Interview with Jon Ippolito

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Interviewers: Crystal Sanchez and Claire Eckert

I was a curator at the Guggenheim in the 1990s and 2000s, starting in 1991. At the same time I was an artist. As an artist, I had become interested in the internet, largely because of its egalitarian structure, compared to the mainstream art world. I was trying to conceive of works that would avoid technical obsolescence by being variable from the get-go.

At the same time that my collaborators and I were imagining ways that a work could skip from one medium to another, like a stone skips across the surface of a lake, I started to see warning flags about all the works—especially media works—that were about to expire. Films would be exploding in canisters. Video formats from the 1980s were becoming obsolete. Conceptual artists from the 1970s were dying. Newer formats like internet protocols from only a few months before were falling apart. It was like the statute of limitations ran out on everything at the same time, around the late 1990s or 2000.

In thinking through some of the problems associated with the death of prominent websites, I began to ask whether we could apply the pro-active solution of variable media retroactively to the problem of rescuing these near-dead art works. At first, I was exploring that internally at the Guggenheim. Then some other organizations got involved, starting with the Daniel Langlois Foundation, a very important resource for art and technology in Montreal. Eventually, those collaborations included museums, archives, and performance organizations from Berkeley to Rhizome to Franklin Furnace; and in subsequent incarnations, they expanded to include places like the Whitney.

Do you think you can make general plans for classes of works, or do you think that in some sense every work needs individual attention?

Every work needs individual attention. But there are ways that you can talk about works, in the sense that "This work is in class A, and not class B." One of the things that the Variable Media Network has come up with is the idea of artwork "behaviors." If a work has behavior

X, it needs to be preserved in a way that will take that behavior into account. Behaviors include things like "being installed," "being performed," "being interactive," and "being networked." It is rare for a work to have only one of these behaviors. Even "being contained"—like a traditional painting or sculpture—can be seen as a behavior that raises its own questions of preservation.

The notion of applying behaviors means that instead of trying to classify works according to the Getty AAT or some Platonic hierarchy, we just say "Look, if we want to replicate a certain behavior later, let's just say it has that behavior." Along with each behavior come questions about preservation that need to be answered.

I really have a problem with the alternative idea that "this is video art" and "that is net art," or even "this is time-based media." I can't stand that term, and I'm happy to take some tomatoes in the face on your website for saying that. The notion of "time-based art" is problematic in a number of ways. Generally speaking, it is used by organizations that were based in traditional forms, have been inching along the bending limb of video art, and assume that at the end of that limb is something a lot like video art but maybe a bit more "out there." So they just call that whole limb "time-based media." The problem is not the term—the problem is what the term makes you think.

For example, we did a case study of Ken Jacobs of his *Bi-Temporal Vision*. Ken is sort of the dean of American avant-garde cinema. He does these amazing installations where he takes two 16 mm film projectors and trains them on the same point on the wall, so you see one film with two different images superimposed. He essentially teases out this three-dimensional, ebbing image from these two-dimensional pieces of film stock. It's absolutely stunning—it makes the *Avatar* Hollywood version of 3D look trivial. Now suppose I say this is "time-based media"—or even for that matter, I say this is "film." What does that do? It urges conservators to put it in a box and say "No problem; I know how to preserve film; you copy it onto safety film and put it into cold storage." But that does nothing to save the other, unique aspect of the work, which is its performative nature.

Well, then you can say that's a special case; what about a film like *Toy Story,* that does not have that performative dimension? You see it in a theater, and you're fine. Why would you need to worry about any of these other behaviors, besides the fact that it unfolds in time? I bring this up because my co-author Rick Rinehart gives a great story about that. When he was at Berkeley, the Berkeley Art Museum and Pacific Film Archives were conjoined, and the Pixar folks showed up one day and said they wanted help preserving this new, all-CGI movie, *Toy Story*. His colleague said, "No problem; there's safety stock, and the original stock is subject to this syndrome, so it's better to do this than that…" But the Pixar people said "Whoa, whoa! We don't want to preserve the *film.* We want to preserve the *movie.*"

So they were like, "What do you mean, the movie…?" What the people from Pixar wanted to do was to preserve the original computer files so they could re-create the movie in 3D or 4D, or with different lighting, or from Buzz's perspective rather than Woody's, and so on. This was a completely different genre now, even if we still call it "film." Its behaviors are not just about being a reproducible, time-based medium; they are also about being encoded—being a rich data set that can give birth to all the versions you see in theaters.

Let's look at where video is going. What is the hottest video format today? Probably Vine. This is sort of Twitter's step child—seven-second videos you can take with your cell phone and then upload and share. It's fairly simple to preserve the file itself, because it's probably some relatively well-known codec—MP4 or whatever. They are short, so they don't take up much storage space. They might be some weird resolutions, but you could still settle that down and say, "Okay, now we have a standard for Vine." But that ignores its network nature. We have people sharing Vine clips over Twitter; we have hash tags that people use for discovering and promoting them. It's tied into the commercial apparatus, with Vine micro-trailers to promote a movie years before it comes out. It's part of a social network. All of that is invisible and lost if all you do is save a bunch of MP4s on a hard drive.

I think standards are useful; don't get me wrong. But we have to know what we're writing a standard for, and make sure we have all we need. MXF JPEG 2000—great. That's a wonderful standard for capturing files. Unfortunately, most people stop there, which is a terrible mistake.

Step two is that we need to think about standards for capturing relationships. For example, the relation between a film and the digital files that give rise to it, or between a film and the instructions for how to re-create an experience to fit with two 16 mm projectors. That is also a great way to think about standards. There are models for this, although I think they are a bit sketchy still—I haven't seen a really good one yet.

But then there's step three, which is maybe where my contribution and my collaborators' contributions come in. *How do you document not just the files and the relationships, but what to do when those relationships fail?* What do you do if you have Vine clips on a drive with metadata connecting them to URLs or Twitter users, and then Twitter dies and the URLs go 404? You need to have some sort of strategy for saying, "When those relationships die, *this* is what we should replace them with." Or alternatively, you can say that we should *not* replace them; when the relationships die, the work is dead.

It's analogous to putting bees in a zoo. If you put bees in a zoo, they die in a few days because they have nothing to pollinate. So you have to plant flowers so the bees don't die. But then you have to worry about the soil and the symbiotic relationships those flowers

have with other plants. Pretty soon, you are recreating a whole ecosystem in the zoo. Do you have to do that? Can you substitute some of these things, if it keeps the behavior you care about running? The Variable Media Questionnaire is designed specifically to say what those relationships are, and what to do when they break down.

Would you consider the Questionnaire itself to be a standard?

It's a standard in the informal sense that it is used by a bunch of places. Originally, it was a FileMaker prototype that we just handed out to people as a template. A lot of people were using it, but they did not talk to each other. As a web service, people can compare notes: this is how Nam June Paik answered this question—how did Bill Viola answer it? You can use those correlations to help you answer questions about your own work. That is really due to the efforts of lead developer John Bell, who has taken the technical lead on the latest (third generation) version of the Variable Media Questionnaire.

But in a formal sense, the Questionnaire is still getting polished. Richard Rinehart wrote a spec for it called MANS (Media Art Notation System), which is a variant of MPEG 21. It's still not available for export yet, so it has not been implemented completely.

Could you talk a bit more about your vision for the Variable Media Questionnaire, and what more needs to be done with it?

The early vision has been achieved. When works like this were first acquired in museums—at least in my experience, which was primarily in the U.S., Canada, and Europe in the 1990s and early 2000s—it was like, "Oh, what do we have in this crate? Check it off, and put it in a warehouse." Since then, I have a lot of anecdotal evidence that they have started asking many questions beyond "What's in the crate?" so they can understand how something is meant to work and what they should do when it stops working.

That can be a very practical conversation: Are we allowed to migrate it? Can we have access to the source code? Or it can be a very philosophical conversation: What is key to the work? What aspects of it can change, and what aspects of it cannot? What is the experience? Is there an experience of the work independent of the materials and hardware it happens to be using at the time? There's really no way to answer that by getting a bunch of technical experts together in a room and hammering out a standard; that has to be discussed case-by-case.

What I am pleased about is that more and more museums seem to be incorporating some kind of questionnaire or interview process into the acquisition of these works. They might not all be using my questionnaire—in fact, most of them aren't; most of them are using

their own home-made questionnaires—and that's fine. It won't be interoperable, but at some point, you have to respect differences.

Since then, I've asked what more we can do. One thing is shoehorn them into a form where you can compare notes; and that's what the Variable Media Questionnaire does. Essentially, everyone has an account, and you can add your questionnaire data. It's very customized from the very beginning, so just the process of adding an artwork to the questionnaire will narrow down the questions it asks you. If you had to answer every question in there, it would take forever.

My collaborators and I are also pushing the envelope on going beyond the creator. Ask the curators. Ask the conservators. Ask the technicians. Ask a gallery visitor off the street. What do they think are the key parts of the work that should be re-created in the future? I'm an artist, so I'm biased toward the creator; but others said, "There are so many other people who have a stake in the work, and we should be gathering their ideas too."

Then there's a host of related innovations, like the notion of a Variable Media endowment, or source code escrow. The endowment idea is that when you acquire the work, you skim 15 percent off the acquisition cost to put into a fund that accrues interest over time to re-create the work when its current condition expires. Around 2000 or 2001, when we were collecting internet art at the Guggenheim, these works always had a host of complications. In addition to all the technical problems, there was also the issue of cultural obsolescence. For example, Mark Napier's *Net.Flag* has this flag for the internet you can create from components of various nations. So what happens when Burkina Faso turns into whatever or Syria breaks up into God-help-us? All of those changes have to be incorporated into that work the future, because that's the artist's intent. Of course, other artists say "No; I want you to keep it the way it way originally. Embalm it! If the hardware dies, it dies." That's fine too; you can say that in the questionnaire. It's important to note that right now, there's no other way for an artist to say "I don't want the work to change at all." Museums and conservators and collectors will just go ahead and change it on you. So the Variable Media Questionnaire is a kind of will and testament, too.

Anyway, the endowment serves as a bulwark against future costs. If you collect enough of these things, then every time one of these works needs some help, you have a fund to pull from for that. In all your other explorations of how to fund preservation of these works, I would encourage you to get it at the point of acquisition. That's when you have the most leverage with the artists and museum boards. Don't wait and say "Oh, we'll do it later, when the board approves it." Get it done, because that's when everyone is under pressure to make the transaction happen. It's really hard to get museums to come up with money these

days. But at the point of acquisition, you can just say "Let's take 15 percent; other museums do it; the Guggenheim does it." So be tactical about that.

Is the Variable Media Questionnaire strictly for collecting organizations, or could individual artists use it to document their own work?

It has turned into the second, as well as the first. I had been thinking it would be filled out by a conservator or a registrar or a curator. But now I'm realizing, "what about all these people with works that are not in a museum, but eventually people may see them as valuable?" We live in an age where storage is so cheap, so why not just gather as much information as you can? You do not need any affiliation to fill out a Questionnaire and get a record, and I encourage artists to do it on their own.

Could you talk about the process of building and disseminating the Questionnaire? How do you get a tool like this to be adopted?

Stamina. The Questionnaire for a long time was basically a crappy DHTML website that did not even record data. It just asked you the questions and you had to write them down on a piece of paper—because that was all I had the time and skills to build at the time. I would just go around talking to people about it and doing presentations, always with that crappy web prototype that I had made. At a certain point people started to get more interested.

I did an article for a magazine called *ArtByte* back in the day; that was about 1998. I had been talking to a curator named Benjamin Weil about his site called ada·web that was dying off; AOL was pulling its funding. It was a great site, and curator Steve Dietz asked fellow artists Keith Frank and Janet Cohen and me to create an artwork on the occasion of its being archived at the Walker Art Center. As I was talking to Weil, I remember saying, "Wouldn't it be great if you could envision these things as inherently variable, so they could be recreated as necessary when protocols change and conditions change?" So in that article, I said that my colleagues at the Guggenheim had started this thing called the Variable Media Initiative—that was the first time this phrase had been used, and no one at the Guggenheim knew what the hell I was talking about.

I applied to the Langlois Foundation to work on it, and Alain Depocas, who at the time was working with their database, came to me and said they would like to partner on it. He helped to build the second generation, which was a functioning database. That was a FileMaker prototype, so it had limited networkability.

Museums don't learn enough from start-up culture. They think the best idea is to get all the department heads in a room and come up with a plan to share with department heads at other museums. That kind of top-down approach has rarely worked for me. It has always

been a bottom-up approach: find a need that you have, create a quick fix, get a prototype people can react to. Eric Raymond's essay on open-source software development says it all: "The best software comes from a developer scratching his own itch." He also said "release early and often." Put something out there and see if it sticks. If it doesn't, move on to the next thing.

So much collective brain power is spent by experts sitting around discussing the OAIS and how that model could eventually trickle down. And then you have Sebastian Chan over at the Cooper-Hewitt or Jason Scott at the Internet Archive who just get an idea and then in a few days, boom! It's there. GeoCities is dying? Boom! Got that! We might look at that and say, "Well, that's not really considering all the stakeholders," or "there's no 50-year plan for how these data will be managed." But the data are now out there being looked at and pored over and re-imagined by lots of folks.

I'm not saying everything you do should be that way, but these are people who are familiar with how Silicon Valley start-ups work and how they gain traction very quickly. Museums could learn from that. They could crowd source and find ways to let bottom-up solutions arise, rather than waiting for top-down experts to prescribe a standard to fit everything.

Do you think the taxonomy of "behaviors" has wider applicability than the Variable Media Questionnaire?

Well, it is open source software, so you can take it and mess with it as much as you want. If you are asking whether the concept of behaviors could be pulled out of that specific structure—a lot of people have made these kinds of questionnaires for their own purposes. So I think the concepts are exportable to different situations.

We tried to make it as flexible as possible. For example, in earlier versions of the Questionnaire, there were media-specific fields like duration and video codec. We found that many people already had fields like this, but they were splintered across every institution because for whatever reason, everyone thinks they should make their own database. (And those who don't use something like Gallery Systems, which is in my mind very brittle.) So we decided, let's separate out the media-independent stuff that is our bailiwick, and allow that to dovetail with the records you already have. So the Questionnaire is a web service you can tie into your own records via a URL to a permalink.

That said, John Bell and Craig Dietrich have also worked up a prototype for what we call the Metaserver, which creates automatic links between your records and the records in the Questionnaire, so you automatically see Questionnaire data alongside your own data. Right now, we have four proof-of-concept projects with four collections tied together that way.

But you can't go and download it yet; the API is still under development for that. That's another John Bell project. It's very cool; it was designed specifically to help people use the Questionnaire while still maintaining their own database the way they like it.

Could you talk about your approach to instruction and the curriculum of your program?

We tried to imagine what a work goes through as part of its lifecycle, and then mirror that in the curriculum. So the first course is on acquisition; it's called Intro to Digital Curation. It covers a lot of stuff, but the focus is on how you acquire something.

Then there is a class on what you might call "representation." Okay, now you have all this stuff—how do you make sense of it? That's mostly on metadata: taxonomies vs. folksonomies, various metadata standards (but not getting too caught up in the alphabet soup), what functions metadata should serve, the politics of metadata. (Boy there's a lot of new stuff in the past few weeks on that last one, with Edward Snowden and NSA—"Don't worry! We're only capturing metadata!")

Next in the sequence is access. Okay, we digitized a bunch of images, we put them on a disk, they got metadata, they might have gotten them into a database—now how do I get the world to see them? Most likely you are going to make a collection database-driven website. Well, how do you do that? What software packages are out there for that?

Then the last in the sequence is preservation. Now we have the well-oiled curatorial machine, but it's going to break in a matter of months or years when the technical protocols that underlie it break down. What do you do about that? In that course, we rely on the experience of the people who take the course, because it's a graduate-level course and we have people from the Library of Congress and various other major institutions. They've all had experience with stuff breaking. It's really easy to get a laundry list of problems; an easy assignment would be to ask the students to describe a recent project of theirs, make a chart of its components, and identify the Achilles' Heel of the project. The easy part is finding the mistakes. The harder part is what to do about it. This is where we walk students through the four strategies of preservation from the Questionnaire:

- Storage. Everybody thinks they have figured out the file format and run checksums and have it in Archivematica or DSpace or something like that, and they're done. No! That's just storage; a lot of people would say that's not even part of preservation.
- Migration.
- Emulation.

- Reinterpretation.

We go through models of all of these. We insist on a level of practical training in this program. So for example, everyone has to run an emulator. Go find a ROM for Donkey Kong or Oregon Trail or some game you played in junior high, and run it on your contemporary PC or Mac. It is really surprising how hard that is for some of these 50-something, highly placed curators and librarians and archivists.

I also teach in the media department at Maine, and I teach an undergraduate version of the preservation course. When I tell them, "Okay, pull out an emulator, and run some obscure game I've never seen," everybody can do it with no help at all. In fact, 90 percent of the class can do things that I probably can't even do. But that's their culture. These emulators were not built by getting a bunch of experts in a room; they were built by kids with acne working in their basements in this incredibly flexible, open-source way. In this case, where the 50-somethings were having trouble running an emulator, I had my sophomores create tutorials on how to do it for the 50-somethings to use.

In the online discussions for this course, there are always such interesting questions that come up when you start asking questions about what it means to preserve a complex cultural and technological works. You can make it the most boring subject in the world if you get caught up in the technical details—or you can make it very interesting by asking "What does it mean to re-create the experience, not just the materials? What fundamentally *is* a work like *Erl King* or *Toy Story* or a Vine video?" Not just what makes them tick technically, but what makes them important? If we want to preserve them, what do we need to preserve *about* them?

… I should add that the whole program is online. The student body has collective experience that the teachers can't match. It's a great discussion that lasts a semester.

Why did you start this program?

The need is absolutely huge. Although I direct the program, it wasn't my idea. I had a Dean, Jeff Hecker, come to me and suggest it. If you have been in a museum, archive, or library—or even a government agency or a photography studio—you know there is tons of work to be done in this area. And usually there is not enough staff and funding and technical expertise to do it. We can help with some of that.

We decided to have an internship that is unlike any other internship, because you can do it in your own place of work. We did that because there is all this work that needs to be done, so it would be terrible to force people to do some artificial assignment where, yes, they would learn, but they would not actually get valuable work done. You wouldn't ask doctors

who've gone through three years of med school to do rotations with plastic dummies, when there are so many patients in far-flung places in need of medical assistance. So we said okay, let's go ahead and help all these artists' spaces and small-town historical societies get some work done through our program. In the preservation course, we have students adding to the Questionnaire; they go find artists and interview them. It's not a purely academic topic; it's a desperate practical need. So it's a bit of a bait-and-switch operation—let's get some good work done by pretending that it's just about educating people.

The hands-on element is essential, but there are some technical challenges there. For example, a number of useful tools, for whatever reason, are mainly accessible on Linux; and most students don't have an easy way to run Linux. We've been trying to run it as an emulation, but emulating an operating system is harder than emulating a video game. We might set up a kind of virtual collection where students can log in and run the tools they might need, BitCurator and so on.

How do you stay informed about what's happening in the field? How do you keep learning?

I have always believed that you learn from teaching. I follow certain news groups and listservs and so forth. I don't read technical papers unless I have to; it is more that I talk to people in the field and find out what they're doing.

We tend to forget that digital curation and preservation are woven into the fabric of our daily lives now. For example, you might not think of yourself as someone who needs to learn about DRM, but if you tried to share a song that you bought on iTunes or Amazon, you are going to find out pretty quickly. You pick up that kind of knowledge better when it comes from something you work with in your daily life than if you read a bunch of academic papers on it.

You also try to do that with students. Yeah, we're going to show them professional preservation software. But we're also going to ask, what does buying a song through iTunes do to its long-term stability? What can you do about a DVD movie that you buy that gets scratched? What are the legal ramifications of circumventing the DRM to make back-ups of those things? What are the legal ramifications of using a certain image as the background of your WordPress blog? Questions like these are increasingly intruding into our daily lives, not least with what we are hearing about Verizon phone records and Facebook files in the NSA database. How many people have even tried to archive their email? A lot of people know that they should—but how many have actually tried? Drawing attention to issues like these is the lowest-hanging fruit.

Another example: If you are on a Mac, Time Machine is a great program, but people don't really understand it. They think it is the equivalent of sticking in a hard drive and mirroring your data, but it's not. If you are just mirroring and a file is deleted or corrupted, you mirror over the deletion or corruption. Time Machine has a sequential back-up that allows you to go back and retrieve particular pieces; it is a very sophisticated storage back-up mechanism. If I ask someone if they realize what is happening when they use a program like that, it can help to tease out a lot of these preservation issues. Important issues of preservation are right under people's noses, you just have to draw their attention to it. Did you know that when you choose to delete that email, you are making a preservation choice?

What have you learned from building the curriculum?

I was surprised at the spotty technical expertise of our students—and again, these include people who have worked at the Library of Congress at relatively high levels and so forth. These are not undergrads with no experience; most of them work in some kind of library or museum context. I was surprised how hard it was for them to do certain technical things. That's okay; it just tells me that we need to spend some extra time with those things, to make sure they are comfortable. The peer-to-peer tutorials can help a lot there, so you don't bore some of the students by spending too much time going over things that they already know, but others don't.

There has been a big adjustment for me because I've never taught an online course before. Perhaps the biggest change I would like to make would be to throw out the crappy courseware that plagues online courses at the moment. These Blackboard-inspired things are completely antithetical to the way I think about teaching, and I think they are also antithetical to the model of receiving and sharing cultural information that our world is increasingly turning to. One of the systems we used last year was Moodle, which is all about "go and find this message in this folder in this directory"—a hierarchical, Windows-within-Windows thing. I don't think that's the right paradigm for today's culture.

So as a pedagogical observation, I really hated the options out there for online courseware. If you find any better ones, let me know. In the meantime, we're optimistic about two kinds of new courseware John Bell is working on. He and Craig Dietrich and Erik Loyer of USC have developed this program called Scalar, which is a kind of publishing platform. It's like a book, but you can choose your own paths through different kinds of multi-media content. That's sort of like the textbook, if you will.

Then there's a discussion part that we are hoping that John has been working on. It's a stream-based conversation model. Think of how you get information today if you are technically savvy person: it is largely through social networks and social media. You have

Twitter open here, Facebook open there. You are no longer putting things in folders. People in Gmail don't put things in folders; Twitter doesn't even have folders. You might tag things; you might be creating smart collections on the fly. You might add tags that you can later export for some purpose. You might choose to participate in a conversation by replying to this here and that there, re-Tweeting something and sharing or liking another. That is a totally different model from putting things in a folder to find later.

Does your background as an artist affect the way you approach preservation?

I think it does, in a couple ways. If you are on the cutting edge of creation in technology as artists often are, you run into these preservation stumbling blocks all the time.

I have a piece that I am almost done re-creating—a collaborative piece from 1998 that was designed for Netscape 4, which had a totally different document-object model than contemporary browsers have. I had to re-do it pretty much from scratch with W3C standard HTML tags and JavaScript and so forth. I'm going to learn a lot from re-creating this project about what it's like to re-create a project—the choices that you have to make.

For example, you might think, "it's just an HTML page—just make it look the same." Well, it's not that easy. The biggest screens back then were 800 x 600. Now people have screens that are just enormous. So I have to think, "What am I going to do with this little postage-stamp-sized image? Do I interpolate it to make it bigger, but make it look pixilated? Do I keep the original size so it looks small on the screen?" There are all these interpretative issues that come up. If you do that in your own work when you are moonlighting as an artist, that will inform the work you do as a curator.

When a started this, people would tell me, "Oh don't worry. Google will come out with a solution. Or this or that working group will come out with a solution." But I have always felt that the creativity of artists would exceed the inventiveness of technicians, and I have not yet been proven wrong.

How are the technical needs of fine art different from, say, archival video works or even complex non-art digital objects collected by an archive or a library?

There is a lot of crossover, but I think the [technical] institutions need to learn from the [art world], rather than vice-versa. The institutions tend to come up with these "one size fits all" technical solutions: "Oh, now we have MPEG 4! Now we have JPEG 2000 XMF! Now we have whatever standard—so we have nailed the video problem!" Artists will tell you that as soon as you try to re-create one of these works, you'll find it's actually very complicated and there are all these dependencies on networks and hash tags and social context and so on.

That can inform preservation thinking for things like *Toy Story* or Vine videos that are not artistic projects, necessarily.

In the art world, you re-exhibit things. You don't just put them in your Trusted Digital Repository and say "We got them!" You have to put them up so people can actually look at them and evaluate them. That's a huge onus, but it's also an opportunity to see if your preservation structures are working. You may have come across this show we did called *Seeing Double*, where we put emulated versions next to the original equipment for complex media works. We literally did a survey and asked visitors, "What do you think? Did we capture the spirit of the original?" That gives art museums a kind of reality check that is not always present for complex works in other contexts. If a top-notch researcher like Matt Kirshenbaum tries to look up a complex media work in a library somewhere, he could probably piece it together, even if you just give him shards. But the average person who walks in off the street might say "I don't know what I'm looking at here," and art museums have to cater to the average person.

On the flip side, the criteria that the art works apply are very stringent. The look-and-feel is very important. If you have to preserve scientific data or even a Shakespeare Folio, no one really cares what the font was, whereas if it is an art work, the font could be *very* important. It could be critical to the meaning of the piece. So might color, resolution, scale, placement, social context, institutional context, and the participatory nature of it.

Another reason art works are an especially difficult challenge is that artists often push the limits of a medium, and sometimes will deliberately take advantage of errors, glitches, and bugs. For example, Joan Jonas' *Vertical Roll* is a video piece where the vertical refresh rate is clocked so high that the image starts to float up and down and the frames are not in synch with the screen. That's something you see with analog video that you might know about from your grandmother's T.V. set; digital T.V. does not have that anymore. This work was made with that property deliberately in mind, so the art sort of jumps because the frames are rolling at just the right rate.

As another example, JODI and Group Z and a number of other artists created this primitive form of animation for an early version of Netscape that took advantage of a bug that allowed you to create multiple body tags on an HTML page. When you did, it would change the color gradually from one to another. (This was before Flash or JavaScript.) Eleven months later, Netscape came out with a new version that fixed the bug, and that killed all those art works right there. They lasted exactly eleven months.

So artists are often on the edge, pushing the limits of technology. Their work may have been deliberately about that misuse of the technology, so there's no point in faking it

afterward. Many of the artists we interviewed would say “No! Don’t substitute a video or a canned version of the original effect; the whole point was all about how you hacked the box to make this effect.”

So these three things add up to make art an acid test for preservation strategies: (1) making re-created works intelligible to a lay viewer; (2) the dependence on look and feel; and (3) the fact that artists often deliberately misuse a medium for a particular effect.