

## **On Continuum – A Talk for Children**

• **Ravi Sinha**

Let me thank you, the teachers, for inviting me and giving me this opportunity to speak to the children. And let me thank you, the students, in advance, for listening to me. You are very fortunate to have teachers who inspire you and challenge you to learn about and think about things that are simple yet deep, challenging yet meaningful. When Paramitaji asked me to speak about this topic – continuum – to young minds like you, I thought it is an inspiring and a challenging idea. And I thought, let me give it a try. I took it seriously enough to write down the things I have to say to you. Talking to children is no child's play, especially when you have to speak on such a topic and have to do so in twenty minutes. I must be accurate, and precise, and honest, to the best of my ability.

At the fundamental level continuum is a philosophical concept. Can one speak philosophy to children? Most people will laugh dismissively at any such attempt. I think other wise. In fact it is a lot more difficult to speak philosophy to adults. Philosophy and science ask simple and deep questions and try to find answers to them. Children also ask simple and deep questions and would like to know answers to them. Did universe have a beginning? Will it disappear some day? If we keep on traveling in one direction will we come to the edge of the universe? What is beyond that edge? Did space and time have a beginning? Such questions are considered child-like questions. And that is what they are. They are child-like questions because they are deep questions. All deep questions are child-like questions. If adults have forgotten to ask child-like questions, too bad for them! It is no wonder that they are bogged down in dealing with complex, adult-like, questions. How to get more money and grab more power? How to compete and get ahead, whatever it takes? How to make a fool of the next guy or gal? How to present lies as truths? How to conceal one's real thoughts and intentions? How to justify injustice and exploitation? How to build traditions that justify injustice and exploitation? The list is long. Adults, as you know, have also become very good at shooting each other. Most distressingly, some children too have begun to shoot each other. I think adults will have to answer for that. They will have to answer why children are losing child-like qualities. Remember, being child-like is different from being childish. Children – most children – are child-like. Adults – most adults – are childish. Now, I hope, you will not feel offended when I address you as children.

But we are supposed to talk about continuum, so let us talk about continuum. Let me first throw at you a definition of this word that you will find difficult to understand. And then we will confront this difficulty and turn it into an easy thing to understand. That is the fun of learning about things. Continuum is such a thing that every finite segment of it contains infinity within itself. When the finite contains the infinite – that is continuum. Now that sounds difficult and abstract. But even the eighth-graders among you know some geometry and know about points and lines. You know that geometric points have no size and geometric lines have length but no width or any other size. You also know that if a point travels it creates a line. You would think that you could construct a line by putting enough points very close to each other. But can you? You know that a point has no size. No matter how close you pack the points together there will always be some gap left between the adjacent points. The line so constructed will be broken. So it will not be a line. To understand the same thing in another way, take a very small segment of a line and ask the question: how many points are there in this small segment? No matter how small a segment you have taken, the number of points is always infinite. This is what I mean when I say that in continuum finite contains the infinite. A line is a continuum. Even the smallest segment of it contains infinite number of points.

One way to understand a difficult concept is to figure out what is its opposite. What is the opposite of continuum? It is the 'Discrete'. Discrete things are separate and countable. The continuum, on the other hand, cannot be broken into countable basic constituents. Of course, you can break a continuum into several countable segments, just as you can break a long line into several shorter lines. But line segments are themselves lines. They are not basic constituents of a line.

The interesting thing is that you cannot build a continuum out of discrete things, but you can build discrete things out of the continuum. The only catch is that the discrete things you build out of the continuum are necessarily connected with each other. Being connected is another crucial property of the continuum. Those of you who are interested in drawing and painting may have played games of drawing a figure – of an animal or a human – without lifting the pencil from the paper. What you are doing in such a game is turning a line segment into a figure. You can also turn a line segment into a multitude of figures each one of which may be separately

identified. But if you did not lift the pencil then all the discrete figures are connected with the same line out of which you have created those figures.

In physical sciences as well as in philosophy there has been a long debate about which one is more basic and fundamental – the Continuum or the Discrete. The so-called *Atomists*, such as the Greek philosopher Democritus or the Indian philosopher Kanad, considered the discrete as more fundamental and postulated that some kind of indivisible atoms were the basic building blocks of matter. There were others, such as the German philosopher and mathematician Leibniz, who imagined a *Plenum* – a kind of material continuum – filling the entire universe and everything was built out of that. A similar idea was prevalent in the nineteenth century physics wherein a continuous medium called *Ether* was supposed to fill the entire universe. One nineteenth century physicist even proposed that atoms are nothing but knots or vortices in this ether and made out of this ether. When Quantum Theory came about in the 20<sup>th</sup> century, it was first thought that it gives precedence to discreteness. But as the theory was developed further into a more consistent theory it took a fundamentally ambivalent position. It said that both continuum and the discrete are equally fundamental descriptions of basic reality. An electron, for example, is both a wave and a particle. It depends how you look at it. A wave presumes some kind of continuum and a particle is an example of the discrete. In the case of the quantum theory the wave is not built out of particles, nor is the particle built out of the wave. They are two incompatible manifestations of the same reality which is neither wave nor particle, or which is both.

There is one continuum, however, which has always been taken as a continuum. It is the continuum of space and time. The smallest volume of space contains infinite number of points and the smallest duration of time contains infinite number of moments. This is why quantum theory has great difficulty in dealing with the basic nature of space and time. Quantum theory always puts the continuum and the discrete on equal footing. This would require a minimum length or a minimum volume of space and a minimum duration of time. One cannot divide these minimum lengths and durations further into smaller units. They are called Planck length and Planck time in the honour of Max Planck who was the originator of the first version of quantum theory. But Planck length and Planck time are more like definitions or speculations. No one knows how space and time actually behave at this scale. This is an unsolved problem of Physics. The dichotomy between the continuum and the discrete remains unresolved at this fundamental level.

Let me now leave physics behind and talk about another kind of continuum. Let me talk about humanity. There are about six billion discrete human beings on this planet. No two of them are identical. And even if all of them were identical, perhaps cloned by some superhuman, they would still be discrete – separate and countable. As we have seen, you cannot build a continuum out of discrete things. Then why am I talking of humanity as a continuum? I told you about connectedness being a property of the continuum. Humans, though discrete, are connected with each other in fundamental ways. Even those are connected who have never met and who would never meet. This connection is of many strands, with many aspects. We are members of the same species, share the same planet, have the same roots, have almost identical genome structure and at the larger time scale we have had the same history or at least connected histories. It is not only legitimate but also useful and ethical to talk about a human continuum. If you believe in a human continuum, you can perhaps take a more humane approach to many of the human problems.

As we have seen, discrete structures can arise within a continuum. You can make a multitude of figures and shapes out of a single line. When we talk of the human continuum, the first thing that follows is the basic claim to equality of all human beings. We are all made of the same human material, so to speak. We have to be equal in a fundamental sense. Equality does not mean identity. We are not identical; we are all different from each other. And yet we have to be equals because we are all humans. In fact, if we were all identical then there will be no meaning to claiming equality. It will become a tautology. You know what a tautology is. It is a truth that is meaningless. Like saying that one is equal to one. There is meaning to equality because we are all different. Equality is to be claimed because we are all different. Equality is to be achieved across differences and despite differences. Equality is to be achieved while respecting differences. And, in order to establish equality, often you have to do something special to make those equal who have been treated unequally, who have been dominated, discriminated, deprived and exploited. You have to give them special help to bring them at par. I feel very sorry when I hear young people claiming more rights and opportunities than some others because they are more meritorious than some others. When you do that, you are already becoming like adults; you are already being selfish; you are already forgetting some of your human traits.

Are all differences to be equally respected? Even more, are all differences to be respected? No, not at all! There are differences of different kinds. Certain differences are positive and desirable; some others are negative and undesirable. You can almost use a formula to figure out which ones are which. Let me describe that formula.

Differences in our society often translate into inequality. Men and women are different, so they are treated as unequal. Blacks and whites are different, so they are treated as unequal. Cultures and languages are different, so peoples of those cultures and languages are treated as unequal. From inequality invariably follows a power relation. One side dominates; the other side is dominated. Now use the following formula. Imagine that by some magic this power relation is dissolved and the society begins to treat those equally who are different in a certain way. If by treating them equally the difference itself gets dissolved, then that is the kind of difference that is worth eliminating. In this case equality should be established by eliminating that difference. On the other hand, if, even after establishing equality, the difference remains, then it should be respected and preserved. Then equality should be established while respecting and preserving that difference.

Let me give an example. Suppose you are a Brahmin and I am a Dalit, and there is a power relation between us because of that. Now suppose this power relation is dissolved and the society begins to treat us equally and we begin to treat each other equally. Then there is no meaning left in your being a Brahmin and my being a Dalit. This is a difference that is worth eliminating. Take another example. Suppose there is a power relation between those who speak English and those who speak Hindi. Again, suppose, this difference is dissolved and the Hindi speakers are treated equally with English speakers. But in this case the difference itself will not go away, because English and Hindi will both remain as languages. This is an example where the difference should be respected and preserved while establishing equality and dissolving power relations. I will leave it as an exercise for you to think about other examples of which differences are to be respected and which must be eliminated.

We have been talking so far of knowledge about the continuum. In the end, let me talk about knowledge itself as a continuum. Knowledge is given to you as separate subjects that are taught by different teachers in different periods. But, actually knowledge is a continuum; it is connected and there is no end to going deeper inside it. You should be curious about different

looking phenomena in such a way that you are always looking for connections and interrelationships. Moon goes around earth and apples fall on ground. The two are very different phenomena. Newton was curious about both. But he was curious in such a way that he found a single reason responsible for both the phenomena. That reason is called Gravitation. Scientific knowledge invariably leads to discovering unity in the laws of Nature.

But I must warn you against a common misconception. Not everything that is claimed as knowledge is part of the same continuum. In fact I would go further and say that not everything that is claimed as knowledge is actually knowledge. I will give you one illustrative example. There is a system of knowledge and there is a system of beliefs. Science, for example, is part of the knowledge system while religion is part of the belief system. You are entitled to your belief system. You can believe in whatever you like. That is your prerogative and I would not argue with you. What you should never do, however, is to claim that your belief system is part of the knowledge system. Knowledge and belief are two different things. Knowledge has to be tested against reality, against the world, against the universe. Belief may not be tested so. You should never mix the two. Having said that, I can also tell you my own preference. I prefer that my belief system does not go, as far as possible, against my knowledge system. I have not found a religion that meets this criterion. So I do not believe in any religion. But that is my personal choice. I am not asking you to do the same. All I am arguing is that you should be aware about the intrinsic differences between the knowledge system and the belief systems. In a country like India it is even more crucial. Here belief systems are often presented as knowledge systems. Sadhus, Gurus, Godmen are what they are largely because of their belief systems. But our society treats them as Gyanis, as knowledgeable people. That is a dangerous thing to do. You should be aware of that. Many of the ills of our society have their origin in this kind of confusion.

Well, I will stop here. Thank you once again for listening to me.

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