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EINSTEIN AND TAGORE: MAN, NATURE AND MYSTICISM*

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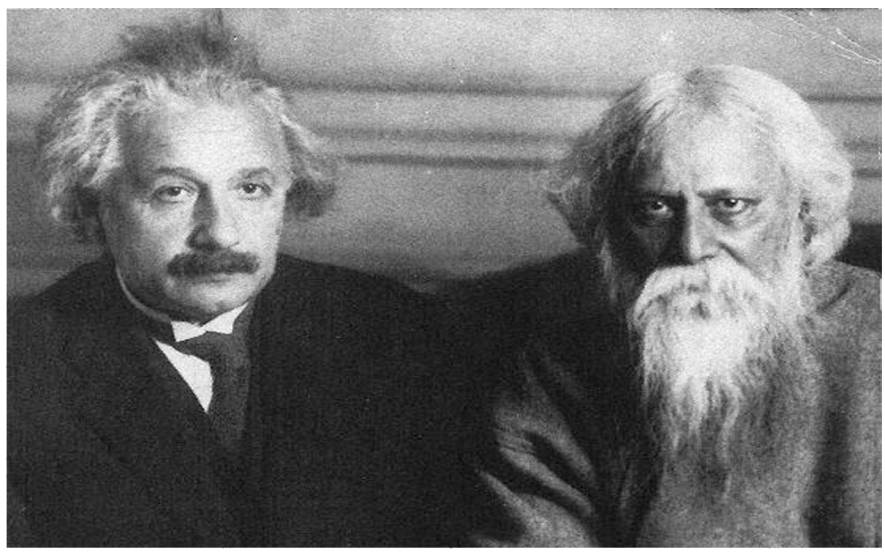
Abstract: Discussions on the nature of reality between Albert Einstein and Rabindranath Tagore, Bengali poet, philosopher and Nobel laureate, have provoked interest among both physicists and philosophers since their first publication in 1930/31. This article points out their relevance to past and present debates about the meaning of quantum mechanics.



In 1983, when the astrophysicist Subrahmanyan Chandrasekhar accepted the Nobel prize in Stockholm, he spoke some much-quoted lines of poetry in English translation that he had learnt more than sixty years before, as a boy in India:

> Where the mind is without fear and the head is held high;
> Where knowledge is free;
> Where words come out from the depth of truth;
> Where tireless striving stretches its arms towards perfection;
> Where the clear stream of reason has not lost its way into the dreary desert sand of dead habit . . .
> into that haven of freedom, Let me awake.

The lines are from Rabindranath Tagore (1861–1941) — the first Asian Nobel laureate, a Bengali from Calcutta who won the literature prize in 1913 — except, that is, for the last line. This line Chandrasekhar, being an atheist, had altered, by neatly substituting 'haven' for Tagore's original 'heaven'.[1]

* A simplified and much shortened version of this paper appeared in *The Times Higher Education Supplement*, 24 February 1995.

[1] Tagore (1913), pp. 27–8. The last two lines, as written by Tagore, read: 'Into that heaven of freedom, my Father, let my country awake.' We thank Professor Chandrasekhar for drawing our attention to his version.

Science and philosophy, leave alone science and religion, have made uncomfortable bedfellows during the twentieth century. In the emphatic words of Steven Weinberg, particle physicist and Nobel laureate, writing in 1992, 'I know of *no one* who has participated actively in the advance of physics in the post-war period whose research has been significantly helped by the work of philosophers.' (Weinberg, 1993, p. 134.)

Nevertheless, many of the greatest physicists, including four of the founders of quantum theory, Einstein, Bohr, Heisenberg and Schrödinger, are well known for their keen interest in philosophy. Fundamental conceptual weaknesses in quantum theory disturbed Einstein until his death in 1955. Now there is an even greater need for new ideas: laboratory experiments at the subatomic level, inspired by the theoretical work of John Bell, claim to have shown that Einstein's notion of 'local reality' — that any individual object, however small, possesses dynamical properties (at all instants) which cannot be affected by any instantaneous action at a distance — is untenable.[2] It seems that quantum reality differs profoundly from macroscopic reality. And as history reminds us, metaphysics periodically does become physics. 'The best-known example is the interior of the atom, which was considered to be a metaphysical subject before Rutherford's proposal of his nuclear model, in 1911,' wrote Eugene Wigner in 1962, in an influential article speculating on the role of mind/consciousness in quantum physics (Wigner, 1962, p. 299). Today consciousness, which until recently was felt to be 'either purely "philosophical" or too elusive to study experimentally' (Francis Crick), has become an area of serious scientific study (Crick and Koch, 1992, p. 153).

As a result of this interest, Einstein's discussions with Rabindranath Tagore in 1930 concerning the nature of reality and the relationship of determinism to free will are now seen to merit more than a tiny footnote in the history of quantum theory. Publicized at the time — initially in the *New York Times* — they continue to provoke comment among a wide range of people because they tackle some of the fundamental questions debated within science over the past half-century. The *Encyclopaedia Britannica* quotes from one of their conversations in its entry on Einstein, for instance;[3] so did Ronald W. Clark (Clark, 1971, pp. 414–15) in his major biography of Einstein (a book admired by Heisenberg for its carefulness); and the physicist Abraham Pais, Einstein's scientific biographer, devoted several pages of his recent book, *Einstein Lived Here*, to Tagore (though his account contains serious inaccuracies).[4] Among other scientists, Brian Josephson, a physics Nobel laureate at Cambridge University, has commented: 'Tagore is, I think, saying that truth is a subtler concept than Einstein realizes';[5] while Ilya Prigogine, a chemistry Nobel laureate, in 1984 went so far as to say: 'Curiously enough, the present evolution of science is running in the direction stated by the great Indian poet.' (Prigogine and Stengers, 1984, p. 293.)

But before we get to the substance of what Einstein and Tagore said, Tagore himself and also the debates of the time about quantum theory must be introduced appropriately. Apart from grasping Tagore's intrinsic importance as a many-sided personality sufficiently renowned that Times Square in New York was renamed Tagore Square for a day

[2] For an overview of studies relating to Bell's work, see Home and Selleri (1991), pp. 1–95, and articles in van der Merwe, Selleri and Tarozzi (1992).

[3] *Encyclopaedia Britannica*, 15th edn, **18**, p. 157.

[4] Pais (1994), pp. 99–108. Pais makes many errors about Tagore's life, confuses the various meetings between Tagore and Einstein and, most importantly, does not use the *New York Times* version of the Einstein–Tagore conversation, which Einstein vetted.

[5] Quoted in Dutta and Robinson (1995), p. 294.

during his birth centenary (1961), we also need to grasp the historical background to his deep philosophical disagreement with Einstein.[6]

In Clark's biography of Einstein, he wrote: 'The speed with which his fame spread across the world, down through the intellectual layers to the man-in-the-street, the mixture of semi-religious awe and near-hysteria which his figure aroused, created a startling phenomenon which has never been fully explained.' (Clark, 1971, p. 246.)

Tagore's situation was strangely similar at the height of his celebrity between 1913 and the 1930s, despite his now being comparatively forgotten. W.B. Yeats, probably the greatest poet in English this century, who introduced Tagore's poems to the West, wrote: 'They have stirred my blood as nothing has for years.' The poet Ezra Pound compared Tagore to Dante. Three subsequent Nobel literature prize-winners, André Gide, Juan Ramón Jiménez and Boris Pasternak translated Tagore's poetry — into French, Spanish and Russian (Dutta and Robinson, 1995, pp. 3–5). In 1916–17 Tagore triumphantly criss-crossed the United States, lecturing to vast and wide-eyed audiences. It was the first of eight lengthy speaking tours outside India that took him to almost every major nation as an unofficial ambassador from the East.

In Germany, in 1921, his reception was particularly tumultuous. A London newspaper reported 'scenes of frenzied hero-worship' and girls fainting in the crush for seats when Tagore lectured at Berlin University (Dutta and Robinson, 1995, pp. 234–5). The general atmosphere following the country's crushing defeat in the war was hostile to the exact sciences; Tagore, with his aura of Oriental wisdom, suited the wounded, anti-rationalist mood. But this was so more by default than by design — for in fact Tagore was sincerely interested in science.

His first ever essay (published in serial form), written in the 1870s when he was barely a teenager, was on astronomy. In his thirties and forties, around the turn of the century, he strongly advocated the work of the physicist and plant physiologist Sir Jagadish Chandra Bose, the second Indian Fellow of the Royal Society (Dutta and Robinson, 1995, pp. 127–9). In Britain, in 1920, Tagore made a special point of visiting the observatory in Greenwich, where the Astronomer Royal showed him the photographic plate of the solar eclipse that had apparently confirmed Einstein's theory of general relativity in 1919. And in the mid-1930s, when he was in his mid-seventies, encouraged by the astrophysicist Meghnad Saha and others, Tagore took up the study of science in earnest and wrote a short book in Bengali for young students (translated as *Our Universe*), which he dedicated to his fellow Bengali S.N. Bose (of boson fame), who had earlier won Einstein's recognition for his work on light quanta. Tagore was very disappointed to miss, through illness, meeting Sir Arthur Eddington on his visit to India in late 1937. (In a letter to him, Eddington observed, unprompted: 'I think it is true that as scientific thought goes deeper it finds much in common with Indian philosophy.'[7])

Tagore did however meet the German physicist Arnold Sommerfeld and his former student, the young Werner Heisenberg, when they lectured in India in 1928 and 1929 respectively. Sommerfeld visited Tagore's rural university at Shantiniketan (the 'Abode of Peace') not far from Calcutta and he later published a vivid description of Tagore, comparing him to 'old Goethe' in his 'infinite diligence'.[8] Heisenberg spent an afternoon talking to Tagore about Indian philosophy at his mansion in Calcutta. Though he never wrote about the encounter, Heisenberg did speak of it much later on several occasions.

[6] For background on Tagore's life and works, see Dutta and Robinson (1995).

[7] Quoted in Dutta and Robinson (1995), p. 392.

[8] Quoted in Dutta and Robinson (1995), p. 283.

One of these was in conversation with his doctoral student Helmut Rechenberg, who is now in charge of Heisenberg's papers at the Max Planck Institute for Physics in Munich; Rechenberg remembers it 'quite vividly'.[9]

Tagore and Einstein first met during Tagore's second visit to Germany in mid-1926, though Einstein was certainly aware of Tagore by 1919 (probably earlier), when together they had signed an anti-war 'Declaration of the Independence of the Spirit'. Their conversation in 1926 was not recorded as it would be later, but Einstein's (German) letter written to Tagore afterwards, survives. Its tone of respect testifies to more than mere courtesy: 'If there is anything in Germany that you would like and which could be done by me, I beg you to command me at any time.' This was followed by a kind of love letter to Tagore, written in broken English by Einstein's young step-daughter Margot: 'At once, I ran to father with your letter to read to him, father loves you too, you know, he was happy with me.'[10]

And so we reach 1930, the vital year. Tagore arrived in Europe in late March on what would be his last visit to the West, taking in six European countries, the Soviet Union and the United States. Stopping in Paris for an exhibition of his paintings, he continued on to Britain where he gave the Hibbert Lectures at Oxford University before a record audience. (Ten years later, he was given an honorary doctorate by Oxford, the first Indian this century to receive one.) Published in 1931 as *The Religion of Man*, with an appendix including his conversation with Einstein, the lectures drew freely upon science and maintained that 'We can never go beyond man in all that we know and feel.' (Tagore, 1931, p. 114.) Tagore was undoubtedly charged with such thinking when, not long after, he again encountered Einstein.

They met at least four times in 1930. In view of the confusion that has surrounded these meetings, the dates and places are worth noting. The first occasion was on 14 July in Einstein's villa at Caputh, near Berlin; the second was on 19 August, at Berlin; the third was in late September, also at Berlin, after Tagore's return from Moscow (where he was accompanied by a party including Margot Einstein); and the fourth took place in mid-December in New York City. Here, the *New York Times* reported, Einstein and Tagore spent a morning in 'animated' conversation; a striking photograph showed them together, with the teasing caption, 'A Mathematician and a Mystic Meet in Manhattan'.[11]

The earlier two conversations were published: the first one (that on 14 July) in the *New York Times* on 10 August, the second (that on 19 August) in the New York-based magazine *Asia* (March 1931, pp. 140–2). Both conversations concern science, but the first, on reality, is the more significant. The newspaper featured it prominently beneath the headline 'Einstein and Tagore Plumb the Truth'. The byline was given as Dmitri Marianoff, a Russian journalist known to the Einsteins for several years, who married Margot Einstein in November 1930. In his preamble, Marianoff wrote: 'It was interesting to see them together — Tagore, the poet with the head of a thinker, and Einstein, the thinker with the head of a poet . . . Neither sought to press his opinion. They simply exchanged ideas. But it seemed to an observer as though two planets were engaged in a chat.'

[9] For a discussion of the Tagore–Heisenberg relationship, see Dutta and Robinson (1995), pp. 442–3.

[10] Quoted in Dutta and Robinson (1995), p. 439.

[11] *New York Times* (21 December 1930). Subrahmanyan Chandrasekhar informs us that the physicist A.H. Compton used to keep this photograph of Einstein and Tagore in his office. It is reproduced at the head of this paper.

Three months later, in October, Einstein wrote a short piece about Tagore. He did so at the request of their mutual friend and fellow Nobel laureate, Romain Rolland, who was planning a grand global *Festschrift* for Tagore's seventieth birthday, due in 1931. (It had five sponsors — Rolland, Einstein, Mahatma Gandhi and J.C. Bose among them — and appeared in Calcutta as *The Golden Book of Tagore*.) But, in answering Rolland's letter, Einstein started a small controversy. He wrote (in German): 'I shall be glad to . . . add a brief contribution. My conversation with Tagore was rather unsuccessful because of difficulties of communication and should, of course, never have been published. In my contribution, I should like to give expression to my conviction that men who enjoy the reputation of great intellectual achievement have an obligation to lend moral support to the principle of unconditional refusal of war service.'[12] Rolland promptly agreed to this offer.

Immediately, however, Einstein totally changed his mind about the content of his potential contribution. Instead of writing on pacifism, he wrote on causality, determinism and free will. (See box.) Why? And why had he changed his mind about the publication of the July conversation in the *New York Times*? He had been fully informed of the plan to publish it, indeed he had corrected a draft of the conversation in mid-July (Dutta and Robinson, 1995, p. 446). Tagore had no role in this, though he too had his reservations: when *he* published the conversation in Calcutta a few months later, and subsequently as an appendix to *The Religion of Man*, he made significant changes, restoring certain passages cut from the draft seen by Einstein and adding some new material to clarify his own point of view.[13] Were Tagore's reservations similar to Einstein's?

The answers to these questions must be largely a matter of conjecture, since neither man commented further on his reasons, at least not directly.[14] They invite us to consider the complex and baffling issues thrown up by quantum mechanics that Einstein debated at length with Bohr, Heisenberg, Schrödinger and others from 1926 onwards, during the same period as his conversations with Tagore.

A lack of philosophical communication between Einstein and Tagore certainly is evident from the published record. While the language barrier played some part in this — Einstein spoke in German, Tagore in English — its roots go deeper. The philosopher Isaiah Berlin (who was present at Tagore's Oxford lectures) commented in 1993: 'I do not believe that, apart from professions of mutual regard and the fact that Einstein and Tagore were both sincere and highly gifted and idealistic thinkers, there was much in common between them — although their social ideals may well have been very similar.'[15] During the 1930s, Einstein was not apparently influenced by Tagore, nor Tagore by Einstein, though it is said that Tagore turned down an offer of an honorary doctorate from Berlin University in protest against Nazi treatment of Einstein (Dutta and Robinson, 1995, p. 344). In later years, Einstein is known to have referred to Tagore privately by the punning name 'Rabbi' Tagore. Isaiah Berlin again: 'I think [this] was meant to be

[12] Quoted in Nathan and Norden (1960), p. 112.

[13] The conversation was published as 'The Nature of Reality' in the *Modern Review*, Calcutta, January 1931, pp. 42–3, and later in *The Religion of Man*. The original draft of the conversation, sent to Tagore by the *New York Times* before publication, is kept at Tagore's university (Rabindra Bhavan archives).

[14] Tagore wrote an article about his meetings with Einstein, which was published in *Asia*, pp. 139–40. It contains some interesting hints about their philosophical disagreement but nothing definite about it.

[15] Quoted in Dutta and Robinson (1995), p. 295.

ABOUT FREE WILL

by Albert Einstein

If the moon, in the act of completing its eternal way around the earth, were gifted with self-consciousness, it would feel thoroughly convinced that it was travelling its way of its own accord on the strength of a resolution taken once and for all.

So would a Being, endowed with higher insight and more perfect intelligence, watching man and his doings, smile about man's illusion that he was acting according to his own free will.

This is my belief, although I know well that it is not fully demonstrable. If one thinks out to the very last consequence what one exactly knows and understands, there will be hardly any human being who will be impervious to this view, provided his self-love does not ruffle up against it. Man defends himself from being regarded as an impotent object in the course of the Universe. But should the lawfulness of events, such as unveils itself more or less clearly in inorganic nature, cease to function in front of the activities in our brain?

Leaving aside the inconsistency of such a view, the influence of alcohol and other sharply controllable factors on our thoughts, feelings and activities should show very distinctly that determinism does not stop before the majesty of our human will.

Maybe, we and human society require the illusion of freedom in our human activities!

The conviction that a law of necessity governs human activities introduces into our conception of man and life a mildness, a reverence and an excellence, such as would be unattainable without this conviction.

Thou sawest the fierce strife of creatures, a strife that wells forth from need and dark desire. Thou sawest the escape in calm meditation and in creations of beauty. Cherishing these, thou hast served mankind all through a long and fruitful life, spreading everywhere a gentle and free thought in a manner such as the Seers of thy people have proclaimed as the ideal.

This statement is Einstein's contribution to *The Golden Book of Tagore* (1931). It appears there in both its original German and in English translation. This is the English translation, slightly modified by ourselves.

ironical, in the gentlest way. Einstein did not hold with rabbis much; still less with quantum physics.'[16]

Instead of their minds meeting, the two men seem mostly to have talked past each other, where they did not openly disagree. A comparable mismatch occurred, famously, between Einstein and Bohr, and lasted for thirty years right up to Einstein's death in 1955. A frustrated Bohr was never able to bring Einstein round to accepting the majority view of quantum mechanics. Although the philosophical views of Bohr and Tagore differ in crucial respects, there are important similarities too. It is fruitful to compare the Einstein-Bohr and Einstein-Tagore relationships. We shall look first at that of Einstein and Bohr.

In classical physics, the macroscopic world, that of our daily experience, is taken to exist independently of observers: the moon is there whether one looks at it or not, in the well-known example of Einstein. And the same may be conceived to be true of the subatomic world. That is what is meant by 'realism': the philosophical position of, say,

[16] Quoted in Dutta and Robinson (1995), p. 447.

Descartes — that the physical world has objectivity that transcends direct experience, and that propositions are true or false independent of our ability to discern which they are.

But in quantum physics — at least according to the 'standard' interpretation of quantum theory, the Copenhagen interpretation (named after its Danish origin and father, Bohr) — reality looks different, particularly at small scales. An electron, for instance, no longer has properties such as position, momentum, energy, in the absence of an observation/measurement. In the words of Heisenberg, whose uncertainty principle lies at the heart of the Copenhagen interpretation: 'The laws of nature which we formulate mathematically in quantum theory deal no longer with the elementary particles themselves but with our knowledge of the particles.'[17] The nature of reality in the Copenhagen interpretation is therefore essentially epistemological, that is all meaningful statements about the physical world are based on knowledge derived from observations. 'No elementary phenomenon is a phenomenon until it is a recorded phenomenon,' to quote a dictum of the quantum theorist John Wheeler (Wheeler, 1994, p. 120). This philosophical stance contains elements of positivism, the point of view strongly developed in the later nineteenth century before the advent of quantum theory by physicists such as Ernst Mach (who argued against the concept of atoms as being mystical entities).

Einstein was at first a staunch positivist, but during the 1920s be became an equally staunch realist, and remained so thereafter. In 1950, he told the philosopher Karl Popper that he regretted no 'mistake' (Einstein's word) more than his original belief in positivism.[18] His turn to classical realism began, according to Helmut Rechenberg, with the success of his general relativity theory, i.e. after 1916; but probably his earliest unequivocal assertion of this shift in his thinking occurred in 1926 in his conversations with Heisenberg. According to the latter, Einstein declared himself sceptical of quantum theory because it concerned 'what we know about nature', no longer 'what nature really does'. In science, said Einstein, 'we ought to be concerned solely with what nature does.'[19] Both Heisenberg and Bohr disagreed: in Bohr's view, it was 'wrong to think that the task of physics is to find out how nature *is*. Physics concerns what we can say about nature.'[20] At the Solvay conferences in 1927 and 1930, Einstein pressed his point of view, and in 1935 he published (with Boris Podolsky and Nathan Rosen) the famous EPR paper, in which he argued with the help of a 'thought experiment' that 'If, without in any way disturbing a system, we can predict with certainty . . . the value of a physical quantity, then there exists an element of physical reality' — in other words a 'local' reality — 'corresponding to this physical quantity.' (Einstein, Podolsky and Rosen, 1935, p. 777.)

Bohr, however, refuted this reasoning — to the apparent satisfaction of the majority of physicists (Bohr, 1935, pp. 696–700). How many really understood him is dubious, considering that even a leading theorist such as John Bell did not, as he freely admitted repeatedly in various writings (e.g. Bell, 1981, p. 60). However, in the light of all the experiments that have so far tested Bell's theorem, many physicists (though not all) accept that the locality condition used by Einstein, Podolsky and Rosen in their analysis is not valid in the quantum world. (Nevertheless, we should note that the experiments on Bell's theorem do not negate the concept of realism *per se*, but only a particular form of realism based on Einstein's locality condition. The general idea behind realism — that

[17] Heisenberg (1955), p. 15; see also Pauli (1955), pp. 12–29.

[18] Quoted in Popper (1976), p. 97.

[19] Quoted in Heisenberg (1971), pp. 58–69.

[20] Quoted in Pais (1991), p. 427.

quantum entities have well defined objective properties even in the absence of any measurement — remains a logically tenable proposition. This is most convincingly shown by the formulation of an alternative interpretation of quantum mechanics — à la de Broglie and David Bohm — based on a realist model, objective but *non*local, which explains in a perfectly consistent way all known quantum phenomena.[21])

Schrödinger was the only one among the founders of quantum theory who was sympathetic to Einstein's position, but he could not entirely accept it. In their correspondence, Einstein accused the Copenhagen interpretation of being a 'tranquilizing philosophy', metaphysical, nothing more than 'a soft pillow on which to lay one's head', rather than engaging reality race to face; Bohr, Einstein told Schrödinger in 1939, was a 'mystic, who forbids, as being unscientific, an inquiry about something that exists independently of whether or not it is observed.'[22]

Einstein's conversations with Tagore in 1930, shortly before he tussled with Bohr at the Solvay conference in October, express his hardening adherence to realism in a remarkably clear-cut fashion. This extract is from the conversation (as vetted by Einstein) reported in the *New York Times*:

> *E:* There are two different conceptions about the nature of the universe — the world as a unity dependent on humanity, and the world as reality independent of the human factor . . .
> *T:* This world is a human world — the scientific view of it is also that of the scientific man. Therefore, the world apart from us does not exist; it is a relative world, depending for its reality upon our consciousness.

A little later, Einstein took up the point again:

> *E:* Truth, then, or beauty, is not independent of man?
> *T:* No.
> *E:* If there were no human beings any more, the Apollo Belvedere no longer would be beautiful?
> *T:* No.
> *E:* I agree with regard to this conception of beauty, but not with regard to truth.
> *T:* Why not? Truth is realized through men.

(Here, according to a later account by the note-taker Marianoff, there was a long pause. Then Einstein spoke again very quietly and softly.[23])

> *E:* I cannot prove my conception is right, but that is my religion.

After some further discussion — in which Einstein asserted, 'I cannot prove, but I believe in the Pythagorean argument, that the truth is independent of human beings,' and Tagore countered with a reference to ancient Indian philosophy, to 'Brahman, the absolute truth, which cannot be conceived by the isolation of the individual mind or described by words, but can he realized only by merging the individual in its infinity' — Einstein became concrete:

> *E:* The mind acknowledges realities outside of it, independent of it. For instance, nobody may be in this house, yet that table remains where it is.

[21] See, for example, Holland (1993), and Bohm and Hiley (1993).

[22] Quoted in Przibram (1950), p. 44.

[23] Quoted in Marianoff (1944), pp. 73–77, a not wholly reliable account of the Einstein–Tagore meeting in July 1930, at which Marianoff was a note-taker.

T: Yes, it remains outside the individual mind, but not the universal mind. The table is that which is perceptible by some kind of consciousness we possess.
E: If nobody were in the house the table would exist all the same, but this is already illegitimate from your point of view, because we cannot explain what it means, that the table is there, independently of us. Our natural point of view in regard to the existence of truth apart from humanity cannot be explained or proved, but it is a belief which nobody can lack — not even primitive beings. We attribute to truth a superhuman objectivity. It is indispensable for us — this reality which is independent of our existence and our experience and our mind — though we cannot say what it means.
T: In any case, if there be any truth absolutely unrelated to humanity, then for us it is absolutely non-existing.
E: Then I am more religious than you are!

(Here, said Marianoff, Einstein 'exclaimed in triumph'.)

The position of Einstein in this last extract is reminiscent of his well-known paradox: 'The most incomprehensible fact about nature is that it is comprehensible.'[24] Nature, for Einstein, had to be independent of man and mind. As he insisted in his question printed in *The Golden Book of Tagore*: 'Man defends himself from being regarded as an impotent object in the course of the Universe. But should the lawfulness of events, such as unveils itself more or less clearly in inorganic nature, cease to function in front of the activities in our brain?'

Einstein could not accept any idea that a universal mind might control nature. Tagore, by contrast, could accept this. As he said to Einstein: 'What we call truth lies in the rational harmony between the subjective and objective aspects of reality, both of which belong to the super-personal man.' In other words, Tagore did not adhere either to Einstein's realist, essentially objective position or to Bohr's quasi-positivistic, essentially subjective view of nature, a position that, taken to its logical extreme, denies the existence of the physical world — or at least its dynamical properties — until they are measured. Tagore did not deny the existence of the table when nobody was in the house, but he argued that its existence becomes meaningful for us only when it is perceived by some conscious mind. And he said, further, that there is a universality in the nature of consciousness (contrary to our normal sense of consciousness as being essentially private). Galileo's experiments with falling stones would be interpreted in the same way by all humans who today might perform the experiment, notes Ilya Prigogine: 'In a sense, this is a result of a common structure of consciousness for all humans.'[25]

What did Tagore mean by this concept of a universal human mind? He once wrote: 'The Universe is like a cobweb and minds are the spiders; for mind is one as well as many.'[26] He tried to amplify and clarify his meaning in his own version of the conversation with Einstein published in *The Religion of Man*. (He did so partly by restoring two passages cut from the draft of the conversation before it was printed in the *New York Times*.) Pursuing the example of the table, he said:

> Science has proved that the table as a solid object is an appearance and therefore that which the human mind perceives as a table would not exist if that mind were

[24] Quoted in, for example, Chandrasekhar (1990).

[25] Letter from Prigogine to Andrew Robinson, 1993.

[26] Quoted in Flaum, Schlomith, 'At the Feet of My Master', *Palestine News* (23 August 1941), (original source unknown).

> naught. At the same time it must be admitted that the fact that the ultimate physical reality of the table is nothing but a multitude of separate revolving centres of electric force, also belongs to the human mind.
>
> In the apprehension of truth there is an eternal conflict between the universal human mind and the same mind confined in the individual. The perpetual process of reconciliation is being carried on in our science, philosophy, in our ethics. (Tagore, 1931, pp. 224–5)

This statement resembles remarkably one made by Einstein's friend, the physicist Max Born: 'All religions, philosophies, and sciences have been evolved for the purpose of expanding the ego to the wider community that "we" represent.' Ironically, Born wrote it in 1920 in his famous introduction to Einstein's *Theory of Relativity*.[27]

If mind/consciousness, the first-person perspective, is somehow to be incorporated into physics, as certain physicists believe it should be, this would entail consequences as dramatic as those involved in the introduction of relativity by Einstein, for it would mean an acceptance that 'the lawfulness of events, such as unveils itself more or less clearly in inorganic nature' may, at least in principle, 'cease to function in front of the activities in our brain' — to answer Einstein's sceptical question addressed to Tagore in the affirmative. But Einstein could never accept this: he was committed to the realism, determinism and strict causality of classical physics, as he made plain to Tagore in their second, more free-ranging conversation on 19 August 1930. Tagore, who was staying with a scientific friend of Einstein in Berlin, introduced the subject:

> *T:* I was discussing with Dr. Mendel today the new mathematical discoveries which tell us that in the realm of infinitesimal atoms chance has its play; the drama of existence is not absolutely predestined in character.
>
> *E:* The facts that make science tend towards this view do not say goodbye to causality.
>
> *T:* Maybe not; but it appears that the idea of causality is not in the elements, that some other force builds up with them an organized universe.
>
> *E:* One tries to understand how the order is in the higher plane. The order is there, where the big elements combine and guide existence; but in the minute elements this order is not perceptible.
>
> *T:* This duality is in the depths of existence — the contradiction of free impulse and directive will which works upon it and evolves an orderly scheme of things.
>
> *E:* Modern physics would not say they are contradictory. Clouds look one from a distance, but, if you see them near, they show themselves in disorderly drops of water.
>
> *T:* I find a parallel in human psychology. Our passions and desires are unruly, but our character subdues these elements into a harmonious whole.

Interestingly, Bohr made a similar point to Einstein, writing in *Albert Einstein: Philosopher-Scientist* at the time of Einstein's seventieth birthday in 1949: 'Actually, words like "thoughts" and "sentiments", . . . indispensable to illustrate the variety and scope of conscious life, are used in a similar complementary way as are space-time co-ordination and dynamical conservation laws in atomic physics.' (Bohr, 1949, p. 224) Einstein did not concur.

Tagore continued:

[27] Quoted in Einstein (1924), p. 4.

T: Are the elements rebellious, dynamic with individual impulse? And is there a principle in the physical world which dominates them and puts them into an orderly organization?

E: Even the elements are not without statistical order; elements of radium will always maintain their specific order, now and ever onwards, just as they have done all along. There is, then, a statistical order in the elements.

T: Otherwise the drama of existence would be too desultory. It is the constant harmony of chance and determination which makes it eternally new and living.

E: I believe that whatever we do or live for has its causality; it is good, however, that we cannot look through it.

Here, in this short exchange, would appear to be the kernel of Einstein's ambivalence towards Tagore: why he changed his mind about the publication of their first conversation (on 14 July), and why he unexpectedly chose to write on determinism and free will, rather than on his promised pacifism, in Tagore's birthday *Festschrift*. Significantly, Bertrand Russell, Einstein's friend and collaborator, was ambivalent about Tagore too. Although Russell praised Tagore highly in the *Festschrift* and published in his *Autobiography* (1967) an appreciative philosophical letter to himself from Tagore, he wrote privately about the letter at the same time to a Bengali contact: 'I regret I cannot agree with Tagore. His talk about the infinite is vague nonsense. The sort of language that is admired by many Indians unfortunately does not, in fact, mean anything at all.'[28]

'I suspect Einstein thought Tagore was talking nonsense,' remarks Brian Josephson (who, as we know, finds Tagore the subtler thinker about truth).[29] This is most likely correct, but it is also probable — given Einstein's undoubtedly genuine respect for Tagore — that Einstein was slightly stung by what seemed to be Tagore's (and even more Bohr's) dogmatic unwillingness to perceive what he, Einstein, effortlessly saw: a profound order in nature, 'out there', quite independent of the human mind. Einstein's seventieth birthday message to Tagore in effect reproves him for his dogmatism in the gentlest way; as does Einstein's later punning reference to Tagore as 'Rabbi'.

To summarize, then, we can discern three philosophical positions concerning the relationship between man and nature arising from the Einstein–Tagore conversations. The first, held by Einstein, is that nature exists, objectively, whether we know it or not. Hence Einstein thought it was essential to describe 'what nature does' instead of merely speaking of 'what we know about nature' (to repeat his earlier comments to Heisenberg). The second position, held by Bohr, is that the objective existence of nature has no meaning independent of the measurement process. The third position, held by Tagore, is more complex, because it requires mind/consciousness — in contrast to Bohr's (and of course Einstein's) position, but in line with certain subsequent interpretations of quantum theory that invoke the existence of 'many worlds'. Tagore says, centrally, that nature can be conceived only in terms of our mental constructions based on what we think we perceive: 'This world is a human world — the scientific view of it is also that of the scientific man' (to repeat his earlier statement). Tagore says further — and it is a separate though dependent point — that there exists a universal mind: 'What we call truth lies in the rational harmony between the subjective and objective aspects of reality, both of which belong to the super-personal man . . . if there be any truth absolutely unrelated to humanity, then for us it is absolutely non-existing' (to reiterate what he told Einstein).

[28] Quoted in Dutta and Robinson (1995), p. 178.

[29] Letter from Josephson to Andrew Robinson, 1993.

Tagore's position has some similarity with the work of various contemporary philosophers. Hilary Putnam, in particular, has attempted to break what he calls the 'stranglehold' on our thinking of the dichotomy between objective and subjective views of truth and reason, by inserting mind into reality. In a recent analysis he argues that, metaphorically speaking, 'the mind and the world jointly make up the mind and the world.'[30] And he goes on to reject the existence of 'intrinsic' properties — e.g. the position and momentum of an electron ('local realism') — of the kind integral to classical physics and to Einstein in the EPR experiment, properties that, in the words of Putnam, 'something has "in itself", apart from any contribution made by language or the mind.' (Putnam, 1987, p. 8.)

Another relevant philosopher is Thomas Nagel. Though his position differs more from Tagore's than does Putnam's, Nagel shares Tagore's fundamental concern: to create a world view that reconciles the objective viewpoint — what Nagel calls 'the centreless universe' — with that of the self, by integrating the two viewpoints with consciousness. He argues that, 'The subjectivity of consciousness is an irreducible feature of reality — without which we couldn't do physics or anything else — and it must occupy as fundamental a place in any credible world view as matter, energy, space, time and numbers.' (Nagel, 1989, pp. 7–8, 55.)

Obviously these are extremely difficult problems with an ancient philosophical and scientific pedigree. In 1611, Galileo noted that 'it would seem ridiculous to me to believe that things in nature begin to exist when we begin to discover and understand them.'[31] Einstein went on worrying at 'the reality question' until the day he died; so, less conspicuously, did Tagore. Neither came to a definite conclusion. (In 1950 Einstein even informed Schrödinger that determinism was 'a thoroughly nebulous concept anyway'.[32]) All three of the above philosophical positions have adherents throughout science today, with Bohr's predominating among quantum physicists and Tagore's the least accepted of the three. None the less, towards the end of his life, Schrödinger came to a view analogous to Tagore's, that 'The world is a construct of our sensations, perceptions, memories,'[33] while David Bohm, in later years, believed that 'It is the brain that creates the illusion of location of physical matter in the macroscopic world.'[34]

It will be interesting to see how the balance of scientific opinion on these great questions alters as science changes. Will Ilya Prigogine's bold prediction — that science is evolving according to Tagore — come true during the next century? Or, as many scientists hope, will increasing knowledge of brain functioning and deeper insights into quantum mechanics and molecular biology make consciousness amenable to being understood in terms of the existing laws of physics, these having been suitably modified?[35] Perhaps, for the purposes of this paper, Tagore should have the last word. Here is virtually the last poem he wrote, aged eighty, shortly before he 'lost consciousness'[36]:

[30] Putnam (1987), p. 1. We thank Amartya Sen for suggesting the idea of comparisons with the work of Putnam and Nagel.

[31] Letter to Pietro Dini, quoted in van der Merwe *et al.* (1985).

[32] Quoted in Przibram (1950), p. 40.

[33] Quoted in Moore (1989), p. 462.

[34] Conversation with Dipankar Home, 1991.

[35] See, for example, Penrose (1994).

[36] Quoted in Dutta and Robinson (1995), p. 367. The original poem is of course in Bengali and was written on 27 July 1941; Tagore died on 7 August.

The sun of the first day
Put the question
To the new manifestation of life —
Who are you?
There was no answer.
Years passed by.
The last sun of the last day
Uttered the question on the shore of the western sea,
In the hush of evening —
Who are you?
No answer came.

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