

**Speaker 7:** Can we sit here or come in up here?

**Speaker 1:** Well, whatever you want. You can come up here.

**Speaker 2:** Thank you for [unintelligible 00:00:21].

**Speaker 7:** So are there questions?

**Phillip:** [unintelligible 00:00:45] and then I don't know.

**Speaker 7:** Please, the microphone and say your name please.

**Phillip:** My name Phillip [unintelligible 00:00:50]. To any of these gentlemen, I don't know which one can answer. If I want to have analyzed paint with water medium, where should I go? For advertisement.

**Speaker 2:** A competent laboratory, I think.

**Phillip:** Thank you very much. I knew that.

**Speaker 2:** So some expenses, probably the level of detail to achieve what you want and that can help you get a very great detail and information after that [unintelligible 00:01:38] say you're using very advanced techniques.

**Phillip:** And I understand you cannot date this medium, this watercolor or an ink painting.

**Speaker 7:** Well, I mean in the dating, it depends if you have a database that is spanning a certain period and you find features that you can place it to that timeline, then you have a possibility to give some kind of a date.

**Phillip:** I mean if I can --

**Speaker 2:** Jumping in, I think there are two ways of looking at the question. You've got what we sometimes call [unintelligible 00:02:17] methods which is like the radiocarbon data way. You have something that is essentially a ticking clock, so these alteration phenomena are a bit like a ticking clock. You have on the other hand new materials or changes to old materials coming in at specific points, which is some non calendary method. Your motivation that you have about that when it was introduced to infer a date. So there are two kind of complimentary approaches to these kinds of questions.

**Phillip:** But I understand that the medium, the oil medium has been studied much more extensively than the water medium.

**Speaker 7:** Well it depends. I mean there's a lot of changes in proteins, if it's a protein based system, there's a lot of changes that can be detected extremely accurately now because there's a lot of interest in the medical science to look at oxidized proteins. Again if you understand the timeline, you can sort of do something with it, but you have to develop that timeline of course.

**Phillip:** When you say, "Understand the timeline." If I know that some works for example are from a given date, then you take that as a reference to analyze the others. Is that what you mean?

**Speaker 7:** Well what I mean is that you basically have to have some kind of calibration where the changes in protein or in other material are sort of followed through time. And so that may give you some indication of the dates but I personally don't like to let's say take just one material out of a work of art and play with that. It's much better to actually look at that in context. Maybe there are other phenomena that you can see that give you more information because the materials is in fact sort of trying to place itself in that art work. See, the point is that many of those materials are not really compatible in a paint. And that's why they change over time, either because they experience light, they may experience a sort of pH, they may sort of experience metal catalyzed oxidation processes and so on. So all these things come into place where you cannot just isolate it and say, "Well let's take that material out and look how old or what it is."

**Phillip:** I understand. But you're positive even with water based paints, it's -- this is a --

**Speaker 7:** Yes. But there's definitely much less known about them.

**Phillip:** You don't know how the medium you know that you are explaining that actually is very important because it also ages and etc.

**Speaker 7:** Well as I say, there's more knowledge now about proteins. I think that the changes in carbohydrates and sugars, potentially you could have a lot of changes but they are really not very much studied at all so you have to go to other fields where they have studied that a lot and see how that information is relevant to this particular question.

**Phillip:** Okay, thank you.

**Speaker 7:** Martin, first.

**Martin:** Yes, thanks very much. First turn, sort of [unintelligible 00:05:33] my question is actually for Speaker 7. I think what you said should be compulsory reading for every one who sends out carbon dating tests and says this proves this picture is from 1500. The basic – the number of misuses of carbon dating I see claiming absolutely [unintelligible 00:05:54] position is very high. But my question for Speaker 7 is a very sympathetic for this basis and analysis of the scientific data and I can see how that would work, could actually give you a greater probability than just each separate ones that were left isolated on its own. Do you see that analysis being able to embrace what I call the old rich factors or the external factors and things like learning out those interests and precious minerals, can they be rolled into this bastion probability analysis.

**Speaker 7:** Yes, I think that's a very probing kind of question. From my perspective, I feel very much like a bastion learner. A kind of new introduction to the field. I found it a very effective way of looking at my pigment history data and there were established techniques for actually combining that sort of data in rigorous ways. And essentially, we've had a couple of size on radio carbon date using exactly the same software I used to combine pigment data. When it comes to these, as you say, orbital factors, I think we're somewhere away from understanding just how to formulate and structure those kinds of things. So Leonardo has an interest in minerals but how do you construct the counter case. So there are a lot of questions that need to be thought of. I think it's an incredibly powerful approach but we need to be extremely careful going into it because you can do some awfully destructive things with it.

**Speaker 2:** Bill, you're at the front or at the right.

**Bill:** Is this working?

**Speaker 2:** Yes, this is working. Go on.

**Bill:** Thank you. Bill Sharon from New York, just to follow up for Dr. Easton. I'm not sure I understand when you say we could do some destructive things of you spoke earlier about misuse basically. What more precisely do you mean?

**Speaker 7:** Yes, I think that's –I perhaps have this fear that we know that it works in certain circumstances very well for certain kinds of data, but it's those circumstances where you have well-structured, well-formed kind of data like pigment chronologies. It's very effective or radio carbon data where we understand how to formulate questions. It's when you start straying into inputting more subjective kinds of things or what might seem more subjective kinds of things and these kinds of counter cases. Okay, this artist used it. It might be a fact that might persuade you a bit more that it's by that artist.

But I think we should be going into such a process with our eyes open as to what the potential pitfalls are as well as what the potential benefits are. So it's, to my mind, it's good to work from where we feel most secure about applying it and it is already I think proving a very useful formulation, but we need to be aware of when we're treading into on certain uncharted waters. And I think it's probably instructive to look at examples of the forensics field. I can't give you one off the top of my head but where it's been used a lot. I know it can be a difficult thing to use in a legal context, the understanding of courts about the basic approaches, how you present that, although I use it to underpin say the combining evidence from pigment identifications. It's not something that I currently commonly put into reports even though it informs my thinking about a particular question.

It's not something that I feel is currently – the field as such is prepared yet to adopt in its full scale form in terms of the such and such of probability of this being from such and such a date. It's fine with radio carbon where it's well established already, but extending that to the paintings feel that we really are just starting. So it's something that helps me think about problems but at the same time, I will try and reformulate it in a kind of an argument if you like.

**Bill:** But is that not also the friction between an academic approach and a market approach? Because market and law, a court of law requires answers in some times. So how do you formulate it? How do you deal with it?

**Speaker 7:** I think this is why it's probably pertinent to these kinds of arguments because it does actually give us a rigorous approach to taking this information and deriving useful knowledge from it so that we can potentially start to express these things in a more structured, more precise, dare I say it, way that helps us to ask the questions we have in a more rigorous manner. I mean listening to the talks yesterday, there were quite a few examples where people will say, "Well we found this but it doesn't prove it one way or another. We found that and it didn't prove it one way or another." In actual fact, that object is an assemblage of all those different facts and we can take that series of facts and combine them in robust ways to get more robust solution.

**Bill:** Well I'm just – can you turn this on again? I'm just wondering if you do create a report, if it's not worse to actually say well this is the kind of approach originally that we're taking as a kind of an introductory. And then say, well if we now apply this to this particular problem, these are the kind of questions that we see and want to address. I mean then it's more or less clear, otherwise it's kind of a hocus pocus thing that you say well it's dated in, so it should be good, but it's not clear to most people what is involved.

**Speaker 2:** I think this is why – okay, you can take a piece of analysis like combining pigment data and you can present that. I think it's why I wanted to start talking about these kinds of ideas at a forum like this that there is a broader discussion to be had about the benefits and dangers of these kinds of approaches. Yes, we do need to start

introducing it to the wider community. [crosstalk] And then there has to be a lawyer to understand it, yes.

**Bill:** Yes, because then the lawyer can understand it too.

**Speaker 2:** One more question because we are dramatically behind.

**Speaker 6:** My name is --

**Speaker 2:** Okay. Talk in the microphone.

**Speaker 6:** [unintelligible 00:13:10]. My question is for Professor [unintelligible 00:13:11]. In which way does the geographical location of the production of a piece of art regarding the nuclear fallout for say 1945 affect the dating for say something that's produced in 1946 in Japan?

**Speaker 2:** Well very – actually the answer is that it doesn't affect. There have been many measurements, performance on the various areas in the world, both in the [unintelligible 00:13:46] and in the most, how do you say, the southern hemisphere. And they exactly resemble each other because it is not the moment that you create but then it spreads quickly in the atmosphere that the times of recirculation of air in the atmosphere are of the order of maybe two months or so. So it's too, if you go there, the day after they have exploded the bomb and you take an animal or a plant leaving none day and pick up, probably it has much higher concentration than you will expect from the general course. But in general, this doesn't happen [unintelligible 00:14:27] because nobody goes there the day after the explosion of the bomb.

**Speaker 6:** I hope not.

**Speaker 2:** A few days that is really distributed and equalized throughout the world.

**Speaker 7:** My question --

**Speaker 2:** Yes, please go ahead, but talk in the microphone please. For who is the question and your name.

**Speaker 7:** Yes. Speaker 7 [unintelligible 00:14:50] from Oxford. Scientists are used to a certain probability of confidence levels that something's correct. I can imagine – well my question is in a court of law, if you end up by saying that the basic probability is 86% it's Rembrandt, I suppose there's going to be a question of case law and precedent as to what the confidence level is needed.

**Speaker 2:** This is not – I mean for us I can give you a two standard deviation, three standard deviation, 99.5% of course increasing the width of the uncertainty and that's up to the court to decide which is the limit they want. Of course reducing the error is always a goal but as I said, I mean especially for the need of recalibration, even if you fight with statistics in there, because I mean the original uncertainty on the radio carbon data is practically all coming from the level of statistics there.

So if you count for a longer time you get a lower error, but at a given point, the error which is then reintroduced by the recalibration would make it useless. That's why I said that it is apart with the exception of the post bomb peak period but then the classical period, this answers also to Martin remark that if somebody comes and tells who that it is capable to distinguish by radio carbon, something made in 1500 and 1520, I'm strongly doubtful that this – I mean even if it tells that it is a 99.5% confidence level. So the marginal error is, we have to admit that's nature, how nature goes – has gone actually in the past.

**Speaker 2:** I think a verdict for a court of law is also made on induction and deduction and it is always in context, so we must realize that there's not a one tool who can bring all the answers. No questions for us. But the pitch under the color x-ray which is very exciting in my point of view. You have a question?

**Speaker 8:** I don't have this – question, just want to have at one point in regards to the first question. My name is [unintelligible 00:17:23] coming from Jerusalem in Israel. There was a famous case in Israel of an archaeological forgery and there was no carbon associated with the [unintelligible 00:17:33] of Jacob, this brother of Jesus. The geological institute in Israel found that they can make dating according to oxygen a thing, much similar way as they do with carbon 14. This is something which I don't know if it has been done elsewhere but when you are talking about water based material, not on very hard clay, it can be done.

**Speaker 2:** I see it's very hard in that [unintelligible 00:18:02] which at least it's something that can be useful perhaps in geology, but also because of the time span of the uncertainties is if – which can be obtained from these measurements as a [unintelligible 00:18:16] 18 to 16 of oxygen. I don't think you should but I must admit that I never faced directly the problem, so I'm ignorant about that. My feeling is that it should be not so conclusive but let's hope that it is – maybe you know something more or – I can go to the literature and tell you and if I find somewhere.

**Phillip:** Yes, sorry to interrupt. This is also a little bit out of the range of the topic, paintings, so you have to be bully a little bit, we go into coffee now. And please back in 30 minutes. Thank you all.