# White Paper

## Element Technica Metadata

### Metadata for Poets

**WHAT HAPPENS WHEN YOU HEAR THE WORD "METADATA"?**

If your eyes haven't already glazed over, read on...

Here's why: There's a good chance that the creative and financial success of your next stereoscopic 3D (S3D) project will depend on how well you and your team understand, create and wrangle metadata. Metadata is not just for shows with nine-figure budgets and armies of propeller heads anymore. (Yes, indie filmmakers, we are talking to you!)

The purpose of this white paper is to:

- Describe metadata in terms of its use in current S3D shows
- Discover how and why metadata will grow increasingly important to S3D shows
- Discuss examples of how metadata works in innovative S3D (Evergreen Films and BBC's $75M WALKING WITH DINOSAURS 3D)
- Find out how to work with service providers to use metadata to increase production value and reduce schedule and budget risk of your next S3D show

Finally, for freelancers in all production departments -- from producers to dolly grips -- success on your next S3D gig may depend on how much you know about and can work with metadata. Our intention with this white paper is that it will provide a starting point for your continuing metadata education.

**DEFINING OUR TERMS**

Video imagery is a combination of two types of data: **"essence data"** and **"metadata"**. Essence data is digital information (sequences of ones and zeros) required to reconstruct a human-visible image out of ones and zeroes.

In short, metadata is information about essence data. If essence data is "text" then metadata is "context". Metadata (like essence data, also a sequence of ones and zeros) allows 2D and S3D teams to cost-effectively:

- Record parameters under which essence data was captured
- Analyze and/or correct imaging problems in-camera
- Analyze and/or correct issues in post production

Metadata is "small" in terms of file size and data rate compared to the monstrous size of image (that is, data essence) files. For example, the file size of a ten minute S3D 2K essence data is nearly 350GB whereas a 10-minute stream of metadata can be as small as [* *] KB. It's easy to see why metadata might get overlooked.

But for reasons we shall see, metadata is as critical as essence data for S3D shows and increases in importance the more the imagery relies on visual effects.

**STATIC & DYNAMIC METADATA**

Metadata can be highly **dynamic**, requiring sampling several times within each video frame. An example of this kind of metadata: zoom, rig tilt and exposure parameters during a crane shot.

Metadata can also be relatively **static**, changing infrequently. An example of static metadata is the name of the show's director, serial number of the show's rig, camera and lenses, and take or scene numbers. The metadata flows in a show run the gamut between "change never" and "change always."

Just as a script supervisor records critical information such as continuity, scene and take number and other key information so that teams further down the pipeline can understand what happened on set, so too does a properly-designed metadata system record critical information about the imagery for later (and ideally more cost-effective) processing and manipulation by the post team.

**WHERE DOES METADATA LIVE?**

Both static and dynamic metadata require much less overhead compared to video essence in terms of file size and data rates. But despite its modest size, a few kilobytes, teams should not assume metadata is less important than essence data.

Metadata can be stored as part of the image file (for example, in the file header for a frame), or separate from the image file (for example, on a data card onboard the rig). Ideally, metadata will also stream to other locations, for example, to an on-set dailies station.

For the purposes of our discussion, it is helpful to think of metadata as a dynamic "stream" as opposed to a static "chunk" of information. As new systems come on line in production, they create their own metadata streams which enter into the overall flow of metadata for the show.

**WHY YOU SHOULD CARE**

Though metadata itself is not new to production, metadata (or the lack of it) plays an increasingly important role in 2D and S3D productions. Dave Stump, ASC, wrote a highly recommended article on metadata on Creative Cow. What Stump says in this article applies to an even greater extent with S3D shows. Why? Principally because tricks of the trade used to create 2D visual effects may not work (or may not work as effectively) in S3D.

Of course, lavishly-budgeted high-end visual effects movies already work with metadata as a matter of course. Such projects often have team members (often called "workflow" or "pipeline" experts) specifically dedicated to keeping metadata accurate, reliable and organized from previsualisation to final delivery masters.

But what's on the horizon may surprise you. Even modestly-budgeted S3D productions (that is, the shows most of us are involved in) can now take advantage of what metadata offers in terms of:

- Increased control over performances by the core creative team (as opposed to the post production team)
- Reduced post production risks, costs and schedules

Good metadata practices do not solve all of the challenges inherent in S3D production, but they do allow post and visual effects teams to start closer to the finish line.

## THE WAY WE WERE

In the pre-digital era, metadata was collected via written notes by the camera team and, later, visual effects teams. This information reflected physical measurements, for example: distance to subject, lens height, tilt angle. Even when these paper notes were meticulously kept on-set (not always the case despite excellent intentions) these notes might go missing after principal photography.

Worse still, these measurements were only as accurate as the tools used to make the measurement (think of a sagging tape measure or a shaky bubble level). And most measurements, when done at all, were made only before and after a shot, and did not record critical information about the change in the system over time during the shot..

This old way of handling metadata won't hold water for much longer. The geometry to sustain the S3D illusion requires continuous and complex calculations, all of which depend on accurate, reliable and flexible (updatable) metadata.

## THE SPACE-TIME CONTINUUM

Just as a clock allows trains to operate on the same track without running into each other or blocking each other, the heartbeat tying all of a show's metadata together is a clock -- a timecode signal. Timecode, itself a stream of metadata, allows systems to synchronize specific metadata to specific frames, or, in some cases, to slices of time within frames.

One of the major challenges of post production in 2D and S3D is to re-link metadata to essence data once it has been broken, either purposely (for example, to conduct a file transcode that does not transfer metadata along with essence data) or accidentally (for example, a power outage in a system that causes an interruption in the essence data or metadata stream).

Because of the reliance of S3D on metadata to maintain the delicate illusion, these breaks can be even riskier (more schedule- and budget-damaging) than in a corresponding 2D show.

## STAYING CONNECTED

Some post processes (for example, transcodes) require that video essence data and metadata be de-coupled. This de-coupling occurs because either the destination file type or format cannot or does not understand and integrate metadata from the source file. Or if it does, integration is spotty and can be prone to human and technical error.

This split increases risk (and potential cost) by increasing the chance that metadata will go missing, get corrupted or otherwise get out of lockstep with the video essence data. When this happens, the production will bear the financial and creative cost of recreating metadata, or re-creating the elements.

Whenever metadata splits from essence data there is cause for concern unless there is a foolproof system in place for recombining the essence data with metadata after the split.

## WALKING WITH METADATA

ET has worked with several major studio features to develop custom metadata solutions for their particular application -- and to accomplish specific storytelling goals. One major current example is Evergreen Films' production of WALKING WITH DINOSAURS 3D, a co-production with BBC, under the direction of Pierre deLespinois and camera department lead, Mick Pacifici.

WWD3D is a "virtual production" show in which the creative team views pre-constructed, pre-animated CG dinosaurs in a video tap while the production team captures live action environments around the digital performers. The pool of hardware and software that allows this to happen relies on metadata to work. Without such tools such a VFX-heavy show would be prohibitively time-consuming or take a production value hit.

Metadata from ET rigs (in this case interocular/interaxial distance and convergence distance) is the foundation for subsequent metadata. Information from third-party solutions such as Preston FIZ controllers also generate positional metadata corresponding to changes in focus, iris and zoom parameters over the course of each frame. Of course, this means that the equipment providing the foundational metadata (in the case of WWD3D, an Element Technica Quasar 3D rig using Sony F23 cameras) must stay within tolerances over time.

Metadata is not an end in itself. It's the information contained in metadata that's critical to calculating parameters (including "nodal point" and "entry pupil") required to match live action with computer-generated (CG) elements while maintaining the delicate illusion of S3D. In the case of WWD3D, the Lightcraft Technology Previzion system collates the information from lens, camera and ET rig to determine these parameters – and protect the show from post-production costs.

If history is a guide, virtual production methods will become increasingly commonplace. For the metadata-aware independent filmmaker, these tools may make the difference in hitting it out of the park (in terms of production value and audience experience) for a given schedule and budget.

ELEMENT TECHNICA

## HOW TO ASK YOUR SERVICE PROVIDER ABOUT METADATA

Some S3D systems generate metadata, but the metadata is used solely in the internal calibration of the specific imaging system. It is not designed to make your post life easier, less risky or less expensive. Other systems generate metadata but leave it to the production team to make sense out of the metadata. Or leave it to you to insure that all metadata systems in your show play nice with each other.

So it is not enough for a solution provider to say "yes, we do metadata." The key thing is for the provider to make sure the metadata from their system works for your show. Beware providers who consider metadata as part of a proprietary "secret sauce," and are reluctant to spend the time or energy to make sure metadata is useful to you. It's not about being high-tech or low-tech it's about being "right" tech.

Others actively work with shows and equipment and service providers to make sure that metadata generated by their portion of the show plays nicely with metadata from other solution providers.

Things to discuss with your S3D service and equipment providers well in advance of your production:

1. How does your solution address our show's specific metadata requirements?

2. How readily does the metadata generated by your system or solution integrate with metadata flows from other systems and solutions used in the show?

3. How can we be sure that metadata generated by your solution stays within tolerances and parameters required over the course of production?

4. How readily can we add new metadata to the stream?

Metadata systems and processes will continue to grow along with the S3D imaging. Some developers will create tools that will allow teams to more easily navigate the sea of metadata their show creates. Others will develop tools, formats and workflows that will enable video essence data to maintain links and synchronization with metadata at all stages of the post process, including transcoding.

## METADATA AT ELEMENT TECHNICA

All Technica 3D rigs are compatible with Element Technica's IO (Input-Output) Module which allows teams to easily collect and stream metadata. The IO Module takes metadata from the rig electronics (interocular and convergence) and ET lens control (focus, iris and zoom) as well as from most 3rd party lens controls and finally from other metadata generating devices like VFX tracking systems or encoded camera support platforms. The module wraps all information into a clean, timecode-stamped sample as often as 8 times per frame. The module writes metadata to an onboard MicroSD card. It can also stream metadata to other locales (for example, a dailies station) or to the device capturing the image files.

The RED Epic workflow goes one step farther, integrating metadata (including metadata from Technica rigs) directly to R3D image files. In addition, users of SGO's post compositing and finishing suite, Mistika, who shoot with Technica 3D rigs can access metadata when opening image files (provided production cameras support metadata). For cameras that do not yet capture metadata, Mistika operators can use captured data from the MicroSD to synchronize metadata with imagery (essence) files based on timecode.

SGO's on-set version of its toolset, Mistika Live, goes even further by analyzing the geometry, color and exposure of incoming imagery data from Technica 3D rigs and sending this analysis (as metadata, of course!) back to the rig via the I/O module.

## METADATA IS METACONTENT

Proper implementation of a metadata workflow allows production teams to maximize financial and creative investments by reducing the need for re-shoots and/or expensive post re-work. If you think capturing metadata is too expensive to consider for your project, think how much you expense, time and trouble you will spend by not having the metadata your show needs.

More to the point, metadata (along with video essence) is part of the intellectual property of the show. And, especially for S3D, metadata can be considered an asset, rather than an afterthought or a "nice to have." Metadata is after all, metacontent.

## DO YOU LOVE METADATA AS MUCH AS WE DO?

ET rigs have been quietly generating reliable metadata since they launched the production version of their flagship Quasar 3D rig. The ET team's experience with stereoscopic 3D goes back even further to 1996 with the launch of Universal Studios ground-breaking attraction Terminator 2-3D BATTLE ACROSS TIME. In addition to our work with the Evergreen team on WWD 3D, we have worked with feature, commercial and documentary teams to develop usable metadata workflows for their shows. ET is always open to discuss your specific projects.

In addition, we welcome inquiries for participation in our ongoing Metadata Certification Program. This program insures that your company's S3D solution integrates metadata with Element Technica solutions. Some of the companies already participating in this program include: RED (Epic and R3D), Lightcraft Technology (Previzion), Fraunhofer's STAN, SGO (Mistika and Mistika Live) and Sony [MPE].

Our expectation is that knowing that the S3D metadata flow is proven will make it more likely that decision makers choose your solution and ours. To this end, we seek to develop additional relationships for solution providers in S3D:

- CG Animation
- Compositing Tools
- Motion Control
- Motion Capture
- Virtual Production/Virtual Cinematography
- On-set Dailies