Arches CoSTAR Public Talk

Good evening, ladies and gentlemen. A very good evening to all of you who are accessing this in this part of the subcontinent. And a very good morning to all of you there in the United States of America.
Thank you, Annabel. Thank you, Dennis, for being with us. Thank you, Chelsea and Megan and Salman for organizing this and posting this, and Meena Hewett, who is the chief executive officer of the-- oh, I'm so sorry-- the executive director of the Lakshmi Mittal and Family South Asia Institute. Meena, may I request you to please welcome our colleagues, the ladies and gentlemen who have joined us this evening for this talk on Arches.
Sure, I'll just take a few minutes and want to thank all of our guests who are with us today. We have been following the news about the pandemic spread in India and really wish you and your family to be safe and in good health. And thank you for making the time to be with us. So on behalf of the CSMVS Museum in Mumbai, the Harvard Art Museums, and the Lakshmi Mittal and Family South Asia Institute at Harvard, a very warm welcome to you all.
Today in our midst, we have participants who have been with us for the last five weeks of what we call the CoSTAR program, which stands for the Conservation Science Training and Research. And of course, we have others who are not part of the program but are probably connected with the arts and architecture of South Asia, conservation practices, or just generally interested in the subjects. A little bit about the CoSTAR program, which has been in the making for the last four or five years and was officially launched in December of 2020.
And we started with two public talks. And many of you may have attended those talks. One was a more of a global look at the state of conservation and what are some of the lessons we could learn from it.
And then the second one was more focused on South Asia with experts from India, Sri Lanka, Nepal, and understanding what are the gaps in this area of conservation. And those talks, as well as some of our own conversations with Narayan and Gina Kim, who's the faculty at The Arts and Sciences and art historian at Harvard, and Anupam and Mr. Mukherjee, we came up with a curriculum for the first module. And the idea was essentially to bridge the gap between art history and museology, art conservation, and conservation science.
And the first module comprises of nine weeks. And we're right in the middle of the nine-week program. And it includes themes that involve technical aspects of art history. It includes the life of an object, its origin, the patronage, the context in which an object is conceived, and then use of certain materials, like plastics.
There was a whole session on plastics that are used, not just in art objects, but also in installation in the museums, and how does plastics deteriorate? How do you care for it? So that was an interesting session. And just recently last week, we had a session on preventive conservation, and how do you think of different elements, whether it's fire, water, physical forces? How are they all sort of interconnected? So a systems building exercise was involved in understanding how we think of conservation.
And the most recent one, which happened Monday, was on intangible heritage, and what are some of the living traditions, like music story, craftsmanship, rituals, and how do you document intangible heritage, which is very interesting conversation. So this is truly unique in terms of how we have pulled together different themes and topics and also how we pulled together different participants in the program. The facilitators are learning just as much from the participants as the participants are learning from the

facilitators. And we're really grateful again to all our participants who have so actively engaged with the material of the module as well as with the facilitators.
So what we're really learning over these last four 4 and 1/2 weeks is that there's no shortage of knowledge in conservation. And what's really missing we're finding is the sharing of that knowledge with each other, and then how do you capture it to disseminate it more broadly. So that's truly the purpose of conservation, the CoSTAR program that we have designed.
So without further delay, I want to again thank Mr. Mukherjee, director general of the CSMVS Museum, Narayan Khandekar, head of conservation at the Harvard Art Museums, and Professor Gina Kim, the art historian at Harvard, and of course, last but not the least, Anupam, who's been a true partner and the force on the ground for bringing us all together. And Anupam, over to you.
Anupam, you're on mute.
Thank you very much, Meena, for those kind words. And as Meena mentioned, this thing about so many subjects coming together, and I think now it is about managing all this information and . And therefore, this talk this evening titled Arches-- A Data Management and Visualization Platform for Cultural Heritage. We're talking about managing data, visualizing it, integrating it, using it, and also sharing with each other today, ladies and gentlemen, where are the various institutions where this application on this platform has been implemented. It's an open access platform.
And to speak about it today is Dennis Wuthrich and Annabel Enriquez. Dennis is the CEO of Farallon Geographics, which is a geospatial web and mobile application development company in San Francisco. And Dennis has been at this-- it's going to be almost 30 years, Dennis, that you've been working with these decision support systems with your technology. And he has played an instrumental role as the technical team leader for enterprise apps, such as Arches in managing cultural heritage data.
And Annabel, Annabel is an associate project specialist at the Getty Conservation Institute. And she's part of the GCI teams for Arches and for the school, which is the Arches for science project. Annabel has studied Urban and Regional Studies from Cornell and then from the University of California, she has a master's in Geographic Information Science and Technology with a focus in heritage conservation. Ladies and gentlemen, I request Dennis Wuthrich to please enlighten us about Arches.
Thanks, Anupam. That's a very generous introduction, really thank you for that. And thank you everyone for joining today. I'd like to start off with just a quick introduction of Annabel. She is a key member of the Arches team. And I've had the pleasure of working closely with her for the past several years.
My name is Dennis Wuthrich. And I'm the lucky opportunity to lead the technical team for Arches. Our conversation today really I think is going to focus on the practicalities, or I hope it focuses on the practicalities of Arches. And I'd like to make sure that we ask and answer at least one question, which is why did we develop Arches? And why might it be something for you to take a look at?
Our conversation today will really be focused on what I think are real world examples of some of the challenges that go along with managing cultural heritage information. And we're hopeful to have plenty of time for questions at the end of our conversation today. Bit of a spoiler alert, I'm just going to jump to the end of the story. I know it's late in India, and it's early here in California. And I think it makes sense by giving away today's ending, so that where we're going here.
Really my hope for today's conversation is to impart the following about Arches for you. It is a data management system designed to help you manage and understand and ultimately work with quite complex information, specifically the kind of information that you have to work with on a daily basis when

you're managing your cultural heritage resources. We built it so that you can make informed decisions and take appropriate actions to become better stewards of your cultural heritage resources.
Fundamentally, our goal with Arches is to put you in a position to actually protect and preserve cultural heritage, that means being active participants in the decisions and the activities that go along with preserving your heritage. There's a lot of things about Arches. And I will only be scratching the surface today.
But a key takeaway is that Arches is an openly available and freely available web and mobile system designed specifically to manage quite complicated information. It's been designed to be extremely flexible in how it's deployed. And it's quite well-supported and is in use around the world.
I think it's pretty ambitious technology, in fact, and it offers quite a number of capabilities. It has core data management capabilities. And these are quite sophisticated.
Lucky for you, we won't go into too much of the how Arches works and focus more on the why. But I think it's important for you to know that it comes with quite sophisticated database management capabilities. We've built into it a lot of tools that help you not only manage the data, but retrieve it. There's no point putting data in a database if we can't get it back out again. And once you have access to your data, properly visualizing it in context, so that you can interpret the data properly.
We've also spent some time thinking about how to support real world activities. We call these project and task management capabilities. So all these are built into Arches.
And really, in a bit of complete transparency, there is a sales pitch here. And that is that Arches is pretty cool. It does a lot of things. I think it's a pretty unique product. And I hope to give you at least a little bit of a sense of what makes it different and why we're so excited about it. But that's the end of the sales pitch.
OK, so now that you know how the talk ends, let's fill in some of the key details, so that you can understand why Arches is what it is. And I'll just say that I'm aware that many in the audience are experts in their particular cultural heritage disciplines, whether that's a museum, or as an architect, or another professional. And for those of you who have been doing this for a while, you know there's some very key challenges in keeping track of your information.
And I've highlighted at least a few data management challenges that I think are worth a little bit more investigation today. And I guess I'd like to make sure that we at least touch on how we manage terminology, the intricacies and challenges of managing time data, location data, and then some of the ways that descriptive and relationship information is really important in how Arches manages those data.
So let's start with the terminology bits. And really this is a nod at recognizing that the words that we use for describing cultural heritage are really important.
Let's start with a key point here, which is fundamentally, one of the things we have to do is describe and really categorize the things that we're going to focus our attention on in the cultural heritage world. And I'm really interested in the categorization part. So here's a really simple question.
What is this? What are we looking at here? And there are a lot of ways to answer that question.
Really, there's a lot of terms for what we just saw. If you'll pardon the rough example here, but there are a number of ways of using terminology to categorize data, to categorize resources. And the terminology is important. It forces us to make distinctions and decide whether there are important distinctions between our resources. And it also forces us to recognize that of the many terms that one could use to describe a cultural heritage resource, there is often a single term that might be preferred.

So here I'm showing some different ways of describing a restroom. All these terms are completely valid. But when we talk about describing and categorizing resources, we want to make sure that we're consistent in the terminology that we use.
It's actually a little bit more complicated than that, because that same challenge exists in many languages in many scripts. So it's quite common for members of different language groups to be working on the same project. And so it's important for everyone to be clear about the terminology that should be used to categorize our cultural heritage resources.
And Arches provides a mechanism for doing that. It comes with a built-in thesaurus management system. And here's a quick nod at what Arches can do.
So it allows you to define terminology for cultural heritage resources. It supports preferred terms, alternate terms, and terms in other languages. Those are important as it turns out. It also gives you an opportunity to use multiple categorization, so multiple parents, which means that you can conceive of multiple categories for the same cultural heritage resource.
That makes it much more possible to achieve higher data quality. Here's an example of a data entry form in Arches that uses this idea of a controlled vocabulary. And you can see here, in this example, that it also reflects the hierarchy that we use to categorize this particular collection of terms. That turns out to be really significant for search.
And let's see why my computer stopped working here. That turns out to be really important for search. Here's Arches default search page.
And what I want to do is zoom in and look at how these vocabularies can help. Now what I'll do here is start a little video. Oops, let's go back here, and we start a video.
And what you'll see here is Arches allows you to enter terminology. And you can either search on strings, or you can search on these controlled vocabularies, these concepts. And in fact, Arches supports not only searches on the preferred term but all those alternate terms, so that when you want to retrieve information from your database, you don't necessarily need to know the preferred term. You can use any of those synonyms. That makes the controlled vocabulary both an essential tool for achieving good quality, as well as for supporting enhanced search capabilities.
Let's change our focus to time. And in particular, the challenges that go along with describing when things occurred, when activities occurred, or when structures were built, the challenges of really describing the temporal domain. We typically do this with calendars or scientific dating methods, such as radiocarbon dates, or sometimes, and maybe all too frequently, with educated guesses.
And in an information management system, when we talk about time, we're typically talking about dates. And here's an easy example of how a date might be encoded. We've got a month, a day, and a year. But even here, when you look a little bit more closely, often we may be concerned with the time of day, which means we need to be concerned with where in the world we are, with where we are relative to Greenwich.
It doesn't take long for describing time to get more challenging. And that happens when we don't have a true date. So here are examples where these are completely legitimate ways of describing time.
If I tell you that a building was built and I have documentation to support the assertion that it was built in the spring of 1932, you know what I'm talking about. But a computer has a much harder time understanding what spring 1932 means, because it's not a true date. It doesn't have a month and a day

associated with it. And of course, it gets even more challenging when the dates that-- the time description isn't even tied to a calendar.

And then that doesn't even really get to the heart of the problem, which is often we're worried about time spans, so not only the moment in which something occurred, but the duration over which it occurred. That turns out to be a pretty common issue in the cultural heritage world. And it's an essential thing to be able to manage.

What I'm really hinting at here is once you start looking at the ability to accurately and consistently describe the time span of events and the uncertainty around the beginning and ending of that time span, you can see that managing time date is a non-trivial problem. And it's around us all the time. I mean it's a real examples that we see on a consistent basis, things like being able to say I'm sure that a building was constructed sometime before 1812 or 1813. And I'm also quite positive that it happened after 1801. This is essential and valuable information that is often challenging to code in information management system.

So how do we do it in Arches? Well, like most systems, Arches can do the easy things without any trouble. Here's an example of a data entry form where you can enter a date. And I'm not showing it here, but you could just as easily enter a date and a time with the Greenwich offset.

But what about the more challenging times that we've talked about? Here's an example that shows how we use a international standard, an extended daytime format standard that provides a consistent way of encoding the uncertainties of time in such a way that we can take those encodings and convert them into true times, so that we can actually do time-based searches in the way that you expect to. Really what I'm saying here is Arches would let you enter that kind of time span that we looked at a moment ago, some time before 1812 or 1813, and definitely before 1801, and convert that into true dates, so that you can do a true time-based or temporal search.

And I have a little video here that should show that. So let me start this video. What we're going to do here is open up the time search component in Arches. You can select which fields in the database to search by.

And we show a little visualization component here that gives you a sense of how information in the database is organized by time. Each of these little sections in this circular visualization is meant to show the number of records in the database that fall within that particular time interval. So not only getting time in and describing it properly, but getting it back out again is one of the things we worry about in Arches.

Locations are also a very important aspect of managing information. And we got a whole talk just on how difficult it is to manage the geospatial parts, the map-based parts of cultural heritage. And Arches provides built-in tools to do this.

It essentially comes with a built-in geographic information system. And it's pretty sophisticated actually. It lets you do some of the key things that are typically a lot more challenging to support in say a straight GIS system.

And here's one very simple example. Here's an example of an archaeological dig location that has several members to it-- an area of the dig, which is represented as a polygon, a trench, which is represented as a line-- and you can see in a sort of an orange color there-- and then a post hole, which is represented as a point. The idea here is that Arches provides quite rich tools for describing the geospatial location of your cultural heritage resources or your research and investigation activities. And that's a key thing to be able to do.

If you're familiar with GIS systems, you know that they can be quite sophisticated. And Arches plays quite nicely and integrates directly with geographic information systems, such as ESRI GIS. Here's a screenshot showing Arches data and ESRI data coexisting quite happily on the same map and the ArcGIS application being able to read directly out of Arches information.

And in fact, we can even embed Arches inside of an ESRI GIS system, so that you have a single tool for managing quite sophisticated data inside of Arches, as well as connecting it to and linking it to your other geospatial data resources. When it comes time to search, Arches provides geospatial search tools. It gives you the opportunity to do quite rich geospatial searches without having to take on the overhead of the GIS tools. Let's face it, not everybody wants to be a GIS specialist. So in Arches, we provide you a powerful and easy to use tools, so that you can ask location-based questions and get appropriate information without having to master the GIS.

Cultural heritage information and cultural heritage resources, really, at some core level are really about describing things. And as we all know, pictures are really a great way of describing things, because they're a visual way of making a point, which means that we've integrated the ability of managing imagery in Arches, so that you can upload photos and access them as a way of describing key information. We call these annotations. And there are at least a couple of examples I want to show you.

Here's an example where we're using an image to describe the-- well, a couple of things. One example might be where a art conservator has removed material from a work of art, so that they can use it in an analysis, or alternatively an area on a work of art, in this case, the label of a wine bottle that might be the subject of a research effort. Point here is you really want to be able to indicate on an image of the physical object what you're looking at or where you've obtained a sample.

Of course, these annotations might be useful in lots of other contexts. So here's an example where you might be an architect, and what you'd like to do is describe or indicate portions of a structure that are of particular interest. Here's an example of a structure where we're looking at a specific portion, which happens to be a series of statutes.

And of course, at an even larger scale, it might be important to describe architectural features or larger scale features of a structure or a site. Here's an example where we're looking at a masonry wall of a site located in a desert region. The point is imagery is a key way of helping to make rich descriptions of a cultural heritage resource accessible and available to you and your team.

And finally, I want to talk about how important it is to understand cultural heritage data in context. Really the idea here is often it's the relationships between heritage objects that are the key things necessary to understand significance. And here's an example. If you walk down Los Angeles, you'll see little houses like this all over the place.

And often, you might not give them a second thought. But if it turns out that a particular house, in this case, this Rancho Vega was designed by one of Southern California's most eminent, preeminent Afro-American architects, then that structure has higher significance. The fact that it is an early representation of design work by an architect who went on to design and create quite iconic buildings in the region almost make it by de facto important. And you only know this by the relationship between this structure and this person.

And Arches provides a way of building and navigating these data relationship networks. It's a way of ensuring that you can understand the significance of cultural heritage resources in context. So that's a relatively quick sprint through some of the practicalities of Arches, why it does what it does. But I

promised at the very beginning of this talk that our ambitions with Arches were really more about making you better stewards of your heritage resources, giving you the ability to take informed and effective actions.

And so I want to pivot our conversation now to how Arches supports that. And before we get into the details, I'm going to take just a step back and give you a little bit more information about how Arches itself works. And I've been struggling for a mental model for you. And I've come up with this idea of Arches as really a digital Lego toolkit.

Arches can be and probably ought to be thought of as this digital version of Legos, where you can snap bricks together and create models with a Lego kit. In the Arches world, you can almost literally snap together digital modules to create applications. And you're quite welcome to do that. I mean really it's just your imagination that will limit what you can do with Arches.

So you're quite welcome to take this freely available software and build whatever application suits your needs. But you don't have to. We've actually built applications much like this example here.

So in the Lego world, you can actually go out and buy a kit and build, in this case, a model of a spaceship. And an Arches application is essentially this. It's a pre-built kit that's out of the box, has been assembled for you to meet a particular set of data management requirements. We call these applications packages.

And there's a long story for why we use that terminology. It actually isn't important. But if you hear me use the word package, really what I'm talking about is an application. And the key point here is we have built Arches applications to meet the specific requirements of managing data for archaeologists, or cultural heritage experts, or conservation scientists, or others.

Packages really are these pre-built components of an Arches application. And in fact, a little bit more detail here, Arches packages, these applications define database contents. They define reporting templates, search tools, the way the Arches application integrates with other systems, the specific kinds of user interface components and data visualizations that it supports, as well as something we called workflows.

And I really don't have time to go through all these details. They're important. But for today, I just want to focus on workflows, because these get to the heart of taking action.

But if you find yourself intrigued at all about some of these additional details in Arches, you can get a lot of information and a little bit of time by going to the Arches website, which is here on screen. And we have I think a decent collection of videos that walk through some of the key ideas of Arches. There are a series of webinars and learning videos that you can go through at your leisure to find out more detail about how Arches works.

So with that bit of background let's jump in to a specific example. Here's an Arches application that we're building with the-- in fact, a group called Historic England, which is a national government agency that are tasked with managing the cultural heritage of Great Britain. And we've built an Arches application specifically to manage the cultural heritage of Great Britain. And it does all the data management that we've talked about. It also supports-- and this is the key thing-- it also supports some daily business activities, one of which is the activity of reviewing a building permit to see if it will adversely impact a cultural heritage resource.

And there's a lot of detail, a lot of information necessary to understand whether a government agency will grant a building permit. And it goes well beyond who's asking for the permit. It includes a number of

issues, including where you propose to build or renovate a building, which cultural heritage resources might be adversely impacted, what are you proposing to do, what are the on-site conditions at the location that you're proposing, what have we agreed to, what conditions might be placed on the building permit, and have you met those conditions as part of your development process? So there are a number of things you need to keep track of.

And what we've done here is we've built what we call workflows, or a series of task-based data entry tools that let a-- in this case, a planner-- ensure that they're tracking the process for reviewing and approving a permit properly. What I'm going to do is focus on this workflow called consultation, which happens to be the process of confirming where and what somebody is proposing to do. So clicking on that button opens up a workflow.

And this is a series of-- or you can think of it as a guided path through a series of data entry and information processing forms to ensure that you're entering the essential information necessary to review and take action on that permit request in a very repeatable and quick manner. So here's the first screen in that guided data entry workflow. And it happens to be a screen that lets you indicate the location and extent of your building permit review location.

You can go through a series of screens. I want to show them all. But here's another screen that allows you to describe the purpose, the proposed development, a screen that lets you define the key actors in this permitting process, so not only the owner of the property, the developer, who might be another person or organization, and the internal reviewers.

But also, behind the scenes, what's happening in this workflow is that we're building those relationships that we spoke of a moment ago, the relationship between the permit and the potentially impacted cultural heritage resources, and all the people and organizations that are part of that proposed permit, and the documentation that will be developed as part of the review process, and the activities, the on-site visits to confirm conditions. All these data behind the scenes are being assembled into this network of relationships, so that you can see in context not only ultimately what the decision was about this permit, but why that decision was taken. So at the end of this data entry process, you can see a summary of what's been entered here confirmed very quickly that you've created a valid record and then see the set of review requests that are currently active and require the attention of the organization.

The one we just created here is the permit of the upper left hand corner, the one in green. So that's just a quick example of how Arches can help you make informed decisions and take appropriate actions to preserve and protect your heritage resources. Here's another example. This is an example of an Arches application that is focused on conservation science and managing the information collected as part of a scientific investigation of say, a work of art.

And it asks a different question, and just one of many examples might be when I am about to start a conservation effort of an object, what's the appropriate paint that I should use? That means that there are a series of workflows that you might need to engage in to answer that question. They would include what are you sampling, where have you sampled it, what analysis have you done, what data have you created by running your sample through an instrument, what interpretations have you made, and where are the data?

So let's look at one example of several workflows here, which is this data upload workflow, which starts by asking, what kind of data set do you want to upload, then moves on to identifying the objects that you sample that the sample was obtained from and the data were obtained from. Skipping ahead, what are

the actual data files that you'd like to upload into Arches, and then which sampled locations do these data files relate to on the object? And then ultimately, what is the content of each digital data file? And what interpretations can I make here?
In this example, I'm looking at the spectra of one file out of multiple files in a data set related to one sample on the object. And in this case, I can make an interpretation. Let's say this spectrum shows the presence of antimony in the sample.
If you're interested, I know there's another presentation on Arches, specifically around how it uses-- how it supports the conservation science workflows. That'll be coming up this next Monday. It'll be given by Catherine Patterson, who is a member of the Getty Conservation Institute.
So if you have time and interest, you might want to hear what Catherine has to say about how Arches supports conservation science specifically, which is maybe a good place to stop and turn the conversation to now that we've seen what Arches can do and why it can do it, where is it in use? And here's where I'd like to bring Annabel into the conversation and have her give us a tour of where Arches is being used and the way it's being used to support quite specific cultural heritage data management efforts. So Annabel.
Thank you, Dennis. So yes, if you could advance the next slide. So for this portion of the presentation, I'm going to briefly explore how art is being used by various organizations around the world.
And actually at this point, I want to make a point that Arches is free to use. The code is open source and free. And most organizations, actually all organizations, they implement Arches independently on their own servers and make their own decisions about what they're recording and how they record it.
And the implementations that I'm going to show you represent the ones that we know of. Because it's open source, organizations don't have to tell us that they're implementing Arches on their own. So as you can see from this map of Arches implementations that we know of, the use of Arches is pretty widespread and growing. Next slide, please.
And currently, more than 30 languages are being represented, or are in the process of being represented through some of these Arches implementations, which again speaks to how Arches is being used. But from this macro view, let's take a look at some of these individual implementations. Next slide, please.
First on the list are a group of implementations by Historic England, which has adopted the Arches platform as a core technology. And in particular, Arches will be used to power the Greater London Historic Environment Record, the National Record of the Historic Environment in England, the National Marine Heritage Inventory. And also it'll be used to house the Heritage Vocabularies for England.
And speaking of organizations that support the use of Arches-- next slide, please. The Arcadia Fund recommends Arches as a cultural heritage data management platform to the projects it funds and has so far funded many Arches-powered projects, including the ones listed on the screen, many of which are in Asia. Next slide, please. I'm going to focus on two of them here. Next slide, please.
The first was the Digital Archive of Nepalese Arts and Monuments or DANAM, which is part of the Nepal heritage documentation project. Next slide, please. And as we scroll through this record and this Arches implementation, you can see the depth of information they have recorded for this particular Sikhara temple, including information in Nepali. You'll see here that they've recorded many images that's up to them and site plans and other information about that site. Next slide, please.
The next implementation that I'm going to discuss is the Endangered Archaeology of the Middle East and North Africa project, which is using Arches to record information on more than 300,000 archaeological

sites and landscapes that are under threat in an area covering 20 countries. Next slide, please. And then just off the coast of Yemen and Somalia is this Socotra archipelago, known for its rich and unique biodiversity. Now, the Arches-powered Socotra heritage database is seeking to match the documentation of the natural world on Socotra with equally rich recording of its cultural heritage, such as cultural landscapes-- next slide, please-- rock art-- next slide, please-- and intangible Socotra heritage, such as rug weaving-- next slide, please-- and games, such as this one called [INAUDIBLE]. Next slide, please.
Now in China, the Dunhuang Academy is using Arches to record data on the Mogao caves and other sites in the Gansu province. In particular-- next slide-- in addition to the descriptive built heritage inventory information, also objects within the caves, they are also using Arches to monitor real-time environmental conditions inside each cave. And they have also configured Arches to note cave location using elevation information, in addition to xy coordinates. Next slide, please.
Then next are two national level inventories in the Caribbean, one in Jamaica-- next slide, please-- and the other in Barbados. Next slide, please. Now both of these inventories are ensuring the recognition of heritage from traditionally underrepresented communities by making sure that community members are engaged and have the opportunity to take part in nominating sites. Next slide, please.
Now moving on to some implementations in the United States, the Arches-powered Florida Public Archaeology Network is using Arches to track changes to archaeological sites at risk, particularly due to climate change. Next slide, please. And they're doing so by using Arches as the hub for a statewide crowdsourcing project called Heritage Monitoring Scouts, where volunteers record information on various heritage sites-- next slide, please-- such as the final resting place of the USS Amesbury. Next slide, please.
Now near Washington, DC, the armed forces retirement home is a campus or site level implementation of Arches. Next slide, please. This site level implementation helps to manage the information necessary in the act of conservation and management of the overall site, as well as individual cultural heritage resources within the site. Next slide, please.
And I'm going to end this very brief look at implementations with the first large scale implementation of Arches, which took place where I am currently located in Los Angeles, Historic Places LA, which launched in 2015 and is still being used by the city of LA to manage more than 50,000 historic places and growing. And now the city is upgrading their Arches implementation to take advantage of the latest Arches features. Next slide, please.
So that is a quick look again of various Arches implementations. And I'm going to turn it back over to Dennis to wrap up the presentation.
Thanks so much, Annabel. That's really great. So let's put a bow around this, get to the finish here. And let me just remind you that our aims with Arches really ultimately come down to improving your ability to be good stewards of your heritage resources by helping you understand the complexities associated with cultural heritage data. In particular, we've built a data management system that is able to respond to some of the key challenges that you have as cultural heritage data managers in managing your information.
We've taken a pretty practical approach here, and in particular, have implemented applications and workflows within applications, so that you can quickly deploy a data management scheme that will be a digital representation of your daily activities. These workflows are meant to really parallel the tasks that you have to undertake on a regular basis to make informed decisions and take appropriate actions for

protection and preservation of heritage. There's at least a few benefits to Arches. It's open, it's free, it's very flexible. But mostly, really the idea I want to leave you with is Arches is built so that you can do a good job of managing your resources as opposed to figuring out how to adapt what you can do based on the limitations of your software.

And that's the key thing as a technologist, ultimately, my definition of success is being able to build a system that makes it easier for you to do what you need to do to accomplish your goals, as opposed to forcing you to figure out how to use software in a way that might not be as optimum as you'd like. And that's a good place to end and see if there are any questions that we might respond to. And thank you very much for your attention.

Thank you very much for your attention.

Thank you. Thank you, Annabel, and thank you, Dennis. Dennis, would you stop sharing the screen, so that we can see our guests who are here today?

Sure.

Excellent. Thank you very much. And Dennis, you said that, "Let's put a bow around this." To close the talk, I would like to open that bow and open the box. And I'm going to see again with all the guests that are here today, what's inside that box once again, right?

So let us after hearing this and getting this overview about what Arches is, if we get to a specific, I'd like Annabel and Dennis to just hand hold us through the answer. Now we have a collection, let's say an archival collection, right? Now archival collection has documents essentially on paper.

It could have some metallic inscriptions and other things also. It could have audio video material. It'll have photographs. It might even have some microphones and other materials like that.

Now, I suppose as you mentioned and you pointed that we could use Arches also for managing the data in such an archive, right?

That's correct.

Yes, it's a yes. OK, now, that is so-- let's say keeping two archives, do we have any example where Arches has been used by an archive anywhere in the world as yet? Or do we have any example where a museum has used it for its collection of paintings or its sculptures?

Well, I can answer the archive question, which is that the example I showed of Historic England, they actually specifically include archival data as part of that application. So they are expecting and need to manage the information around an archive as a part of their cultural heritage data management system.

Yes, and to add to that, I didn't mention this, but another source of implementation is actually the J. Paul Getty Museum, which is using Arches as a technology to manage data on objects. And actually not just the museum, but the Getty Research Institute is using Arches to hold information on photographic prints and objects.

I see. So you mean to say is that Arches can be adapted. It is like saying the user [INAUDIBLE] depends on quality is the user lens, isn't it?

Yes, and I think one of the key points, and I think Dennis alluded to this in his presentation. Actually, he did more than allude to this is that Arches can be used for many different purposes. It really depends on the implementing organization and what the requirements are for their projects for that organization's projects to define how Arches is being used and what information is being captured and how.

OK, so let's stick to this thing about the archives as an illustration. Now, tomorrow we ask Annabel and Dennis to hand hold us and help us implement Arches into this archives that we have for us. For

example, what would you tell me, Dennis, what will be that small team that I must first get together on me to start working on this? And then we can increase the team later. But what is that core team of people you would like me to have that I can practically start working with Arches and understanding. As the head of the institution, I am asking you, OK, tell me who do I need, and I'll make provision for that.
Yeah, that's a good question. So really, the question is about how would you start an Arches project? And the answer is really, it's similar how you'd start any data management project, which would be to define the scope.
What do you expect to manage? So what are the data that you need to manage? And what are the key attributes that you need to-- what are the key attributes of your data management system?
And in concrete terms, what you would want to do is you'd want to make sure that you understood the data that you're managing, so the current state of your data. You'd want to make sure that you thought through how you'd like to model the information. So how should it be represented?
And once you've made those two key decisions, you can start to build out the data management capabilities in Arches. Now I'll just say from a practical standpoint, it may be that-- and this is kind of a key thing with Arches that we didn't have time to talk about but maybe is appropriate part of the answer. And that is it may be that someone has already created a datum, a system that does either what you want to do or offers a large part of the capabilities that you want. Those applications are publicly available as well. So you may be able to look at the Arches community and already take advantage of work done by others who are working on this exact same problem that you are. So it is a concrete example. You've heard Annabel and I talk about this project with Historic England. That Arches application driven by the needs of Historic England is available to anybody. And you might be a cultural heritage professional in India or Nepal or France and you can take the work that Historic England have done for the English and recognize that maybe 80% of what they've done is completely relevant to your work and just take advantage of that and just customize the last 20%.
OK, so then it brings me to-- your answer has made me think of one has opened the window. If I see the app you showed me, the world map of the world with places where Arches is being implemented and where it has been implemented already. If we make a pie diagram, how many of these would be cultural sites and how many would be museums and collections?
I think right now, the most would be cultural heritage. I'm sure that there are museums using Arches. And they might be using them for managing collections. We've actually heard of this as the kind of work that museums want to do. What I can say I've seen personally is Arches being used to integrate with collections management systems.
And they alluded to a talk that Catherine Patterson of the Getty will be doing on Monday. So a very good example of this where Arches is integrating, that is to say working specifically with a collections management system, not to reproduce the data in the collections management system, but to access it and use it for support of research goals and research objectives. Now that's how I've seen it work personally. There isn't any reason why you couldn't develop a collections management system on top of Arches. If you wish to do so, you could do so.
OK, so just one question, because that with the queries from the audiences also. Annabel, could you give us two examples of sites which you would like us to refer to when it comes to architectural heritage sites, where arches has been used as case studies, so that we can refer to them? Which would you recommend?

Oh, I see. Well, if we're talking about a site level implementation, one of the ones that I went over was the Armed Forces Retirement Home, which is a campus level implementation of Arches. And then also even within some of the other built heritage inventories that are using Arches, there are many examples of sites within some of these, for example, in Historic Places LA. There are sites as well as EAMENA or the Endangered Archaeology for the Middle East and North Africa project. But actually, this is probably a good time to mention that if you go to the archesproject.org website, there is a listing of implementations of Arches, where there are live implementations that the general public can access based on those implementations, basically their rules for access.

All right, and for natural heritage site, could you give me one example?

For natural heritage sites, actually I'm trying to think of a good example of a natural heritage site. But I know that there are some within some of these implementations, and especially in the ones that are in preparation.

And for museums, would you say the Getty Museum would be a good example? Or is there any other museum in any other part of the world which has implemented Arches?

Well, I would recommend-- actually, there is a site called 12 Sunsets. And it basically is a photographic archive that does not use Arches for the front end, but uses Arches as the back end data management. And that you can find that on our website under implementations.

[INTERPOSING VOICES]

Could you please type that on chat? It will just help us. Yeah.

Sure. Actually--

The name of that site, the name of that site.

OK.

OK, thank you.

And I'll just add at the risk of a faux pas here, I know Yale University is working specifically on this. So there's an effort underway at Yale to use Arches to manage information access to a number of museum collections. So they've got-- Yale has a number of museums that span a bunch of different disciplines. And they're using Arches to aggregate and harmonize data from those collections into a single search engine.

OK, now suppose we do find the illustrations useful and we find that we can implement it, the first question that's going to come from the heads of institutions in India. Let's talk about India. Who has the copyright of the data? And how safe is the data?

OK, I can answer the first part of that, and then Dennis can answer the second part. The first part of that, it depends. So as I mentioned earlier, Arches is supposed to be deployed independently by organizations. So every organization that implements Arches on their own server defines what the copyright and the data protection is there.

And then also too, Arches has some pretty sophisticated controls for permissions in regards to who is able to access what data within an individual Arches implementation. So copyright is really a question for each individual implementation to address. And then Dennis, in regards to the safety of the data.

Yeah, I'll just amplify what Annabel said. So when you deploy Arches, you own your data. You have the copyright of your data. It's up to you to decide whether you want to make it public or not. But really, the institution that implements Arches owns the data.

As far as data protection goes, Arches provides lots and lots of data security that it has quite a sophisticated permissions model, so that you have a lot of control over how much or how little you want to expose data to user groups. So it can be deployed in a way in which it's completely locked down and only members, only specific accounts can access information internally. So it can be that. It can be that locked. Or alternatively, if you wish, you can expose some of your data or all of your data to the internet, again, if you decide that you want to do so.
And the data is stored in the institution servers if they want to, right?
The data is stored by the institutions. Literally, I think we should be super clear here. You, as the institution, have responsibility for managing the data.
Yes, so the data is always accessed, because people were thinking that you put the data in and it's there somewhere else and whether you'll have access to it again. So it's your data, and you have access to it when you want to.
It's your data. You own the data. And you have the responsibility to manage the data.
OK, I'm just seeing some of these questions. In terms of one is OK, so then as you mentioned, this is interesting, because once that data has been collected and then it has been arranged in a certain manner, of course, at the discretion of the people who are using Arches, I suppose it is up to us what use we want to put it to, right? So someone is asking here from the-- there's a [INAUDIBLE] is a very major architectural institution.
And Professor [INAUDIBLE] is asking that. I suppose one could also use it for community development if we put in our fields and other ontologies, work with different things on it. Yeah, you could apply it for that?
Actually, yes, and I mean, there are even non-cultural heritage uses of it. It really is up to the organization, how they want to organize their information and configure Arches.
One designer, museum designer, Saurabh Sharma is asking that the Arches user interface, is it customizable?
Yes, yes, it is.
It is. It is. OK, it is customizable. OK.
And actually, just very quickly add to that, there are several ways to customize the Arches interface. But we provide interface level tools to customize the interface as well, in addition to software development encoding.
We have a young architect, Apoorva, here who's saying that she has used Arches when she was doing a thesis on historical fort in Mumbai as a student. And it was an extremely useful tool in managing the data and putting the layers of the maps and photographs and sketches et cetera. So there are users here.
The professor from the Indian Institute of Technology Roorkee, Dr. [INAUDIBLE] is asking that-- he's been working on English times monographs, conservation of English times monographs. And he's saying that when we link such material to open source networks, would it open a window for infringement issues? And if yes, how can we control such processes?
[INTERPOSING VOICES]
--link such material to open source networks, would it open a window for infringement issues?
I think it depends on-- well, so open source doesn't necessarily mean open data. So that's the first point I want to make there. So it really depends on what those networks are, and how those data networks are managed. So there are a lot of variables that might come into play. But any time you're releasing your data or making your data available to any kind of aggregation site, I would definitely recommend being

clear about how that data is going to be distributed and used, and what the copyright is for that particular network or site.
So Arches, is this application that's been developed by the Getty Conservation Institute, right?
Yes, and initially with support from World Monuments Fund.
OK, and is it going to get-- some people are asking, are their chances that it gets monetized in the future? Or does it mean like this? Yeah, so, OK--
Go ahead, go ahead, Annabel.
I was just going to say that Arches is open source software. And the open source license basically specifies that the code will always be available to those-- I mean, that essentially if anyone further develops the code, they have to make that available to the community. And Arches, as long as the Getty Conservation Institute is involved, the core code will be available for free.
Now one of the things that we're doing, and as I mentioned, as Arches is open source software is we've been building an open source community. So that the onus for the support and the maintenance of the software is not just on the Getty Conservation Institute but for the whole community. But we continue to be involved.
And has the Getty team been able to be in touch with this community and be able to monitor for the sake of statistics and other things, the work that they're doing and how it is going forward, and is it falling apart after some time, or is it building up? Do you--
[INTERPOSING VOICES]
It's definitely not falling apart. [LAUGHS]
I'm just saying--
Oh, I know, oh, absolutely, what I was going to say is that our community is actually growing by leaps and bounds. And it's the strongest it's ever been. And we find even more and more community members joining every month, every year. So--
Yeah, no, I'm sure. My question is specifically, you have created a system by which you're also monitoring this growth of the institutions, which are using Arches. And are you creating the sector background of it? Are you also doing a study along with that?
Maybe I can provide a little bit more detail here. So the community part of Arches is really important. We take it really seriously.
And I think it's one of the great strengths of Arches. And we have a philosophy where we want people to join. We want people to be active participants.
And I can just say from a technical standpoint, one of the things that we're really focused on is extending through training and support the ability for developers around the world to take the Arches code and extend it and use it, so that the user community is growing. Like Annabel said, it's growing in a very robust way. And part of the reason it is because we're making active efforts to ensure that people can be self-sufficient with the software, that they aren't requiring-- we don't require you to use the Getty.
You can literally use the software completely independently if you wish to. Or if you choose to engage with the community, you can take advantage of networking with other Arches users, share information, share code, share use cases, pool resources if you wish to. So that's all the power of the community. And we're actively working to ensure that community members have input into how this software will continue to grow and evolve. So these are all aspects of the community.

One thing we're also doing, the Arches project hosts fora, so actual locations where you can jump in and have communications with other members of the community. There are two Arches forums right now-- one for users and one for developers. And if you look at those, the user forum, the last time I checked, which has been several months now ago, I think had around 500 members in it.
That's right. It's more than $500. And I think a good thing to know, and actually we have a community hall tomorrow is that we're going to be upgrading our community forum platform, so that to further support the interactions of our community and to really be more of a robust hub for community engagement. So that is actually going to happen in the next-- within the next month, we'll have a new platform for community engagement.
So that means there is a handholding mechanism for working with Arches, right?
I'm not sure about handholding. But we do provide via our website materials to help people get started in particular. And I will link to this in the chat. We have a page of resources that actually help people, help those to get started with Arches. And then also as Dennis mentioned, our videos page, which has our webinar series, which we launched in 2018.
I see. I see. Are there any other questions which anybody would like to ask? We have 10 more minutes. Bhaskar Venkataraman asks, what is a typical adoption journey or a cycle?
Yeah, so Dennis started to talk about that earlier when you asked the question about the team that would be required to start. And so it really starts off with defining your requirements for any system, whether you're using Arches for your data management and in terms of a cycle. It also depends on if we're talking about a cultural place inventory or a museum collection or archive. So typically, it would follow a very similar adoption journey as any kind of software adoption project. Dennis, do you have anything to add to that?
Yeah I mean, I think the point is Arches is-- the adoption cycle isn't any different than it would be for any other kind of software. So that is to say you start with requirements definition, then you do a system development. You do system deployment and training. You do system maintenance and upkeep. And that's the traditional cycle.
And Arches, this exact same cycle as any other piece of software that you would use to have a formal data management process. And the key thing there I think is formal, right? So you can use spreadsheets if you want to manage data. I mean, I wouldn't recommend it. That's not with spreadsheets before. And yet that's how many people manage their data.
And that's OK for small implementation. Potentially, it's OK for small implementations. But as soon as you need to have an authoritative secure robust data management system, then you're moving from ad hoc data management like you would do with spreadsheets or local one person databases to an organizational level data management system.
And that's what Arches is. Arches is really meant to be a system that supports more than one person. It's meant to support an organization. I mean, it can be deployed for projects at scale. It's literally being used for national inventories.
Annabel gave an example of Arches being used to manage inventories across 20 nations. So it can be used at the national or international scale. She also gave an example of Arches being used at a campus scale. So it's less about how much data you have and more about how formally you need to manage your data.

So talking about this, it's very nice that you mentioned the scale that you can do it at the scale and that scale. So for example, the gentleman called Kartik Dubey is working in Jaipur these days. He's doing a listing project for the city of Jaipur. And he feels that this feature might be helpful. That's an understatement.

And he's saying that so if he's going to do this, what would be the first step for him to do first of all? What would you advise them to do right away if he's really keen on trying this out there? So how should he go about first educating himself about Arches?

Well, just as a note, I did drop a link in the chat, which is our Getting Started with Arches page. So that's definitely a good place to start. Yes, but also too, one thing that we haven't really touched upon is some of the considerations for implementation of Arches.

Once you've decided, once you've defined your project requirements, which will help to inform your technological requirements, if you do want to try out Arches, then you will have to bring on, if you don't already have this tech support, you would want to bring that on. And in that link under Getting Started, there is a link-- and also just on our website, there is a link to service providers that can provide services really to help set up Arches, so that you can start to evaluate it as a technology. Actually, Farallon is on that list as the original and main developers of Arches. But also we have some other service providers who can help.

Yeah, I would just add, I think that's a great answer. The thing I would add is any project like this, you should start with a list of what you need the technology to do. So my advice would be decide what you need first, and then look at whether the technology can support your requirements as opposed to picking the technology, and then trying to adapt yourself to what the technology can do. So I just think that's good advice for any information system, right? Start with what you want to achieve, and then ask if the software can help you achieve your goals.

OK, Bhaskar Venkatraman asks, is this purely browser-based or OS device dependent?

Well, the application, the web application is browser-based. But we do have a mobile app that is available to collect data for ingestion into a particular Arches implementation, which is available for both Android and iOS.

OK, so ingestion can be-- in fact, there was one question about ingestion also. So ingestion can be from camera, lab, map, teams, whatever, right? What is the data ingestion support in Arches? Bhaskar had asked, in fact.

Yeah, no, so really, if you have access to a web browser, then the Arches application can support data in any way that you can-- if you're taking photos via your camera, you can upload that to your computer and then upload that to Arches via the web browser. But if you have a mobile device, you can also via the Arches Collector app, use that to take photos and have that be pushed onto your Arches implementation.

OK, I have just two, three minutes left. I have just quickly one question from my side. The versions, now you have version 5, is it? Which version are we on now?

We're on version 5.2.

Oh, OK, so when these keep getting upgraded, how easy is it for the people who have been doing it over the years to upgrade to it? Or is there an issue, or it's very smooth and seamless?

Well, I will say it this way, going from 5.1 to 5.2 is smooth and seamless. Going from version 3 to version 5 is not smooth and seamless. And the idea there is Arches continues to grow and develop. And we're constantly adding new capabilities and new functions and adding enhancements. We're doing bug fixes.

And so we actually have a formal way of defining versions. And what you should expect is moving from one version to the next within a major release should be pretty smooth and painless. So going from 5.2 to 5.3 or going from 5.3 to 5.4, the expectation is that should be a pretty straightforward process. But there's no guarantee that going from version 4 to version 5 or version 5 to version 6 would necessarily be a backwards compatible process.

And that's because when we do our versioning, we version such that it's clear that within a major release, there's the idea of internal consistency. Backwards compatibility is something we support. But there are times when we have to make, or there's such large scale changes or additions to the software that [INAUDIBLE] and major releases is required. That's when there might be-- I'm not saying there will be, but there might be more effort in upgrading.

OK, OK, and there was one question, which I wonder if it was partly answered is that Rajat Ray asks us that would you know if anyone is using Arches through available templates without looking at the code level at all?

Yes, many people are.

Yes, that's right. That's right. A lot of times what can happen and what I think Dennis described is that there is an implementation that is doing something similar to maybe what you want to do, and then you can just take that package and implement it for yourself. And maybe through the interface, you are able to make changes to the labels and such and make it more of your own with your own terminology. And you're able to do that via the interface.

I'll just add a little bit to that, which is there's a distinction between configuring Arches and customizing Arches. And you can do both. But one of the things that Annabel's talking about here is configuring Arches. And Arches provides tools, so no code but a user interface that lets you do a surprising amount of configuration, up to and including configuring the database.

So you can create a whole new Arches database without writing a line of code. You can create and customize-- sorry, you can create and configure a data entry screen without writing any code. And you're free to do that.

Now if you get to the point where you want to make changes that go beyond just configuration, then you may customize. And that's where a little bit of coding will be helpful. But you're free to do that. You are absolutely-- there's nothing stopping you from opening up a code editor and editing the code directly and making changes if you want to.

And if you do so, then the idea is to do it in a way that doesn't-- well, you had this question earlier on about upgrading. When you make customizations to Arches, you should make them in a way that-- so they won't break in the future. And we have very well-established patterns for how to do that. So anyone who's a developer will feel very, very comfortable with how to do customizations.

And just to the last remark and question is that with all this data besides cloud and the Arches platform, what are the other data backup capabilities?

Arches comes with a very robust database. And it's like any other enterprise level database. It has all the data backup capabilities that you would need.

And so data, I'll just say that you can use very well-established data backup tools on Arches. And the odds of losing data are microscopic. That's one way to answer the question. And I think in an important way, a practical way.

But there's also this idea of the data outliving the system that it's being used in. And we didn't talk about this at all. But I think this is a key thing with Arches.
And that is Arches by design structures data so that when you export it, it can be read and interpreted by systems that don't know about Arches at all. In fact, that's one of its key strengths. It's able to export its data in a format that is machine-readable, human-readable, and imparts a lot of metadata about the structure of the database itself, so that the data remain useful and retain the context that you need to ensure that you can interpret them properly.
So at the most basic day-to-day kind of administrative level, data backup is built into Arches. It's just part and parcel of how the software works. And every time we deploy Arches, one of the key things that we do is we define data backup schedules and all the essential data system administrative details. But we also make a point of saying that you can schedule exports of the data in a way that ensure that you're getting all of the information necessary to use Arches in a system outside of the software.
Excellent. So you can use it in all its systems and also in terms of the instruments, whether it's Mac or Android or anything, you can just-- your PCs, it works with everything. There were a number of questions related to that.
It's web-based, so you deploy it on a server and then a browser on Android device or a Mac or a Windows machine will work.
OK, and to close, [INAUDIBLE] asks us, [INAUDIBLE] that they currently have an NAS system. But it is only backend. Can Arches be implemented only on the backend and not on the front end website?
Yes, in fact, you can envision Arches as a data store with an API. And you could use-- you could literally just write your own front end for Arches if you wanted to. And in fact, Annabel gave an example of 12 Sunsets, which is essentially that, Arches as a back end system to manage several hundred thousand photographs and the metadata around photographs and then a completely custom front end developed that uses the Arches API to access the data.
OK, and I didn't understand this question. What's the markup, some XML question mark? Bhaskar, you asked this question.
It sounds like the question about the language that Arches is built in. And Arches, for those who care, I'll say that Arches, the application is built in Python. And the user interface, the part that you see on your screen, is JavaScript and straight HTML and CSS.
Bhaskar, does that answer your question? You could unmute yourself. And if it clears, because that's the last question.
I think I'll also note that you can also do a JSON-LD export if that is not knowing exactly what this question is.
Yeah, it says what is the markup--
[INTERPOSING VOICES]
--question is about-- its export is in either CSV, JSON, or JSON-LD.
OK, I think we had-- Bhaskar is here. Bhaskar is here, is it? Bhaskar, you don't want to ask? OK.
No, Anupam, sorry, because of the format of this webinar, we are not able to see the audience. So unfortunately, yeah, we can't have--
Bhaskar, we'll get back. We'll email your questions to them. And we'll send you the answer, OK? I'm putting down an email address here on which you could write, science.artconservation-- yeah, Megan, are you doing that?

I could do that right now. Yeah.
Yeah, just send that email, so that Bhaskar can write to us and anybody else. [INAUDIBLE] can you back up Arches with the local area servers? Yeah.
The other thing I'm going to do actually is I just dropped in to the chat the link to our Arches forum. So if you have any questions that have not been answered, do feel free to post a question on our Arches forum.
OK, excellent.
Good idea.
Thank you. Thank you very much. Thank you. OK, thank you very much. Ladies and gentlemen, I think all these questions that I asked have come from the audience.
And I've been absolutely true to them to the questions and have not sort of modified them by my own understanding of things, or lack of understanding of things. And I would like to thank Dennis, and of course, Annabel. And I'd also like to take this opportunity to remember the support and all the good work that our friend Alison Dalgity has done. She is the senior project manager at the Getty Conservation Institute at the Getty Conservation Center. And she has been instrumental not only this program, but of course, with Arches.
And Meena, thank you very much for getting this all together. We have a session on the application and conservation science of Arches, an offshoot of it. So we look forward to that in the coming week.
And thank you, ladies and gentlemen who've been with us, and the questions were brilliant. And if Annabel and Dennis want these questions, maybe our team, they can compile the questions, send them to you. And you can add them into your FAQ, so to speak.
Thank you very much, ladies and gentlemen. Once again, have a lovely day and have a lovely evening. And we look forward to seeing you soon. Meena, would you like to say some words before we close?
So just my special thanks again, Dennis, to you and Annabel, we took more time than we had planned. But it clearly shows there's such a hunger for this kind of knowledge and information. And we look forward to continuing working with you both. Thank you.
[INTERPOSING VOICES]
Thank you so much. This was really, really good. I really enjoyed it. Thank you.
Thanks.