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Einstein, Tagore and the Nature of Reality

Edited by
Partha Ghose

Einstein, Tagore and the Nature of Reality

The nature of reality has been a long-debated issue among scientists and philosophers. In 1930, Rabindranath Tagore and Albert Einstein had a long conversation on the nature of reality. This conversation has been widely quoted and discussed by scientists, philosophers and scholars from the literary world. The important question that Tagore and Einstein discussed was whether the world is a unity dependent on humanity, or if the world is a reality independent of the human factor. Einstein took the stand adopted by Western philosophers and mathematicians, namely that reality is something independent of the mind and the human factor. Tagore, on the other hand, adopted the opposite view. Nevertheless, both Einstein and Tagore claimed to be realists despite the fundamental differences between their conceptions of reality. Where does the difference lie? Can it be harmonised at some deeper level? Can Wittgenstein, for example, be a bridge between the two views? This collection of essays explores these two fundamentally different conceptions of the nature of reality from the perspectives of theories of space-time, quantum theory, general philosophy of science, cognitive science and mathematics.

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Preface

The nature of reality has been a long-debated issue among scientists and philosophers. Albert Einstein (1879–1955) invited Rabindranath Tagore (1861–1941) to his house in Kaputh, Germany, on 14th July, 1930, and had a long conversation with him on the nature of reality. This conversation has been widely quoted and discussed by scientists, philosophers and scholars from the literary world.

The important question that Tagore and Einstein discussed was whether the world is a unity dependent on humanity, or if the world is a reality independent from the human factor. Einstein took the stand adopted by Western philosophers and mathematicians such as Aristotle, Plato, Frege, Russell etc., namely that *reality* is something independent of the mind and the human factor. On the other hand, Tagore adopted the opposite view. Nevertheless, both Einstein and Tagore claimed to be realists, but their conceptions of reality were obviously fundamentally different. Where does the difference lie? Can it be harmonized at some deeper level? Can Wittgenstein, for example, be a bridge between the two views?

There are no universally agreed-upon definitions of truth and reality in Western philosophy. Realisms of various shades of meaning have developed over the years, such as naïve realism, representative realism, direct realism, transcendental realism, Platonic realism, moderate realism, new realism, organic realism, constructive realism, entity realism etc.

In the philosophy of science, the focus has been more on to what extent the world described by science is the real world (critical or scientific realism). Classical science was clearly realistic in nature in the sense of being observer independent and deterministic. Quantum mechanics changed this perspective. Whether or not the world described by quantum mechanics is real and deterministic has been hotly debated since its inception. The latest predominant view is that it is not. Since all experiments can give us is information about the world, there is a growing school of thought that looks at the world as a giant information processor and prefers to look at information itself as reality. What implications does this emerging view have on the perennial debate?

In classical Indian philosophy, too, this debate was carried out with amazing analytical skills, leading to developments in the Samkhya-Yoga worldview (a dualist view), Kashmir Shaivism (a monistic view), Buddhist philosophy (ranging from straightforward realism through the Middle Path to mind-only idealism), Jaina realism and *anekantavada*, *Nyaya* realism and the *Vedanta* schools varying from dualism through qualified non-dualism to strict non-dualism (*advaitavada*). Each school has its own subtlely nuanced concept of reality. Tagore developed his own view of reality based on Indian philosophy broadened by his knowledge of Western philosophy and science and his own spiritual experience. How does it stand in relation to current developments in science and philosophy?

If we are concerned with the purpose of life, what we should be doing and the *meaning* of life and death, then the issue of reality (what *is*) and ethics (what *ought* to be) is of crucial importance to us. If things are different from how they are presented to us, then the issue of reality becomes crucial to our survival and well-being. Hence, the nature of reality has been an important concern in literature, art, philosophy and the social sciences. How do these concerns relate to the Einstein-Tagore debate?

It has long been realized that the mind plays a fundamental role in recognising and characterising reality. Hence, knowledge of the character of the mind is crucial to understanding the nature of reality. Recent progress in understanding the evolution of language and advances in neuroscience and cognitive science have led to many discoveries with important bearings on the debate that need to be raised and discussed.

An impression has been created that the Einstein-Tagore debate was a failure, perhaps because of the following account of the event written by Dmitri Marianoff, Einstein's step son-in-law that appeared in *The New York Times* issue of 10 August, 1930: 'Einstein listened with studious attention, then gave his characteristic view. 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'. There is a parallel in the history of quantum mechanics, namely, the famous Bohr-Einstein debate. Unlike one afternoon's conversation between a scientist and a poet in which language was certainly a barrier (Einstein was not fluent in English and Tagore did not understand German, so there was an interpreter), the Bohr-Einstein debate was between two outstanding scientists of the time over a subject that both helped to create, and it stretched over nearly twenty-eight years (from 1927 to 1955). The subject matter was essentially the same, namely, the role of an observer in describing nature. Bohr pushed his theme of the essential role of measurements (and hence of observers) in describing nature, and Einstein stuck to his faith in an observer-independent reality. Their metaphysical stands were radically different. Physics has benefited from the great debate, which still goes on, and it is hoped that the Einstein-Tagore debate will open up other aspects of the nature of reality and contribute significantly to progress in the philosophy of science as a whole.

To commemorate the 150th birth anniversary of Tagore, a three-day-long international seminar on 'The Nature of Reality: The Perennial Debate' was organised from 1–3 March, 2012, at the Indian Institute of Advanced Study, Shimla. The intention was to have wide-ranging, in-depth discussions on the entire gamut of man's engagement with reality through science, philosophy, language, cognitive science and the social sciences while keeping the Tagore-Einstein conversation as a reference point. This volume is a collection of essays written on the basis of the talks delivered at the Shimla conference as well as some additional ones specially written for this volume. The chapters explore the two fundamentally different conceptions of the nature of reality reflected in the 1930 Einstein-Tagore conversation from the perspectives of (i) theories of space-time, (ii) quantum theory, (iii) general philosophy of science, (iv) cognitive science and (v) mathematics.

Introduction

In the Introduction, Kathleen O'Connell describes the background of the meetings between Einstein and Tagore, the two iconic figures of the 20th century, one a scientist from the west and the other a poet from the east, both at a personal level and within their socio-historical times. It details the dates and locations of their personal meetings in 1926 and 1930. It also explores mutual interests such as science, nature, education and music; shared acquaintances such as the Indian scientist Sir Jagadish Chandra Bose, the discoverer of microwaves and a pioneer in plant electro-physiology, and the French savant Romain Rolland; their perceptions concerning one another and their roles in opposing aggressive nationalism and fascism.

At their first meeting at Einstein's residence in Kaputh on 14th July, 1930, Tagore began the conversation with the words, 'You have been busy hunting down with mathematics the two ancient entities, Time and Space, while I have been lecturing in this country on the eternal world of Man, the universe of Reality.' Hence, it is befitting that after the Introduction, the volume begins with a chapter on the nature of space and time.

Space-time and reality

In Chapter 1, Brown and Lehmkuhl explore Einstein's search for the nature of space and time. In the years between developing the special and general theories of relativity, Einstein came to see flat space-time as a real entity whose causal role violates the so-called action–reaction principle because it remains unaffected by matter, energy and events. He consequently regarded his 1915 theory of gravity—his general theory of relativity—as a triumphant resuscitation of the principle, while Newtonian mechanics as well as his 1905 special theory of relativity supposedly violated it. The authors examine why Einstein came to emphasize this position several years after the development of general relativity. Several key considerations are relevant to

the story: the connection Einstein originally saw between Mach's analysis of inertia and both the equivalence principle (the exact equality of inertial and gravitational masses and the consequent local equivalence of gravitation and accelerated reference frames) and the principle of general covariance, the waning of Mach's influence owing to de Sitter's 1917 results and Einstein's detailed correspondence with Moritz Schlick in 1920.

In Chapter 2, Cao explores the nature or the truth of space and time from a perspective based on a constructive version of *structural realism* that appears to be a synthesis of the views espoused by Tagore and Einstein. In their conversation, Einstein's clearly stated view that 'Truth must be conceived as a Truth that is valid independent of humanity' is in sharp contrast with Tagore's equally clearly stated view that 'the Truth of the Universe is [can only be] human Truth.' Like Brown and Lehmkuhl, Cao also devotes considerable attention to Einstein's deliberations on the so-called 'hole argument' in the years leading to his 1915 formulation of the general theory of relativity and their philosophical implications, especially those concerning the nature of space and time. Cao examines these in the context of the dominant views on space and time held by Newton, Leibniz, Kant, Engels, Marx and those suggested by recent developments in the studies of quantum gravity. Cao's examination seems to show that the reality of space-time is the result of stepwise human construction: from the very abstract Kantian form of pre-space-time to the more and more concrete reality of space-time, which seems to be in line with Tagore's wisdom. On the other hand, although these constructive steps can be viewed as steps in the ascendance from the abstract to the concrete in Hegel's dialectical logic, which was used by Karl Marx in his construction of social reality, the constructive ascendancy described in this chapter involves not the logical categories, but physical entities, events and processes, and thus this dialectical constructive approach to understanding the nature of space-time should be regarded as an application of Marx's dialectics rather than Hegel's; that is, as a human construction based on objective reality, which seems to be in line with Einstein's 'religious belief in super-human objectivity.'

Quantum mechanics and reality

No discussion on reality can be complete without delving into the implications of quantum theory. Accordingly, in Chapter 3, Charles H. Bennett explains how quantum physics has helped explain the nature of information and the origin of randomness. In the early part of the 20th century, quantum mechanics suddenly opened up a strange new world of counterintuitive simplicity that physicists and philosophers are still digesting. Although originally devised to explain the behaviour of tiny objects like atoms and photons, quantum theory is fundamental to the understanding of nature on all scales. In addition to having withstood a century of experimental tests, it provides a picture of reality that is ultimately more satisfying and coherent than either the strict

determinism of Laplace or the blatant probabilism that so repelled Einstein about quantum mechanics as he understood it. Bennett sketches, in simple, technical terms, the subtler understanding of quantum principles developed since Einstein's death, emphasising the central role of *entanglement*, a peculiarly intense and unsharable kind of correlation made possible by quantum laws that Einstein himself was the first to recognize, and *decoherence*, a loss of correlation within a system that occurs when the system becomes entangled with its environment. From the vantage point of entanglement and decoherence theory, Bennett takes us through the basic laws of the quantum world to give us a glimpse of the origin of quantum randomness in entanglement, the difference between classical and quantum information processing, quantum cryptography, the ambiguity of the past and the future, quantum Darwinism, the threat of the invasion of privacy and the ontological status of escaped and lost information, to point out why the question, 'Why did this happen instead of that?' is sometimes no more answerable, nor requiring of an answer, than the question, 'Why am I me instead of someone else?', that we all learned to stop asking as children. In the end, he points out that according to many cosmologists, some as-yet-unexplained accidental features of the universe (such as the small-but-nonzero cosmological constants or the anisotropy of the cosmic microwave background) probably had their origin in a Schopenhauer form of the weak anthropic principle, and that 'it is unreasonable to deny that some sort of anthropic selection may be biasing our view of the universe.' In other words, we live in 'a world just barely compatible with our existence'. That is his take on the Einstein-Tagore 'debate'.

In Chapter 4, Anthony Sudbery examines the two broad, opposing classes of attitudes to reality (realist vs. idealist, material vs. mental) with corresponding attitudes to knowledge (objective vs. subjective, scientific vs. romantic). According to Sudbery, this clash can be seen at its strongest in Blake's rejection of the scientific view of the world, which he found personified in Newton. Blake's picture of Newton shows him focusing on a geometrical figure and missing the rich reality around him, which can only be found in personal, subjective experience, not in the general, objective view of reality that is the aim of science. It is one of the most enigmatic features of quantum mechanics, the most fundamental and accurate of all sciences, that it is hard to reconcile it with this objective view. Sudbery uses the Everettian 'relative state' or 'many worlds' interpretation to illustrate that in order to understand quantum mechanics, one must heed Blake's lesson and accept that there is a subjective reality—a reality relative to a particular observer inside the world who is also subject to the laws of quantum mechanics—which is as valid as the objective reality seen from outside that world. Each of these kinds of worlds or realities is needed to make sense of the other; they are not contradictory, but compatible and complementary.

In a somewhat similar vein but using different arguments, Ravi Gomatam starts Chapter 5 with the observation that, though taken at face value,

Einstein and Tagore disagreed over the nature of truth or reality, both of them believed in a Reality that humans could comprehend. They only differed over how far the two—Reality and our conception of it—can be synthesized. He argues that, in the context of quantum mechanics, Einstein did not distinguish between a subjective recording of a measurement outcome and the measurement itself, which is an objective interaction in the world, though the distinction is crucial. Tagore, in contrast, held that Truth and Reality in the absolute sense can be comprehended only via a relational but individual perspective. But he limited this perspective to a spiritual search for divinity by the individual, in perfecting the relation with the Universal Person, an idea Gomatam traces to the Bengali *Vaishnava* tradition of the Bauls (a heterodox sect of wandering minstrels who sing of the Man within the mind). With a view to synthesising Einstein's and Tagore's positions so as to bear upon the issues of causality and reality in quantum mechanics, Gomatam introduces the tenets of the original Bengali *Vedanta* tradition, named the *Gaudiya Vaishnava Vedanta* (GVV) and presented by the saint-philosopher Chaitanya over five centuries ago. Chaitanya proposed the philosophy of *achintya bhedaabheda* (inconceivable simultaneous oneness and difference), which is neither monistic nor dualistic, although it integrates features of both. Specifically with reference to the Einstein-Tagore dialogue, Gomatam argues that GVV advances the idea of relation as being ontologically primary, with objects epistemologically derived. This is in contrast to the relational viewpoint that has so far prevailed in physics since early mechanics, in which objects are ontologically primary and relations are epistemologically derived. He discusses how this new ontological relational viewpoint of matter could be appropriate to address the nature of quantum reality and causality.

General philosophy of science

The following chapters deal with these questions from a more general philosophical point of view. In Chapter 6, Tushar K. Sarkar starts with the observation that the question, 'What is Reality?' is mainly meta-scientific or philosophical in nature rather than a purely scientific one. Accordingly, he begins by unpacking the different strands of the question: epistemic, ontological, conceptual and methodological. Since the answer to a meta-scientific question depends more on an expert's methodological leaning than on the results of scientific experiments, and a scientist's methodological leaning depends, in part, on the ruling paradigm(s) of the time, the answer to a question is often determined in practice by a mutual feedback loop between a methodology and an accepted paradigm. This often gives rise to conflicting answers to a question. Sarkar provides some illustrative examples. He then gives a summary of the salient features of the standard version of quantum mechanics in order to identify the exact issues that lie at the root of the controversies between Bohr and Einstein, and to give a definite shape to the question of what Reality is. He does this by raising some meta-scientific

questions and pointing out that a scientific theory is no more than a bunch of symbols until they are interpreted. The conceptual-philosophical issues raised during the Einstein-Tagore conversation are then put in their contexts by looking at each one's (i) scientific and (ii) socio-cultural backgrounds, which reveal some affinities between Tagore's view and the quantum mechanical view of reality. Keeping in mind Tagore's grounding in the *Upanishads* (the later and philosophical parts of the ancient Indian *Vedas*, which contain Sanskrit verses about the ultimate reality called *Brahman*), which regard truth/reality-consciousness-bliss as a holistic unity, he then discusses, in a somewhat different vein than Gomatam, the plausibility of introducing consciousness as a legitimate explanatory parameter, matter-consciousness relationships, ways of bridging the gap between direct sensory inputs and the knowledge constructs constrained by our built-in knowledge representation mechanisms and gives some reasons for busting the myth of pure objectivity. Finally, he introduces the distinction between a photographic snapshot, a portrait-painting and a creative, imaginative 'vision' of the nature of Reality, and argues why a creatively imaginative reconstruction of Reality that is neither a snapshot nor a portrait is the *only* plausible option for us, scientists and poets alike.

In Chapter 7, C. S. Unnikrishnan examines the interplay between 'observable' and 'unobservable' and 'insensible' entities that inevitably occurs in theory construction. Entities like fields, wave functions and even space and time are all unobservables except as manifestations of material existence and behaviour. There is thus an obvious difference between the reality associated with these unobservable theoretical entities and that of perceptible matter. The success of the physical theory is often taken as evidence for the physical reality of such unobservables. While a rigorous natural philosophy cannot take them for granted, there does not seem to be a way of avoiding such unobservables if one has to construct theories. From this point of view, Unnikrishnan makes the case that physical theories are a 'constructed' reality, consistent observations. While observables and unobservables coexist peacefully in most of classical physics, conflicts and dissonance arise when microscopic physics is described by quantum mechanics. Cosmology also provides an observational framework to bring out some of these conflicts. Unnikrishnan gives three examples. One is about the loss of physical reality due to the need for a consistent quantum mechanical representation. The second example deals with the conflict between the assumed reality of quantum fields, so fundamental and essential to our standard physics worldview, and the observable universe. The third deals with an all-important difference between conventional modern physics constructed in the unreal, nearly empty 'space' and an empirically stronger physics with matter-filled universe as its arena. Not surprisingly, the latter, with its universal cosmic links and physical inseparability, also holds human concepts of harmony and beauty.

In Chapter 8, K. Sridhar views the Tagore-Einstein discussion as providing several vantage points from which to address questions of scientific

truth, its epistemology and methodology, empiricism and realism. In the last few years, a vigorous case has been made by some philosophers of science and scientists for revisiting the question of empiricism in science. It has been argued that the classical form of empiricism based on verification or falsification, which is still the basis for all discussions of scientific methodology, is no longer a viable methodology and needs to be replaced by a less demanding and a possibly probabilistic one. This has been strongly criticized by scientists who treat empiricism, of the traditional kind, as the hallmark of the scientific method. Tied intimately to this debate is the question of realism, especially in the context of modern-day atomism. Sridhar looks at atomism and realism within the context of these debates.

Reality and cognitive science

Cognitive science is an emerging multidisciplinary approach that offers a completely different perspective on realism. In Chapter 9, Avi Chaudhuri offers a clear perspective from this point of view. He begins by asking: If a tree falls in a forest and no one is there to hear it, will it still create a sound? This famous question highlights a central debate surrounding two different conceptions about the nature of reality: the world as it exists independent of humanity versus the world as a mental construct that is solely dependent on human perception. Of course, the falling tree would make a sound, according to Einstein, the physicist. However, Tagore, the poet and philosopher, would argue to the contrary because reality according to him is in turn dependent upon human consciousness. Chaudhuri follows Tagore's thesis from the perspective of cognitive neuroscience and argues that even cases of conscious perception rely on various enigmatic facets of the human mind, such as *attention*, *motivation*, *emotion* and *culture*. The biological basis of attention has been a particular area of intense study because of its gating functions in sensory information transfer to the mind. He discusses this phenomenon with illustrations and examples through everyday phenomena, along with some captivating illusions that show a striking failure to apprehend reality. He ends by asking the question: If a human being is in the midst of reality but does not perceive it, does that reality still exist?

Chapter 10 has three main parts. The first part expounds in some detail the different concepts of reality held by Einstein and Tagore, also explored by other contributors. The second part deals with the recently empirically proven occurrence of *entanglement* (so far believed to be a quintessentially quantum phenomenon) in *classical optics*, shifting the boundary between the quantum and classical domains and sharpening the debate on the nature of reality emerging from modern physics. The third part is concerned with an alternative approach to reality based on *cognitive science*, introduced in the previous chapter, which is usually ignored by physicists. The debate between the theses of *embodied cognition* and *artificial intelligence* is outlined. The

former holds that the nature of the 'mind' is largely determined by the form of the body, i.e., the particular way in which an organism is embodied (e.g., whether it has feet, fins, eyes, a tail etc.) will influence how it performs goal-directed actions in the world, and the particular sensorimotor experiences connected with these actions serve as the basis for category and concept formation. In other words, cognition is essentially *constructive*, something that Cao, Chaudhuri and Sarkar also emphasize. This is in contrast with the approach of artificial intelligence, which uses the *computer metaphor* of the mind and views cognition as a passive retrieval. Tagore clearly believed in embodied cognition, while Einstein appears to have favoured the computer metaphor of the mind.

Mathematical reality

Mathematics underlies the basis of all quantitative sciences, and its importance can be traced back to the ancient times of Pythagoras ('All is numbers'), Aristotle ('The principles of mathematics are the principles of things'), Plato, who insisted that no one should enter his Academy who has no knowledge of geometry, and the ancient Indian astronomical text *Surya Siddhanta*, whose antiquity cannot be established but certainly goes back to the Hellenistic Greek period when there was cultural contact between Indian and Greek astronomers. Mathematics was used and developed further in India by the mathematician-astronomers Aryabhata (476–550 CE), his contemporary Varahamihir and later mathematicians and commentators Brahmagupta and Bhaskara I, and in Europe by Galileo ('The book of nature is written in the language of mathematics') and Newton. However, with the ever-increasing abstractness and precision of physical theories like relativity and quantum mechanics in the twentieth century, there has been a growing disconnect between the reality portrayed by the mathematically underpinned physical sciences and the reality of direct experience.

In 1931, when Bertrand Russell, Alfred North Whitehead and David Hilbert were using logic to understand the foundations of mathematics, Kurt Friedrich Gödel made an enormous impact on scientific and philosophical thinking by publishing his famous *incompleteness theorems*. He proved that in any computable axiomatic system that is powerful enough to describe the arithmetic of natural numbers, (i) a consistent system cannot be complete and (ii) the consistency of the axioms cannot be proven within the system. This ended the programme started by Gottlob Frege culminating in Russell and Whitehead's *Principia Mathematica* and Hilbert's *formalism*. In recent years, Roger Penrose has used these incompleteness theorems to argue that the human mind has abilities that are non-computable and which no Turing machine (a hypothetical device representing a computer) can possess. In other words, the human mind is non-algorithmic. One does not, of course, know what form a non-computable science would have, but one thing is certain: It would be quite unlike present-day science. This reopens

the debate on the nature of mathematical reality and its relationship with the human mind.

In the final chapter, Mihir K. Chakraborty offers a glimpse of the mathematician's view of reality. He touches on Gödel's views on the philosophy of mathematics and gives a brief introduction to Gödel's incompleteness theorems in a historical perspective. He also offers his own understanding of the philosophical issues involved and his realisation in this regard of the significance of the Einstein-Tagore conversations.

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Partha Ghose, Editor

Introduction

Kathleen M. O'Connell

The relationship and exchange of ideas that took place between two of the most iconic personalities of the twentieth century, Rabindranath Tagore (1861–1941) and Albert Einstein (1879–1955), has provided an area of continued interest over the years. This volume, which concentrates on the scientific and philosophical implications of their exchanges, attests to that continuing interest. The introduction will examine them at a more personal level, exploring their interests, acquaintances and perceptions concerning one another, as well as their roles in the broader socio-historical context.

On the surface, it would seem as though the two figures hold little in common. There is a well-circulated and mesmerising photograph taken of the two in Germany in 1930, which seems to accentuate their differences. The two Nobel Laureates look out at us with penetrating eyes. Tagore, elegant and poised in a *rishi*-like textured robe, looks directly at us with intense expression that seems to reflect deep consideration of a profound problem. By contrast, Einstein, with hair rather wildly unkempt and in a dark suit with tie slightly askew, is looking slightly upward, giving the appearance of contemplating something in the distance in somewhat abstract fashion. Describing the two, Dmitri Marianoff, who married Margot Einstein (step-daughter of Albert) in November 1930, offered the frequently quoted comment: 'Tagore, the poet with the head of a thinker, and Einstein, the thinker with the head of a poet'.

Despite obvious differences, a closer examination of the two individuals within their historical and cultural times reveals a number of mutual affinities and concerns. There is, as mentioned, their shared roles as Nobel Laureates. Tagore was awarded the Nobel in Literature in 1913 (the first non-European to do so), *"because of his profoundly sensitive, fresh and beautiful verse, by which, with consummate skill, he has made his poetic thought, expressed in his own English words, a part of the literature of the West"*. Einstein received the Nobel in 1921 in Physics *"for his services to Theoretical Physics, and especially for his discovery of the law of the photoelectric effect"*. Both individuals, apart from their particular fields, were caught up in the profound social and historical changes that were affecting peoples' lives everywhere. They each expressed concern over the rise of

aggressive nationalism and became champions of human rights and creative freedom in the pursuit of world peace. Beyond the scientific and political dimensions, they shared an interest in educational trends and the arts, particularly music.

Tagore's political activities had included the organising of political opposition against the 1905 partition of Bengal and his writings, such as the powerful political novel *Home and the World (Ghare-Baire)* published in 1917, explore the political and socio-religious effects of narrow sectarianism. He was deeply affected by the First World War and condemned war and militarism in his book *Nationalism,* also published around the same time. Einstein was vocal in his opposition to German militarism and gave up his citizenship at the age of 17, refusing military service and moving to Switzerland to study at the Zurich Polytechnic. He returned to the University of Berlin later, reacquiring German citizenship and continued his anti-war activities within Germany.

Their shared concerns about national chauvinism brought them into contact with Romain Rolland, another Nobel Laureate (Literature, 1915), who invited each to sign an anti-nationalist document, 'declaration pour l'independence de l'esprit' in 1919, to which they both agreed. Other signers included: Jane Addams (USA), Tolstoy's secretary Pavel Birukov (Russia), Benedetto Croce (Italy), Georges Duhamel (France), Hermann Hesse (Germany), Selma Lagerlof (Sweden) and Bertrand Russell (England), among others. At the time, Tagore had replied to Romain Rolland's request in an open letter dated July 9, 1919*:*

> When my mind was steeped in the gloom of the thought, that the lesson of the war had been lost, and that people were trying to perpetuate their hatred and anger into the same organised menace for the world which threatened themselves with disaster, your letter came and cheered me with its message of hope. The truths that save us have always been uttered by the few and rejected by the many and have triumphed through their failures. It is enough for me to know that the higher conscience of Europe has been able to assert itself in one of her choicest spirits through the ugly clamours of passionate politics; and I gladly hasten to accept your invitation to join the ranks of those freed souls, who in Europe have conceived the project of a Declaration of Independence of the Spirit.[1]

Jagadish Chandra Bose, scientist and close friend of Tagore's, was another figure linking these individuals in their scientific interests, concerns about education and internationalism. Tagore had helped raise money to send him to England to continue his work in physics and botany. Bose was in close touch with Rolland and a member of the 1921 Committee on Intellectual Cooperation, formed by the League of Nations, which also included Einstein, Henri Bergson, Eve Curie and Gilbert Murray. The committee

outlined its purposes in a pamphlet as promoting a general culture of internationalism to 'to prepare a generation which will carry over on to the international plane ideas of brotherhood, understanding, and mutual assistance'.[2] The work of UNESCO and the New Education Fellowship, which Tagore participated in, marked a continuation of these efforts to define and implement an idiom for international education.

Like Einstein, Tagore's interest in science and education had begun in childhood. In fact, a paternal uncle, Girindranath Tagore, had set up a scientific laboratory in the Jorasanko joint-family home, where chemistry experiments were conducted along with other experiments using battery-operated devices. In Rabindranath's memoirs, *Jivansmriti and Chelebela,* as well as in *Visaparichay* (a textbook on science that he wrote later in his life), he describes his education at Jorasanko, which included anatomy and scientific experiments. He also relates how a trip he made to the hill station Dalhousie with his father Debendranath, when he was twelve, stimulated his interest in astronomy and how these fascinations with astronomy and physiology led him to a large volume on astronomy by Sir Robert Ball and other volumes by Newcombe and Flamryon, as well as a set of articles on physiology by Huxley. Rathindranath Tagore mentions that when he and his father visited England in 1920, they made a special point of visiting the observatory in Greenwich, where the Astronomer Royal showed him the photographic plate of the solar eclipse that was said to confirm Einstein's theory of general relativity. Tagore dedicated his book on science *Our Universe* to Satyendranath Bose, whom Einstein had earlier recognized for his work on light quanta. His knowledge of quantum physics was reinforced by his interest in the findings of Niels Bohr and his meetings in India with physicists Arnold Sommerfeld in 1928 and Werner Heisenberg in 1929.

Both Tagore and Einstein had rebelled against conventional forms of schooling and argued for more flexible, creative forms of education. Of his early educational experience, Tagore says:

> The highest education is that which does not merely give us information but makes our life in harmony with all existence. But we find that this education of sympathy is not only systematically ignored in schools, but it is severely repressed. From our very childhood habits are formed and knowledge is imparted in such a manner that our life is weaned away from nature and our mind and the world are set in opposition from the beginning of our days. Thus the greatest of educations for which we came prepared is neglected, and we are made to lose our world to find a bagful of information instead. We rob the child of his earth to teach him geography, of language to teach him grammar.[3]

Rabindranath soon refused to attend school and received no diplomas. Instead, he devoted forty years of his life towards developing a creative learning centre in the natural setting of Santiniketan, which evolved into

the centre of higher learning Visva-Bharati and an Institute at Sriniketan dedicated to rural education and incorporating scientific methods in aid of better health conditions and agricultural procedures.

Dmitri Marianoff reports that Einstein spoke of his hatred for the old mechanical methods of pedagogy in Munich, with its militaristic instructors and how everything was stilted and academic, the cramming of irrelevant information to pass examinations. When asked what he would teach, Einstein replied in a manner very reminiscent of Tagore's approach:

> Nothing that would overburden one side of the youthful mind. Why occupy our minds with so much unnecessary baggage, no part of which ever serves us in later life? Instead of this, why not teach natural science that will bring us more in contact with the world? From dead arts, they teach us dead things. That is not life, nor a serious part of life.[4]

Later, when he received an honorary degree from the State University of New York in Albany in 1936, he chose to speak on education, again on lines reminiscent of Tagore:

> To me the worst thing seems to be for a school principally to work with methods of fear, force and artificial authority. Such treatment destroys the sound sentiments, the sincerity, and the self-confidence of the pupil. It produces the submissive subject.
>
> . . . The point is to develop the childlike inclination for play and the childlike desire for recognition and to guide the child over to important fields for society. Such a school demands from the teacher that he be a kind of artist in his province.[5]

Regarding their personal meetings, which number at least six, there seems to be some controversy regarding precise dates and places, which may in part be due to the fact that the peripatetic Tagore travelled so extensively during his trips to Europe and met so many prominent people of that era. In a 1931 typed memoir that is kept in Rabindra Bhavana, Santiniketan, Tagore's writes concerning their meetings: 'I met Einstein during my first visit to Germany after the War. I was then deeply impressed by his great simplicity. There was nothing stiff about him-there was no intellectual aloofness. He seemed to me a man who valued human relationship and he showed toward me a real interest and understanding'. It is reported that their first meeting took place in 1926, when they met twice: once for a breakfast at the Prussian Ministry of Culture, and again at Einstein's home in Berlin. This meeting would have been after his visit to Italy in the spring of 1926, at the official invitation of Mussolini. Following that visit, he had spent time with Romain Rolland in Switzerland, where he also met Italian dissidents and learned of how his comments in Italy were being used by the fascist government. This resulted in Tagore publishing an open letter in

the *Manchester Guardian* condemning the fascist regime. The 1926 Tagore-Einstein meeting resulted in a photograph, as well as a later note from Einstein to Tagore in which he offers to be of any assistance to the poet, but no record of their conversations. In the typed 1931 memoir that has been preserved in the Rabindra Bhavana archives, Santiniketan, Tagore writes of their 1926 meetings:

> I recall that we talked on that occasion of whether or not I believed in modern industrial improvements to help us in our modern life. I told him then, and I have no reason to change my opinion now, that they were essential to our physical well-being; and inasmuch as nothing could stop these improvements, we should seek to use wisely what man's ingenuity had created out of his necessity. For we had reached that degree of civilization when we could no longer scratch with our fingers; we were using our intelligence to overcome through machinery the weakness of our limbs. Both Einstein and I held similar opinion that it was necessary for us, by such means as mechanical invention offered, to make use of Nature's store-house.[6]

Their next meetings took place in 1930, and would have taken place during a very busy schedule of Tagore's, which included, among other activities, an exhibition of his paintings at Galerie Pigalle in Paris and Birmingham and the presentation of his Hibbert lectures in Oxford in late May. There is general agreement that the first of the 1930 meetings took place on July 14th in Einstein's villa at Kaputh, near Berlin. Their conversations were recorded by Amiya Chakravarty and conducted through an interpreter, Dimitri Marianoff, who later married Einstein's step-daughter Margot, and noted in his account that, 'Tagore came often to see Albert'. Tagore's recollection is as follows:

> When I again visited Germany in the summer of last year, I was invited to come to see Einstein, this time in his own home in Kaputh, a short distance from Berlin. The Professor had a very beautiful retreat there, built high up on a hill. He came down to the road to meet me. His shock of white hair, his burning eyes, his warm manner again impressed me with the human character of this man who dealt so abstractly with the laws of geometry and mathematics. Together we walked slowly up the hill, and on his balcony we had afternoon tea. Between us was a sympathy which only the barriers of language made awkward. His mastery of English is not enough for conversation and I cannot speak German. The interpreter between us must have had a not too easy task.[7]

As well as encompassing their interest in philosophy and science, the visit acknowledged a mutual love of nature. Tagore, of course, was one of the world's great poets of nature, and his educational scheme was predicated on

learning in a natural setting. Marianoff notes that Einstein's could no more do without nature 'than his meat or drink—the imperative need of his walks in the out of doors. The vastness of the mountains, the new grass, the brilliant dew on green leaves, white birch trees, dark pines, broad fields, pasture lands, sounds, sights, smells of the earth, sunrise, sunset—the whole great living story. The sentences he reads here are stronger, finer, more splendid in their phrasing than any words he finds in books'.[8] That Einstein met Tagore and immediately took him into his garden, rather than the veranda or living room, was a gesture that he reserved for those he held in 'special affection'.[9] The Kaputh location would have been the setting for their first dialogue with Amiya Chakravarty and Marianoff in attendance. The dialogue, which was later entitled 'On the Nature of Reality', begins with Tagore acknowledging that while Einstein has been busy hunting down with mathematics the two ancient entities, 'Time and Space' he has been lecturing in Oxford on the 'eternal world of Man, the universe of Reality'.

A second visit took place about a month later on the 19th of August at the beautiful villa of Toni Mendel, a close friend of Einstein's, at Wannsee, a suburb of Berlin, where she lived with her daughter Herta and son-in-law, scientist Dr. Bruno Mendel.[10] Tagore had just visited Coblenz, where the German Youth Movement was developing, and the dialogue that took place on this occasion was later entitled 'Youth and Music'. He wrote in his memoir:

> Professor and I met again, at the home of Dr. Mendel, who is occupied with the investigation in the field of cancer. Once more I was able, in Einstein, to note the innate modesty of the man. He has a vitally acquisitive mind, and while I haven't much training to meet him on mathematical grounds, we had many discussions together which approached the boundary line of human and abstract conceptions of Reality. Einstein has often been called a lonely man. Insofar as mathematical symbols help liberate the mind from trivialities, I suppose he is a lonely man. His is what might be called a transcendental materialism, which reaches the frontier of metaphysics, where there can be utter detachment from the entanglement of the world of self. To me both Science and Arts are expressions of our spiritual nature where they are above our biological necessities, and possessed of an ultimate value.[11]

It is not surprising that their dialogue would focus on the development of youth and music, two subjects that were never far from their minds. Both were steeped in music from an early age, and it was integral to their personalities. Einstein played the piano and violin from an early age and was known to start his day playing classical music. Tagore, composer of over 2,000 songs, including the national anthems of India and Bangladesh, as well as inspiring the Sri Lanka anthem, was deeply rooted in the Indian classical tradition and familiar with various folk forms of music.

Two versions of the July 14th and August 19th dialogues were published, one carried by *The New York Times* on August 10th, following the first dialogue and edited by Einstein, and another slightly different version that Tagore edited and published along with his Hibbert Lectures.

After the August 19th visit with Einstein, Tagore spent a month in Switzerland, where he met with Romain Rolland, departing for Russia in mid-September with Margot Einstein, Dr. Harry Timbers, Amiya Chakravarty, Dmitri Marianoff and his grand-nephew Saumendranath, When he came back from Russia, sometime in late September, Tagore again met Einstein at the home of Toni Mendel, her daughter Hertha Mendel and son-in-law Dr. Bruno Mendel. There appears to have been no record of the conversation that took place during this visit, but no doubt it would have included an extended discussion on Tagore's impression of Russia, a subject that was of deep interest to both men.

Einstein around this time agreed to be one of the sponsors of 1931 *Golden Book of Tagore*, along with Mahatma Gandhi, Jagadish Chandra Bose, Romain Rolland and Kostis Palamas. At the end of his article, Einstein addressed Tagore:

> You saw the fierce strife of creatures, a strife that wells forth from need and dark desire. You saw the withdrawal in calm meditation and in creation of beauty. Cherishing these, you serve mankind all through a long and fruitful life, spreading everywhere a gentle and free thought in a manner such as the seers of your people have proclaimed as the ideal.[12]

Tagore sailed for New York in early October, where he met President Hoover and spoke to a standing-room-only audience at Carnegie Hall. Einstein and his wife left for American on 2 December, 1930. They spent December 10–15th in New York and during that period, Tagore and Einstein met for a final time, in which they spent a morning in 'animated conversation', producing a striking photo with the caption: 'A Mathematician and Mystic Meet in Manhattan'.[13] Einstein continued on to California and a research appointment at the California Institute of Technology that lasted several months before his return to Germany. Tagore left for India at the end of the month.

What brought them into contact in following years not so much their common interests in education, music or even science, but rather concerns over a developing world crisis that included the rise of Nazism and the persecution of Einstein. By December 1931, the Nazis under Hitler were gaining strength, and Einstein accepted a reappointment at the California Institute of Technology, noting in his travel diary that he had made his decision to give up his Berlin position. Within the next several years, the Nazis had raided and confiscated his house at Kaputh and the Berlin apartment, blocked his bank account and declared him an enemy of the Third Reich. Following the confiscation of his property, Einstein presented his passport