*whose experience?”* and does it admit *translation in logical language* with adequate semantics?

This much was clear that our *conceptually conceived world* can’t be constructed on the basis of a naturalistic compositional semantics of first order logic . It can’t even be reduced to any single higher order logic! The *subjective* and *objective* interface is more enigmatic and less Cartesian than it was thought, and any further sense can be made with reference to quantum mechanics. Though not fully visible yet , but a *quantum theory of cognition* is perhaps in sight. But that is a whole new episode. We can’t get into that within the scope of this article.

We will give only a thumbnail sketch about how the debate was picked up by quantum mechanics...

**4: What happened to the *split*?**

Quantum theory has truly revolutionized our concept of reality .But one of the crucial elements of the lessons of quantum mechanics is fundamentally about measurement process. Quantum mechanics introduces us to a fundamentally new perspective about the question like – *what constitutes a measurement*. Within the scope of this article we can’t get into the formal details of the issue. Effectively this is about the classically held *split* between the *object of knowledge* and the *means of cognition.* As we mentioned that, classically the means of cognition *– our sensory mechanism coupled with measuring apparatus,* is *not* a part of what is *being measured* or cognized. Classical measurement is *un*-problematically a means of procuring some *pre-existing* information about the *system* being *observed* or measured. The *line of demarcation* between the measuring instrument and *what is being measured* is fixed and unambiguous. Classically measured features are non-contextual and can be handled within the framework of commutative algebra or Boolean property structure. But quantum mechanics introduce a formidable difficulty to *fix* this *line of demarcation* leading to the question of *infamous boundary*. Standard quantum mechanics doesn’t prescribe any exact location of the *line of demarcation* between classical and quantum domain. This is sometimes called Heisenberg’s paradox. This led to an inconclusive debate about the status of measuring apparatus (means of cognition) – whether this can be treated *classically* or as an *inseparable* part of the system being measured. That is to say, whether the means of cognition should be treated as something *external* which can be decoupled or it has to be *internalized* in any way. But due to linear nature of Schrodinger’s equation, *internalizing* the apparatus would lead to something like *infinite regress* which Schrodinger dramatized in his celebrated *Cat Paper* (Schrodinger 1935).

However, it is not yet clear that whether quantum measurement problem play any significant role at the level of *our* neural activities. If quantum mechanics is significantly operative at the level of our neural data processing, the *infinite regress* should manifest itself as something which can be termed as *syntactic closure*. But that would mean a fundamental *impossibility* or *blockage* to procure knowledge or assigning semantics as a final outcome of cognitive process.But nature must manage to operate without this ‘*closure’* at the level of our cognitive activities. Otherwise how *knowledge* is possible!! Semantic awareness must be a consequence of ‘*leakage’* in syntactically closed loop, though the leakage mechanism is far from in sight yet. Is itquantum logic or non-Boolean property structure which is fundamentally involved in our cognitive process? There are attempts to develop mathematical formalism for an *abstract theory of meaning* based on holistic quantum computational semantics ( Maria Dalla Chiara , 2007 )

Quantum mechanics inspired researchers in system science also to model cognitive processes - models in cybernetics of observing system ( Francis Heylighen ,Von Forster , 1981)

So these are the glimpses of the huge bulk of new questions we have been introduced to after quantum mechanics. Needless to say that, the solution of these questions is not entirely a matter of *theoretical* model building. These all inspire to design subtle experiments at the level of cognitive dynamics. We are leaving this for another occasion.

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**Notes and References -**

[1] Schrodinger. E., 1992. *What is Life?* with *Mind and Matter* and *Autobiographical Sketches* . Cambridge University Press. p.118

[2] Immanuel Kant famously asked for the first time “How is Metaphysics possible?” in his *Critique of Pure Reason (1787)*

[3] A good many numbers of Books written during this time were fundamentally about this standpoint. A few scientists were really composing the footnotes of skepticism within *Neo-Kantian framework*. Apart from the writings of Mach and Kirchhoff, significant works include *The Principles of Mechanics presented in a New Form* by German Physicist H. Hertz (1894, Eng translation 1899). He maintained the same tone also in his *Electrical Waves* (1892, Eng translation 1893).

 There were also some fervent opponents of the *Atomic Theory* such as Wilhelm Oswald and George Helm who called themselves “ *Energetists* ” to indicate that they thought the *concept of Energy* as the most fundamental ontological concept needed for science .

[4] For a comprehensive discussion see *Beyond Analytical Philosophy* by *Hao Wang*, MIT Press, 1986

[5] The logical paradise of *Cantorian* Set was soon lost!

Cantor’s logical paradise was soon lost with the paradoxes exposed while dealing with self-referential predicates like, ‘the ‘*set of all sets* which are members of themselves’. It was a disaster to recognize 'whole' to offer itself as 'part' while dealing with these kinds of collections. Consequently, one can't exhaust the set involving itself as a part! The simple and intuitively obvious notions like 'greater than', 'smaller than', 'is a part of "... seems to come in trouble; that is to say, the Part and Whole relation in traditional form was exposed to be vulnerable. This result can be extrapolated to say that, a machine, if constructed to execute the simple command to $\ll $*countatably exhaust* $\gg $this kind of set, would ***never halt*!**

So, not all sorts of 'Many', as was appeared to be implied intuitively, can be conceived as *ONE* in Cantorian sense - Parts taken systematically together, for example, being added one with another and so on .... would not always construct *Whole* .

Cautioned by the paradoxes (1900), Russell and Whitehead in PM (1908) tried to patch up set theory *avoiding* the paradoxes. Russell famously introduced his ***Theory of Types*.** One can however appreciate logical Types by recognizing simply that *Type* of any set restricts the possibility of self reference. If self reference is described as inclusion of a class within itself, it is because the class formed out of all classes is considered to be again a part of the same one of *unique Type,* Then *Whole/ One* would continue to offer itself as part. But if every new whole, being formed this way, is considered to be a *new type,* its inclusion into its own *previous type* can be artificially restricted. So, if every Set belongs to a specific *type,* clearly no set could contain itself because it would have to belong to a *Type higher* than its own.

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