

February 19, 1992. John

MR: You don't have to be nervous, all I want to know is, find out a little more about your ideas like on "Inventing Reality" and those questions that we had the, this essay, and the questionnaire, yeah. So, (pause) here in the beginning you say, man's attempt to rationalize life,

J: Yeah

MR: The question is, then you say here that scientists elaborate questions by inventing models, so you clearly say that scientists invent models

J: Yup

MR: And the equations, and they have their rationalizations. Now, here the question is, is scientific knowledge artificial, and the second is, does it show nature as it really is. I think it has a double

J: Yeah,

MR: So the first ahm, you say, scientific knowledge is based on models, scientists invent it

J: Yeah

MR: So is it artificial, artificial meaning man-made

J: I think it is man-made

MR: But what about the second then, does it show how nature as it is?

J: Yeah, it does, but from a

MR: from our perspective?

J: yeah, from our perspective

MR: So, knowledge is it then always relative, our knowledge, is it always relative to humans, or would we ever have, the next question is about truth

J: yea

MR: So how do you see truth then?

J: Well, truth (pause)

MR: Well, how do you define

J: How do you define truth?

MR: Because over here you say that, ok, humans invent models and equations, and so on, to describe nature, and you said, it may never show nature as it really is, because it is invented, now how does that relate to truth? Here you say, it approximates truth,

J: Yeah, because we didn't actually you our equations, reality, sort of thing, whereas approximating it really is through our perspective and, you know, I believe in, I believe in God as you well know, from reading my essays, it is based on His equations, because I think it was based on mathematics

MR: So you think that the creation as God created,

J: It has constants, not based on mathematics and that's why we (believe math?)

MR: What would you then say, ok, this comes later, do we discover those constants, you said you just said that God (pause) sort of created the world

J: yeah

MR: according to these mathematical, so do we then, so do we then discover truth, those

J: Ok, ahm, we can discover the constants, I think, they are based on truth

MR: Like what do you mean the constants?

J: Like something, something that repeatedly comes out from the calculations which, you know, is a physical (?), you know, God like wanted it this way, and so He wanted it, its just the way in our perception,

MR: Well is it our perception or is it

J: Our perspective
MR: So we have a certain perspective on reality, but, and then you say here, scientific knowledge approximates truth, would you say then in your conception that truth is what God said
J: Yeah, that is what I think
MR: Ok, we, do you think that whatever humans invent can ever, is that what you mean
J: Yeah, I think that we are trying to find ourselves, and finding ourselves is like answering the big questions about truth
MR: yea, but do you think then that man is approximating what you said, God said initially? Is it God who created the universe?
J: Yeah
MR: which is mathematical?
J: Approximate
MR: And so we, sort of
J: approximate
MR: come close
J: come close, but it's not the absolute, we not
MR: You think, we never get to the absolute
J: I don't think so, it is always changing, like entropy, I guess
MR: You see, I don't want to be mean, but I sort of want to nail you down here, because on the on hand you say here, God creates the universe (yeah) its absolute, its mathematical, (ahm) man invents mathematical equations and you say, it approximates truth. What I want to know, do you think that there will ever be a moment that man's invented mathematics (yea) will be close to, or, infinitesimally close to
J: Yea, I think so, if a
MR: because it is, (pause)
J: I guess we could, because we have the mind, God gave us the mind whatever, to answer everything about us
MR: but what does it take? What do you think, is it just, does it just take years and years of searching or, how will we get to that?
J: It does, I mean, like from the beginning of time, or the beginning of historic time, like, as far as, He gave us approximating truth, I think, and then such as more recent, scientists they are getting more and more (close) close, and I think, eventually we we could the world doesn't end before
MR: So you think then, that we get or few individuals because it seems to get more and more difficult (yea), do you think that some few individuals will know the truth or come infinitesimally close. (pause) What about these presuppositions, ok, these are assumptions that we have (yea), I guess presuppositions are unquestioned assumptions, unquestioned, like you never question yourself whether space exists, because you say it exists because (yea)
J: because we see it there
MR: But well, one could still question our perception of space doesn't
J: it is approximate
MR: yea, whether our perception is is (pause)
J: well, presuppositions do, I mean
MR: Do they
J: they do delay scientists finding the absolute truth
MR: So you think that we just have to wait
J: well, yea, when a (pause)
MR: could you give an example

- J: an example, see, ahm (slow), see the Bohr atom, Bohr's model of the atom, he had this model that had orbitals, like the set distances, had orbitals, and they were all circular, and they were all orbitals, ok, and on the, the mechanical, the
- MR: the quantum mechanical was the next on
- J: yea, that, it disproved it. But I mean, it took a long time to disprove it
- MR: Well do we know that quantum mechanics is the right thing?
- J: No because we can't see the force, we are just presupposing that it is there
- MR: one thing we know is that it works, but does that mean it is the right one, because currently there are two different interpretations of quantum mechanics, one is the main stream the other one, there are some physicists who say, you know, other physicists, you know, who follow Einstein, who say no, there are other variables that we don't know yet (yea) so they have different ideas about the theory, but both theories explain
- J: the same
- MR: the same thing, so can we, which one is true, or both seem both seem to explain the same thing and we can't distinguish,
- J: Oh, I think, we don't know about the topic enough to distinguish which one is right or not, it will take time, I am sure and may be, I don't know, may be because future scientists will discover
- MR: let me ask you another, very related question about light (yea) what is light?
- J: A particle or a wave, a particle is that the
- MR: well, that could be one way, do we know what light is?
- J: Not really, because scientists believe that it is particles it has both characteristics of both, characteristics of wave . .
- MR: but what is it then
- J: well, I think it is, I don't know, I don't think scientists have found what it is truly, yet
- MR: Do you think that this is one of the things that scientists will eventually find out
- J: yea I think so, because it is, I mean it's here everyday, and scientists you know, its a physical something, physically is affected by light and i think it
- MR: This is one of those things, that you would say, once we know what light is, that's the truth?
- J: Until someone disproves it, but it would have been until after someone disproves it so (pause) its hard to say, what truth is really about, because
- MR: So what you are saying then, or what you seem to be saying is (pause) that scientists have to make leap of faith, a leap of faith
- J: yea,
- MR: and believe something is true
- J: those are the presuppositions if you
- MR: because you said, if you never could be sure, then we have to believe that it is (pause). I think we already have that (to myself) you said that God created the universe according to mathematical laws and you also said that scientists invent laws, so you think that scientists changes these laws, his, the scientists change their laws until they approach more and more. Ultimately then. if you say approaching, they should approach those laws that you say God
- J: yea, that is what I think (pause) we are far from it, still
- MR: What about that, several times you sort of, the way of explaining your own understanding, with aliens were to come [refers to essay]

J: because I believe in other forms of life
MR: so, the other forms of life, but what would they perceive differently
J: let's see, I think well the scale of things, and their units, their unit probably will be different because one two three four, they might not be using numbers, they might be using totally different, something
MR: different ways
J: and so they'll (pause)
MR: but how would that (pause) would there be anything that is similar then?
J: Let's see, ahm
MR: because ultimately, if they inquire, they also should be coming closer and closer to truth, and develop your ideas
J: Ahm (pause) well, see they probably think differently from us, but they probably see the same
MR: Would they find the same laws, would their laws look similar to ours? Or differently
J: If they are I mean, if they're collaborating we'll develop, I think, something like that that will be just approximating
MR: What about, the universe created us, earlier you said God created us or is that tho you one and the same
J: Ahm
MR: which one?
J: the universe created us, well, (pause) God did create the universe so I think the universe did create us
MR: OK, so we, may be it will help me to better understand these, how do you see (ahm) the universe being created, I guess
J: the origin of time
MR: that's right, how do you see it?
J: well
MR: like, I think one big thing in the debate was that was the universe created in seven days
J: seven days
MR: yeah, and seven thousand years ago, or was it, or do you believe big bang, or
J: I believe in the big bang theory, I mean, something had to initiate it, so I think God created that and seven, you know how seven days, that is a parable, just is an analogy to how God created the, I think it wasn't created seven thousand years ago
MR: which sort of form, which church do you
J: I am a protestant
MR: Just protestant
J: well, no, this is the name of it, Christian missionary and (?) church
MR: I never heard about that
J: no, its (pause) they have a, its more relaxed beliefs, its not like catholic, or protestants, I feel at this church that we go to now its repetitive and I don't think its
MR: what church are you going to
J: It doesn't reach deep into, well actually I am going just to the school's right now, my previous, to coming here
MR: You mean in
J: like in Omaha, there is one, and in Denver Colorado, there is one, and in Santa Fe
MR: The church that you
J: yea, the church and they believe in, like being born again, you, do you know what that is, where you (pause) where you pray to God saying that (pause) like you wanna follow in His foot prints, foot steps, and you

wanna just act, act like a Christian, have more (?) have more of certain things, its not like any ethics towards any, or you can't eat certain things, its not like the Mormon, the Mormon religion, its based on the bible, they have their own (?)

MR: OK, social, the social environment does that affect the content.

J: yes it does because, I mean, I think there is, there is advantages and disadvantages in the different things, because ah, if there is scientists, who is very sociable is in all the science community then, they are going to have presuppositions too, but there is beliefs and that might detour what they are trying to achieve, and it will change

MR: I have, you know, in that respect, for example, I often bring up scientists, for example a scientist working for Ciba Geigy, or you know, and they just came out with a new chemical, or a new medication and then may be another, another scientist working for an environmental group, and they both study the same chemical, one comes up with the result or with the knowledge that this chemical is save and the other one comes up, or the other group of scientists comes up and says this is not save. So I was wondering

J: is there, yea that happens a lot in, especially in society

MR: so

J: because like, you hear so many times like people say, coffee is bad for you, and then coffee is good for you, and its just further more studying

MR: yea, but how do we then approach, you said truth and you accepted that there is on truth (yea) do you think

J: That there might be two?

MR: well I don't know. Will they eventually converge? or will one be shown

J: Well I think there is one answer

MR: But which one, when you say for example coffee is bad, and coffee is good, and you have two camps

J: I think that it's a probably a, everything is bad, and everything is good, like there is bad things, like in excess, like coffee in excess is probably bad for you, and in amounts that are like one cup a day, that is not bad, I think (pause) ahm its just the way they look in it, they have, they can have different perspectives on it, the extremes, how good or bad (pause)

MR: Let me see (looking for sheets). now with respect to learning. Now that we have sort of established what we think scientific knowledge is, and a, you told me about truth and ah, we have established that also that scientists when they establish new knowledge, you said they are affected by their environment. Now, what does that mean for, what are the implications for learning? (pause) see for example, on, the questionnaire asks how would you prefer to learn, so you say something about and I was wondering if you see some link here, and I high lighted some of the most interesting. You say, you want the teacher to show the correct method, very often, and the teacher insist that my activities be completed on time, and to learn the teacher's method, why would that be? For example, to learn the teacher's method and the teacher to show the correct method

J: First, well that's how I personally

MR: no, that's what I want to find out

J: well, because usually if I look at someone else doing it first, I am very visual, so that's how I learn, I can't, I mean it is harder for me to sit down and learn it from a book, I'd rather see it done first, and then try it myself after that and then that's how I see it

MR: But, I was wondering if you think that there is just one correct method, or

- J: No, there is more than one, but the teacher probably knows easier method and probably more efficient
- MR: see there are some other questions let's say, let's say to find out my own way of doing my investigations you say sometimes
- J: sometimes, yea well
- MR: I was wondering, why sometimes, I am a person I always want to find out for yourself
- J: very often, I want to find out
- MR: well I mean if I had a lot more time that would be the way I'd go but if you only have the amount like you have a lot of large work load here [at Appleby] then I think it would be inefficient, and until you are good enough to do that there is only so many things
- MR: so you, how do you relate that, here you say you want to have a lot of direction from the teacher is that, do you relate that to time, I mean, would that be different if someone said you could take as long as you want to learn
- J: yea, I think if I had more time and I would try to learn it on my own and would try to do many different types of solving and see which is best for me, but it takes a lot of time for me to do that, I don't always don't have that time
- MR: But do you understand, as well, like when you figure something out for yourself
- J: Yea, I do understand I see what you are trying to say, you don't remember as much
- MR: You remember well, when you figure it out for yourself
- J: yea, I think you remember more and longer
- MR: that's right and when you get something shown, the teacher shows something to you, you may not
- J: just like television, if you just watch it you don't learn that much, and if you read it, its one for life then you'll understand
- MR: so is that, to come back to your essay, in your essay you say that you like the labs,
- J: I do, because I, I think, because I (pause)
- MR: Why would that be
- J: may be because I have a lot of time to do it and in tests I am not the fastest calculator and I know that has an effect, and I like to take my time, and do it
- MR: how does that then relate to knowing, what do you think a scientist does
- J: he does tons of experiments, he learns from experiments, he doesn't learn from taking tests,
- MR: But why then, as a student, obviously a scientist doesn't need or say, or I need a person to show me
- J: Oh, yea, yea I understand
- MR: I was just understanding what your view is on that
- J: if I was a scientist, I guess I would have a lot more time and that would be the one thing I would be looking at, and I would have the whole of my concentration for like 12 hours a day and I think you could do that, and also if you had a group of lab technicians you would get it done quicker, because its like brainstorming everything is figured out quicker, because 5 brains are quicker than one
- MR: what then is the purpose of school science, how then, ideally how would you like to see it
- J: Ideally

MR: Ideally, imagine we are not here at Appleby College and you have the choice to learn the way you want, what would be the way you'd like it

J: Ahm

MR: What sort of environment would you

J: I would like the faculty to student ratio be very small and then I'd wanna do independent projects, I think that helps a lot

MR: how would it help

J: well, it helps you to learn how to manage your time and what references you can use for it, it teaches you like in the business world you're gonna have math teachers

MR: So what roles does the teacher play? How do you say, what is the teacher for

J: to show you new topics, to get you started, I think

MR: because you could say, one could say, well literally there are literally hundreds of physics texts, so I mean one could oneself study by reading, so what is the teacher for, how

J: gets you motivated, I think

MR: why, why would the teacher you also say, teacher motivation to get you motivated, you also say the teacher should insist, should often insist that the activities are completed in time, you wouldn't do it

J: well I think, yea, I mean everyone is a procrastinator, and

MR: Everyone? Appleby student?

J: Yea, I think so,

MR: I am, I don't feel like a procrastinator, I have a presentation March 22 or so and I already have my overheads, I already have my whole presentation ready so that its not procrastinating

J: no, in general, I know there is people that I mean, if you look at at Walker House, there are a lot of people, the night before a calculus test, independent, they stay up till 5 in the morning, but I am, I'm not as bad as some of the procrastinators, I get in all my work on time and stuff, but there is some, I have some characteristics of procrastinating

MR: you do?

J: yea

MR: OK, you write about labs, physics is like a language, it can be difficult, what's the difficult part in physics, what

J: ahm, ok well, I think the, there is so many formulas, and so many concepts to learn that I think, memorizing all those, and that's only part of the difficulties, and I think also like problem solving can be difficult, in dealing with the ahm extensive math problems

MR: But is that what a scientist does, a physicists

J: he does, in the end, the analysis to analyze his results, of his observations, but I think a scientist creates his own math

MR: so what, you said it is difficult to translate, what is the, what is difficult to translate into common knowledge

J: probably, just scientists, some scientist's concepts, like in physics, Sir Isaac Newton, or Einstein his was complex, he was a genius, not everyone is a genius, I mean, also I feel chemistry is, for me it's easier to learn

MR: why

J: I don't know, it feels that its a simpler topic, so it's easier to teach and explain, and physics is much more difficult and complex

MR: but you want to be an engineer, so what

J: I know

MR: this is sort of awaiting you

J: I do,
MR: so what what are your ideas, you will continue at the university doing word problems
J: I know, I mean
MR: because if it was for me, I would just do just do labs, but then if you just do labs, you are not prepared for university
J: for university
MR: So what, from your point of view, what would it take
J: well
MR: in a class
J: in a class, well doing more word problems, I mean doing problems, as a class
MR: you mean in small groups
J: actually on the board, I mean, for like 15 minutes, and then everyone works as groups, and then you, give us a few problems to do for homework and we go over them and we see which ones, I think that helps to learn, it keeps people
MR: So, the way I understand you, is that the teacher always also should be a task master. First of all you also said you should be, you needed to be on track, with the time, the teacher keep me on time because you are a procrastinator, you also said you wanted the teacher to set the learning activities rather than choosing them on your own. Let's see and look here, I do want to look at a few ideas, concepts that we were talking about do you see, for example, do you see any link between the lab, the lab experience and the ideas and the mathematics [using the concept map from theory]
J: yea
MR: sort of does one, if you study one, does one help you understand the other?
J: yes I think so
MR: Like what?
J: Like, just recently, our labs they help us on the tests, and for a practical, the experiences
MR: yea, but what does it help, does it help you to understand the concepts, or the mathematics,
J: the concepts more
MR: the concepts more?
J: yea
MR: and how do you link the mathematics and the concepts or the mathematics and the lab
J: I think, once you get the concepts, then you use the mathematical equations
MR: but if you look at a word problem, what do you look for, you look right away for an equation?
J: no, first you have to make a model
MR: so what do you do, when you do you try to make a model, do you try to draw
J: I try to, yea
MR: see here, that is a text, most of the mathematical concepts you find in texts
J: yea
MR: right, or in a lecture, I was wondering, how do you understand the math in physics? do you need to practice?
J: yea, practice, practice, and I think through other methods

MR: do you have memorize?
J: yea
MR: what about interpretation? Like, how do you learn the concepts, if you read a book, or in a lab, how do you know that (pause) that your idea about a concept
J: Ahm (pause)
MR: for example, we have the photoelectric effect, how do you know that you understand what it means?
J: well, I read the book again and see if my thoughts relate to
MR: but do you try you read just one book, do you try to talk to someone
J: no, actually I should probably, but I just read the one physics text, the text, and I mean, its probably not absolutely correct all the time,
MR: what, ah, you know to come back to your writing in your essay having difficulties, do you think that is somehow related?
J: to, just, having just one source
MR: yea (pause) see, when you just read one source, you can never check
J: your answers
MR: or you understanding, if you talk to other people, or you were unfortunately in that course for two years now
J: yea, you read that in my essay, yea I guess, how I came into new, I had a reputation of being semi-smart in my other school, so I got some lab-partners to work with, but here it's harder to contribute something, because the competition is more, I think, you have noticed yourself, like how Ferdi and Matt Milne-Smith are in one group, and like the moderate people are in the other
MR: but that doesn't necessarily mean that that a they should get the high marks, because I often find that people when they with a smart person, they lay back, they let the smart person do everything, if there is not a smart person, not a MMS in one group, they get together they learn as much, and get as high grades as the other ones, because they are not laying back
J: but think there is a mixture, it should be, because I myself, I know, there is some occasion where people slack off, but I myself work, feel that being involved helps you
MR: but then a, why people lick Ferdi and Matt, why they chose each other?
J: they know that they are competent
MR: they also want to be challenged and there is a pro and a con, some people say the groups should be mixed, but I also observed that when you take a person who always occupies everything
J: yea
MR: if you take him away, the others actually get involved themselves. I don't know if you had a great group experience, but does it sort of help you in the lab, when you work with others
J: yea
MR: how? or why does it help you?
J: it gives you the ability to deal with people
MR: what about the kind of things that you learn form them?
J: Ahm
MR: does that help or could you do the lab just by yourself
J: actually, I think, as a group it is faster because you can do the tedious well each person can do the tedious stuff and accumulate the tedious jobs and so the general flow of the lab goes faster and then you learn more
MR: what about the outcome, when you have the data, but you have to sort of know what they mean, does it help you as a group

- J: yea, because when one person looks at a set of data it can't be as objective about it then when three people
- MR: so how does it?
- J: just by brainstorming you can get a general consensus, and it is probably more accurate than one person's view of the data
- MR: so, OK, so it does sort of help you to understand. What about, what would you like to do, you want a mixture of texts and labs? Do you like doing the labs?
- J: yea, I do, not
- MR: not so much?
- J: well, I like a mixture if you just do so many labs, then they do take time, they take a lot of time and that takes away from your memorization of the formulas
- MR: so do you think that this is important, the memorization of equations and so
- J: it is not as important as, its the concepts that you want to memorize, not the formulas, more the concepts.
- MR: so do you like that part, memorizing concepts
- J: well, yea, it can be a challenge sometimes it also can be more involving too its (pause)
- MR: so, I write here culture because that is what we already know, I was wondering, I guess from what you said is, you learn for yourself in the labs, that's why I say some knowledge is individual. So, what do you see for the rest of the year, what do you want to do?
- J: I have to improve my marks
- MR: well, yea, but what sort of, what do you think you need to do
- J: I think I have to dive into the text more, and look at more concepts mean, because I think we should do labs too, more labs because this term we have done the labs too, but not for marks and I put everything in a portfolio, is that gonna be marked
- MR: Why don't you bring it by, before I make up your marks
- J: OK