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Digitizing and Managing 35mm Mounted Slides: The Flip Side

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Abstract

Cultural heritage organizations of all types and sizes commonly maintain and preserve collections of 35mm mounted slides, oftentimes numbering in the hundreds, to thousands, to hundreds of thousands. Digitization of these objects presents multiple challenges. The mutual dualities of frontside/backside, combined with simultaneous reflective/transmissive content capture requires unusual imaging equipment and techniques to create efficient rapid capture workflows to meet current cultural heritage archival documentation requirements at scales such as these. Further, the interpretation, creation, and archiving of metadata from such captures present concomitant challenges, which may often be best met by integration into the imaging and processing workflow at the time of capture. Our research and development project created a suite of workflows and protocols for efficient and safe handling of slides as museum objects, complete data capture with current digital imaging studio equipment, and efficient post-processing of the digital image files.

Introduction

As museum photographers and digital imaging specialists, one of the most important job requirements is, for each object, to create a comprehensive set of archival digital surrogates that represent the object as completely and accurately as possible.

In the case of 35mm mounted slides, our first challenge was to define "the object." Traditionally, slides are digitized by capturing only the image content of the film (Fig. 1). However, the mounts of slides often have key metadata about the image content or about the history of the slide itself. Handwritten notes by the photographer, stamps from the business that developed the film, numbers from the organization that owned and stored the slides, and other key data points are often present, giving new meaning to marginalia (Fig. 2). This information is commonly added to the slides without any particular order or structure, so the information is difficult-to-impossible to transcribe by automated transcription systems. Additionally, the entire current condition of the slide represents an important snapshot in time about the slide as a physical entity. Details such as whether the mount is made from paper or plastic, whether the corners of the mount are rounded or square, whether the mount has staining or other signs of degradation/aging, all of these are important elements of metadata for curators, conservators, and researchers. Thus, the whole story of "the object" is not just contained in the image embedded in the film, but truly in the entire slide—both the film and the mount.

To the extent that it is possible, archival digital surrogates should be completely self-evident—if there were no metadata attached to the image at all, the images should convey a complete visual representation of the object. The concept of What You See Is What You Get (WYSIWYG) is a useful guide. Documentation images should reproduce as closely as possible what the object would look like if you were viewing it in person under similar lighting conditions.

The term "archival" here is specifically important as well. In the context of cultural heritage data of any sort, the archival term connotes a level of confidence with respect to museum-grade qualities. "Archival" paper has physical characteristics that suggest it will last longer than most other paper without any changes—chemical reaction from contact with other materials, yellowing from age, etc. For a digital image file, the concept of "archival" is commonly interpreted to be as "pure" a digital image file as possible, free of digital manipulation beyond normal adjustments that are acceptable (such as minor adjustments to exposure levels, color corrections, minor sharpening, etc.). This leads to a whole host of guidelines on acceptable/unacceptable practices, but in the context of this paper, the key factor here is that a single raw image file of an object is preferable to a composited image file (wherein multiple image files are digitally combined to produce one final image file). This was the primary motivation for our project that drove us to create a dual mode lighting environment to capture completely unobstructed views of both the transmissive and the reflective portions of the slides in a single raw image file—one per side.

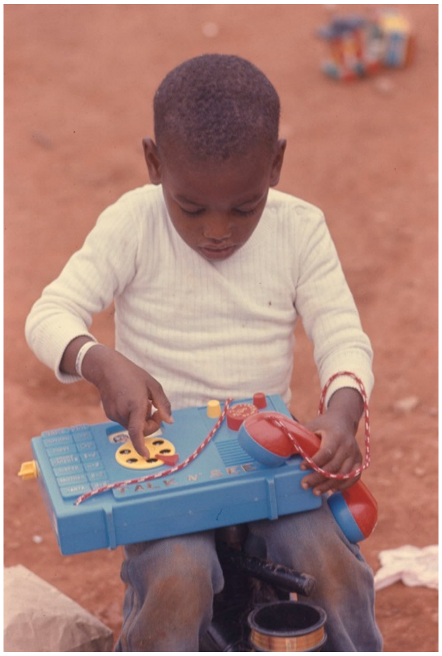

***Figure 1**. Traditional version of a digitized 35mm mounted slide—captured and cropped to preserve only the image content of the transmissive film portion of the slide.*

***Figure 2**. An example of typical front/back "object" content to be digitized. This is what the two sides of the slide would look like if viewed on a light table in a well-lit room, so the mount and the film can both be seen simultaneously.*

Method

With the criteria identified above in mind, initial project goals were:

- Design a **capture workstation** to allow safe, easy handling of 35mm mounted slides
- Create a **dual mode lighting environment** to capture the transmissive film and the reflective mount portions of the slides in single raw image files
- Develop **post-processing workflows** that maximize efficiency

Capture Workstation Design

Research on existing slide digitization hardware found several options that met some of the capture requirements, but no options that met all of the requirements. Project staff developed a customized design for a prototype apparatus. A team member provided fabrication services, which allowed for short-cycle, iterative design ideation and testing.

A design was reached that met all of the workstation requirements in a relatively simple modular configuration, which would also facilitate digitization of other types of film (2x2 and 4x5 negatives, for example).

A bottom later of sheet aluminum provided lower support for the slide mount to rest on, with an opening sized for the film portion of the slide only (Fig. 3). This specifically sized opening allowed transmissive light to illuminate the film portion of the slide, but prevented bleedthrough in the mount. All of the slides were placed in a consistent orientation to simplify object handling—landscape images with the bottom of the image toward the bottom of the apparatus, portrait images with the bottom of the image toward the right side of the apparatus. Final image orientation would be normalized in bulk during post-processing.

An upper layer of sheet aluminum was created with tight tolerances to have positioning support on three sides and to be open on one side, toward the bottom of the apparatus. This design provided an easily and safely repeatable placement of slides in a consistently precise position, and space to turn the slides for capture of the backside. The precision of placement was also a critical requirement to allow for bulk cropping of the film portion in subsequent post-processing.

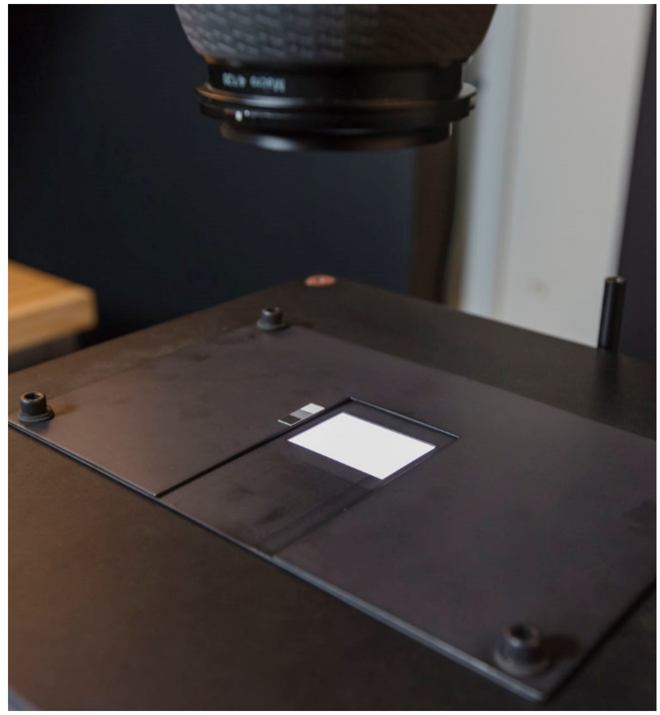

***Figure 3**. Close up view of the slide holder, a simple slot constrained on three sides that allows the operator to easily and safely place the slides in a very consistently precise position, and to easily flip the slides over to capture the other side.*

Dual Mode Lighting Environment

The primary requirement of the dual mode lighting environment was that it could meet current standards for cultural heritage reproduction imaging of flat objects. The Federal Agency Digital Guidelines Initiative (FADGI) Still Image Working Group's Technical Guidelines for Digitizing Cultural Heritage Materials, and the Metamorfoze Preservation Imaging Guidelines provide these standards.

Based on these guidelines, sampling frequency and spatial frequency response metrics were assessed to determine if existing equipment would be capable of meeting the requirements for 35mm slide digitization. As the quantitative and qualitative factors that must be weighed in this evaluation are quite complex, research was conducted to determine whether a single 50 megapixel image of the full slide—including the mount—could be cropped to the film portion of the slide and still satisfy resolution requirements for this set of slides. Importantly, examination of the film portion of the slides revealed that the slides themselves had been captured handheld in the field, under widely varying natural outdoor lighting conditions. As such, the image content of the film itself did not contain unusually fine details that would require correspondingly high digital capture resolution. The requirements for the reflective portion of the mounts were quite low, by comparison to the film portion requirements, so if the film portion resolution requirements were met then the reflective mount portion requirements would be more than sufficient. Thus, for the set of slides and the studio equipment in this project, it was determined that a single capture of the full slide would suffice to meet the resolution needs of the final primary image file, after cropping to the film image area.

Apparatus design also featured physical modularity that could be configured with different types of studio lighting equipment. Key elements for the modular lighting environment were to balance the intensity levels of the transmissive and the reflective light sources, and to equalize the white balance of the two sources. The baseline set up would capture the reflective portion of the slides at levels determined by the use of our reflective targets, and simultaneously capture the film portion of the slides at lighting levels that would retain all of the film image data. The consistency of the setup would be critical to creating accurate digital surrogates that, when compared to each other digitally, would reflect the same differences that would be seen among the original physical slides. Great care was taken to ensure that the digital capture levels for the film portion of the slides would not clip either the brightest or the darkest image elements.

Studio lighting equipment can be configured in myriad ways given the variety of light types (studio strobes, camera flash units, fixed lighting modules, etc.), and lighting modifiers (soft boxes, snoots, gobos, gels, filters, polarizers, etc.) commonly available in a photography studio.

It was seen as a desirable element that the 35mm apparatus be easily movable and small enough to fit into most common copystand setups that are used frequently for museum digitization of many types of flat objects.

Two options evaluated in the design phase of the project were: (1) the use of studio strobes as reflective and transmissive light sources, and (2) the use of studio strobes as the reflective source with a fixed LED light panel as the transmissive source. Reflective and transmissive film targets were evaluated to create a configuration that would balance the tonal response, white balance, and color accuracy metrics in both portions of the slide as captured in the dual mode lighting environment.

In the first example (1), three studio strobes were utilized: two from above configured in typical copystand arrangement (one on either side pointed downward at approximately 45 degrees), and one from the side pointed horizontally below the film plane and reflected upward by a white panel angled at 45 degrees (Fig. 4). In this case, it was revealed that studio strobe lights and modifiers (soft boxes and reflectors, in this case) do not reliably operate at a single, consistent white balance (Fig. 5).

In the second example (2), an LED panel positioned below the apparatus provided transmissive light (Fig. 6). In this case as well, the LED panel had an adjustable white balance that was able to equalize the white balance of the reflective and the transmissive light sources.

This second configuration proved to be the most reliable and predictable arrangement, and it was this model (Fig. 7) that was used throughout our pilot project with this first set of slides, just 250 slides from Robert Houston representing his work in 1968 in Washington DC documenting the Resurrection City protest event on the national mall.

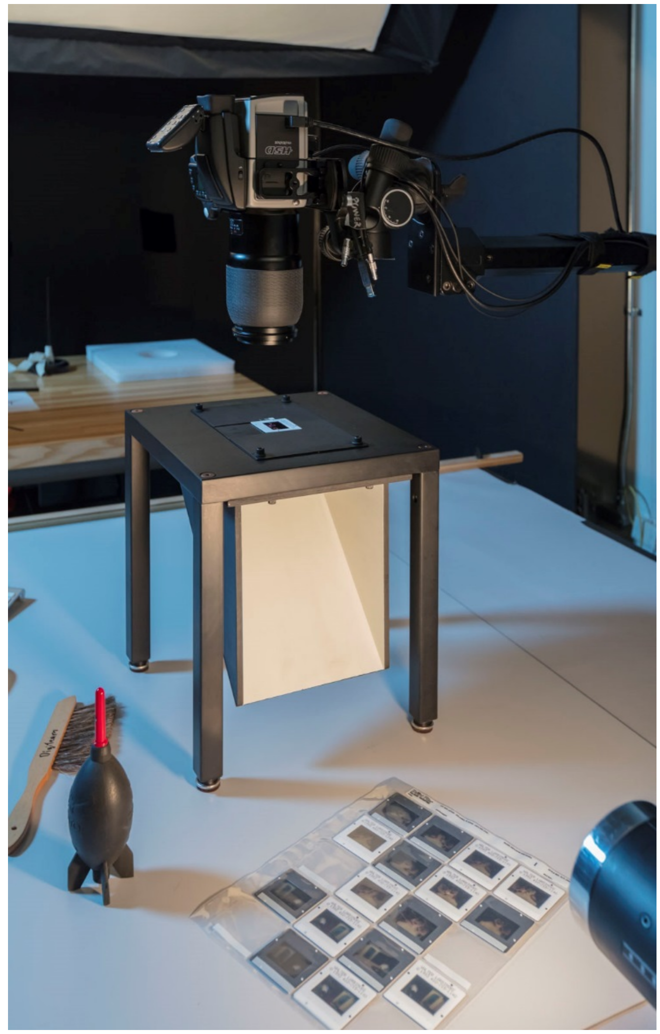

***Figure 4**. One option for dual mode lighting: two studio strobes overhead in typical copystand configuration (45 degree down angles) to provide reflective light, one strobe from the side (visible here in the bottom right corner in the image) reflected upward from beneath the slide to provide transmissive light.*

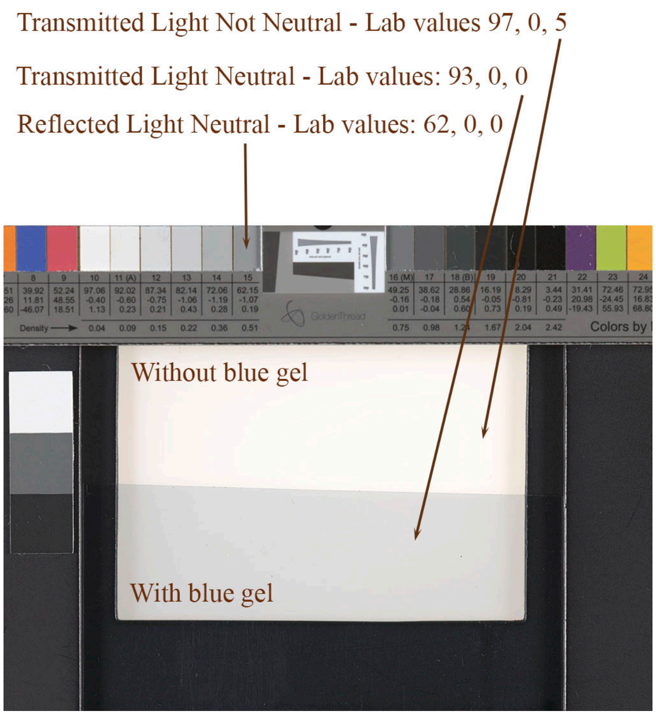

***Figure 5**. Despite the use of identical strobe lighting units for all sources in this demonstration image of a testing configuration, the reflected light on the target across the top and the transmitted light in the image area without the blue gel do not show the same white balance. The use of a blue gel, as shown here in the lower half of the image area, was required to bring the two sources to common neutrality.*

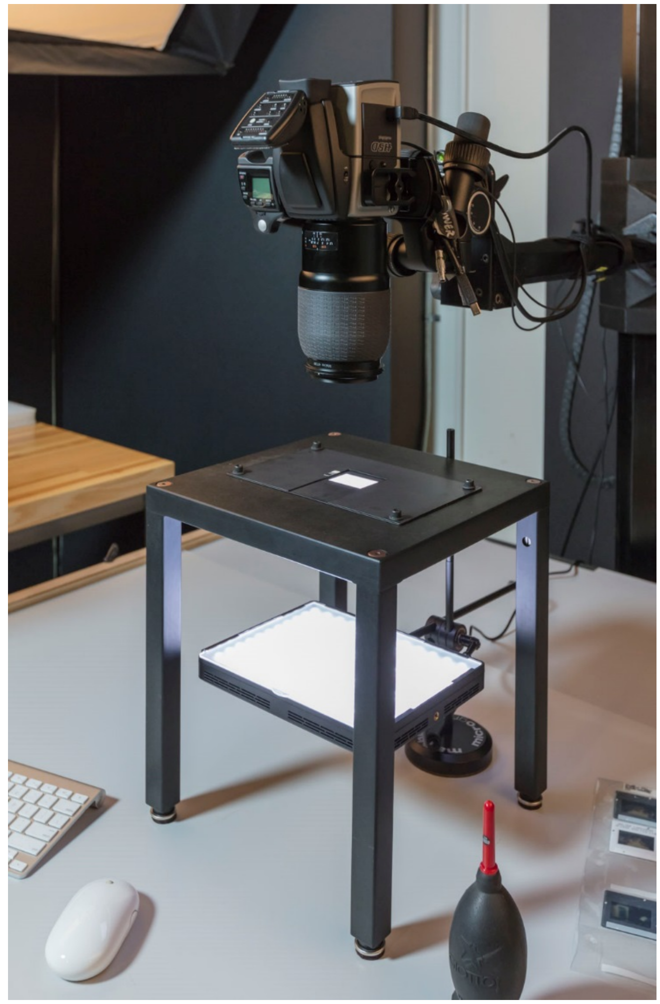

***Figure 6**. Another option for dual mode lighting: two studio strobes overhead in typical copystand configuration (45 degree down angles) to provide reflective light, with a fixed (always-on) LED panel pointed upward from beneath the slide to provide transmissive light.*

***Figure 7**. Final configuration of the capture workstation.*

Post-Processing Workflows

Post-processing workflows are a critical part of the overall digitization process. Post-processing steps can often be evaluated as replacements for image capture steps, which played a key part of this 35mm slide digitization project.

Several fundamental pieces of the post-processing workflow were decided right up front, carried over from our daily digitization workflows. Images would be captured with the camera tethered to our imaging workstation. Images would be captured in raw format and, as much as possible, all processing would be performed on the raw files. Images would be processed as archival master versions, so every image file would have the same camera and software settings applied, which also allowed us to create templates for the capture and the processing settings and apply those templates in bulk for efficiency. The image files would be named at the time of capture to embed the museum's object number and a sequence number, which dovetailed into other automated processes that were already in place for syncing the image files from our Digital Asset Management System (DAMS) to our Collections Information System (CIS). The fully edited raw files would be used to generate 16bit TIFFs of each raw file, and both the raw and the TIFF would be preserved and stored in our DAMS.

It was debated during the design and development phase of the project whether or not to include an edited final version of the primary image without the mount. As is particularly important with digitizing all images created on film—negatives or positives—there is no single formula for converting the film version to the digital version. Volumes have been written on the subject, with great variety of opinion. The process of creating a print or some other variant of a film image has always been a highly subjective matter, fundamentally reflecting the desires of the photographer as to how the final version should look and feel. The original photographer's intentions are given the highest priority in how their image should appear. So in the case where the original photographer's intentions are not known for an image—would Robert Houston himself have printed a slide darker to create a mood, or chosen a higher contrast, or performed dodging or burning during printing to increase or decrease the visual contribution of some element? How should any of us presume to know if he would want to change the appearance of any of his images in any way? All of these questions are of critical importance in the creation of a print from a frame of film, and yet we cannot know any of those answers as inheritors of a photographer's slides, unless the original artist is present to guide us.

From this debate emerged the perspective that the slides would be captured and reproduced solely from the "archival" point of view—to make a digital surrogate that reflects what the object looks like right now as accurately as possible, with as little subjective intervention as possible. As a helpful closing point in deciding this debate, it was recognized that the technical characteristics of these archival image files would retain all of the critical image information. So in the future if a request is made to make a print for a book or for an exhibit, the archival image file can be processed for that specific output request, and the archival file will retain enough information to meet that request. The archival version may not look right, but it retains all of the information required to create a version that does.

After recognizing that "the object" was truly the image content of the film as well as the physical details of the full slide mount, it was recognized that, in the end, our final *image* deliverables would include three images for every physical slide:

1. One image of just the film content without the mount—the traditional version of a digitized 35mm slide
2. One image of the frontside including the mount
3. One image of the backside including the mount

Our first approach was to keep the imaging to just two captures as a workflow efficiency measure: dual mode lighting of the frontside and the backside, including the mount. The first image file would then be digitally duplicated and renamed, to get from two captures to three deliverable files.

However, dual mode lighting does create visibly different versions of the film portion of the slides. A comparative analysis was conducted to assess whether the visible differences would be significant enough to require a third capture during the imaging workflow.

Here again, several elements weigh against each other and the final decision is subjective in the end. When the same slide was captured first with dual mode lighting and then with single mode lighting (wherein only the transmissive light is source turned on), a direct comparison of the two results can be made (Fig. 8).

Given that our museum object handling protocols only allow the use of handheld photography puffers to remove dust from the objects, some particulate matter remained in place at the time of capture—either resting on the surface, attracted by static electricity, or more tightly adhered from the development process. As such, all of the physical particles present at the moment of capture would be embedded in the digital image, regardless of whether we used dual mode or single mode lighting, and they would all show up as either white or black spots. However, examination of a sample set of image pairs confirmed that the visual impact of the particles that appeared as white spots under dual mode lighting was unacceptable. In addition, dual mode lighting caused a loss of contrast in the darkest regions of the image area due to slight flare, as a small amount of scattered light was reflected from the top surface of the film.

The result of this assessment was significant however, as it implied three digital captures instead of two, with a change of lighting workflow step included between the first and the second capture.

***Figure 8**. Comparative crops from single-mode transmissive-only lighting at top, and dual-mode lighting at bottom. Note that all of the particles remain visible in either case, but that particles adhered to the top surface of the film appear as white spots in dual mode lighting.*

Version 1

So *Version 1* of the digital surrogates and the capture workflow sequence looked like this (Fig. 9):

1. Place the slide on the apparatus with the frontside up
2. Turn off the overhead strobes
3. Capture the primary image in single mode lighting (transmissive)
4. Turn on the overhead strobes
5. Capture the second image in dual mode lighting
6. Turn the slide over
7. Capture the third image in dual mode lighting

***Figure 9**. Version 1 of the three final images (full frame images shown here, before cropping) – single mode lighting for primary image (L), dual mode lighting for frontside with mount (C), dual mode lighting for backside with mount (R).*

As digitization with this version commenced, an unexpected phenomenon was noticed. The slides in the collection had been rehoused into archival slide sleeves after they were received from the donor. Oddly, the slides had been inserted into the sleeves in a seemingly random order with respect to which side of the slide was facing forward or backward (Fig. 10).

Figure 10. The alternating colors of these slide mounts indicate that they are inserted into the sleeves incorrectly. For these mounts, the darker side is the emulsion side—the backside. Viewing this sheet of slides like this on a light table, all of the slides with the dark side showing would be incorrect, reversed images.

Discussion among the team revealed that, while some of the team members who—shall we say—enjoyed a slightly greater vintage were surprised by this arrangement of the slides, other team members of a newer generation did not see a problem at all.

It dawned on us that the younger team members had never worked with film cameras, and had never seen actual 35mm slides in person, so they were simply unaware of one critical factor about slides specifically, and about film in general: ***image orientation***.

With film, the image can be seen from a variety of physical orientations of the film frame itself—rotation of the film frame around the image axis so the image is upside down, or turned to the left, as well as flipping the film frame over like a coin so it is seen from the "frontside" or the "backside." Only **one** of these possible orientations is correct and all others would incorrectly represent the original scene that the photographer saw. The photography industry managed this phenomenon by having indicators embedded in the film—printed text embedded in the film or notches cut into the film edges—so photographers and processing professionals could identify the correct orientation during handling.

Orientation with respect to rotation around the image axis might be indicated by markings in the film, but the camera could have been held in such a way that the bottom of the camera was not facing down. In the case of a DSLR, photographers commonly rotate the camera—either left or right, depending on personal preference—to capture an image in portrait orientation. So the rotation of the image in that respect is not determinate and must be judged by visual inspection of the image content.

However, the orientation of 35mm slide film, with respect to "frontside" and "backside," **is** determinate and is also critical to depicting the image correctly.

Observe that in the center and the right images of Figure 9, the image of the boy is reversed, being mirrored or flipped horizontally. This simple change has enormous impact on the image—is the boy dialing the phone with his right hand or his left hand? It so happens that there is also text on the toy, which can confirm correct image orientation, but in the absence of that text there could be no way to tell from the image content itself which orientation is correct (Fig. 11).

Figure 11. The implication of film orientation, when the photographer captured this image was the boy using his right hand or his left hand to dial the phone? One of these is the correct orientation and the other is incorrect.

This unexpected realization spawned yet another full discussion. The project occurred during this transitional time in history, at the end of the era of 35mm slide film, while many people are familiar with it and how to handle it correctly, and many other people are not familiar with film at all. Looking to the future it seems clear that fewer and fewer people will be aware of this characteristic of film. This increases the chance that, in the event that these three digital images in *Version 1* get separated from each other, someone might end up using the third image without realizing that it is an incorrect version of the image in the film. To further complicate the dilemma of this imagined future person, the digitized images of the frontside and the backside **are** accurate representations of what the slide looks like if you have it in front of you—a WYSIWYG version of both the film and the mount. So it could perhaps be easily missed that—between the two—the original orientation of the scene is only represented correctly one of them, particularly in our hypothetical case where you don't have both digital views available to compare side by side.

And so, the project took on the next challenge: how to convey information to future users in such a way as to make clear how 35mm slides work and to prevent completely the accidental usage of the incorrectly oriented image contained in the digital file?

Version 2

So *Version 2* of the updated capture sequence and a proposed new digital surrogate looked like this (Fig. 12):

1. Place the slide on the apparatus with the frontside up
2. Turn off the overhead strobes

3. Capture the primary, frontside image in single mode lighting (transmissive)
4. Turn on the overhead strobes
5. Capture the second frontside image in dual mode lighting
6. Turn off the LED panel light below
7. Turn the slide over
8. Capture the backside image in single mode lighting (reflective)

Figure 12. *Version 2 (full frame images before cropping) – single mode transmissive lighting for primary image (L), dual mode lighting for the frontside with mount (C), single mode reflective lighting for the backside with mount (R).*

Sharing the *Version 2* user testing images with team members revealed another unexpected result: "*Oh! I didn't know that slides were dark when you looked at the back of them?!*"

This observation, in addition to the realization that this version would not reflect our desires for a WYSIWYG digital surrogate—blacking out the film portion of the backside view of the slide would not accurately represent what it actually looks like in person—sent the team back to the drawing board.

Version 3

And thus, *Version 3* came under consideration. The new conundrum for *Version 3* focused on the third image of the capture sequence in particular. How to warn future users about the unusual characteristic of 35mm mounted slides, wherein the orientation of the mount and the film has this odd interplay of "correct" and "incorrect?"

A full explanation would convey that the digital image of the frontside including the mount shows the mount and the film correctly oriented for all purposes. However the digital image of the backside including the mount is more complicated. It shows the film and the mount correctly in one sense, but incorrectly in another critical sense. The backside view **IS** a correct documentation view of what you would see if you looked at the slide in person. But it is critically important to recognize that the backside view simultaneously contains the reversed, incorrect view of the scene that is contained in the film.

The addition of a watermark on the third image was evaluated for all of the project requirements—the additional post-processing workflow steps, the implications for the set of image files, and the appearance of the final image.

The language of the watermark was addressed as the first priority—what would the watermark say? A desire to include a full explanation had to be balanced against having such a small amount of space to apply a watermark; there is not enough space to add a full paragraph like the one above to explain all the details of orientation to our novice future user. A brief, simple statement of fact achieved a reasonable balance (Fig. 13): "This is the reverse side of a 35mm mounted slide." This was sufficient to provide a future user with enough basic information to be able to discover more information from other sources. It can safely be presumed (one hopes) that online resources will exist in the future, and simply searching the Internet for "35mm mounted slide" can lead to myriad sources of deeper information.

The rotation of some images from the landscape orientation at capture to portrait orientation during post-processing required deeper thought as well. A single automated watermark action would be more efficient than two separate watermarks for landscape and portrait orientations. By creating a watermark with the text set at a 45 degree angle and sized to would fit within a square central region of the slide image (Fig. 14), the goals of the watermark could be achieved for all images, regardless of landscape or portrait orientation. The use of dark text with a light outline makes the text legible for all images, regardless of the contrast variability of the images themselves.

The addition of a watermark in terms of workflow was determined to be a reasonable addition. Current software tools enable this step to be automated as a stored action, so the watermark could be applied to multiple images in bulk.

In the interests of maintaining archival master files, preserving the edited master raw file without the watermark proved an acceptable choice because our DAMS protocols restrict access to raw image files to a limited set of internal users only. The TIFF file containing the watermark, which was embedded into the raster image (not stored on a layer in the TIFF) could then be shared publicly while meeting all of the objectives of the project.

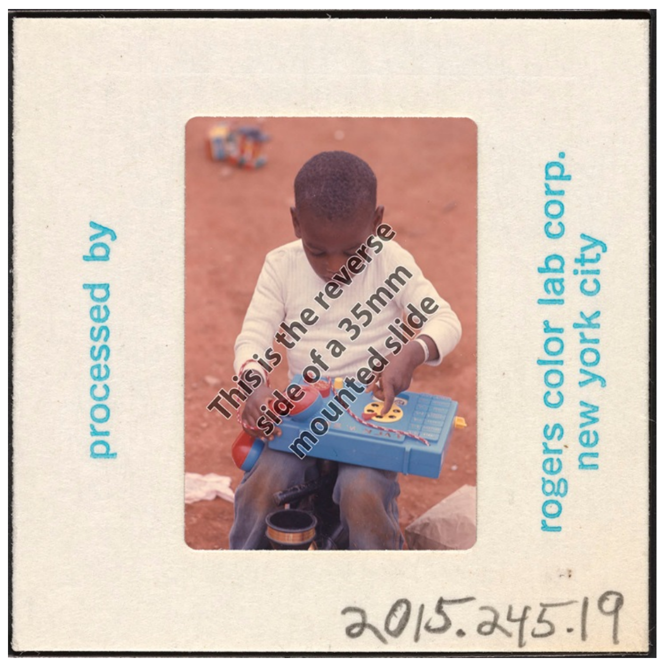

Figure 13. *Watermark embedded in the Version 3 backside view of the slides.*

Figure 14. *A watermark template was created that could be applied to every image, regardless of portrait or landscape orientation. The watermark was set at a 45 degree angle, sized to fit within a central square (dashed line in both images above), and utilized dark text with a white outline to ensure legibility across all types of image contrast variability.*

Figure 15. *Version 3 – the final fully edited and cropped images. The traditional digitized version captured in single mode lighting (L), the full frontside view with mount in dual mode lighting (C), and the backside view with mount in dual mode lighting and the watermark embedded (R).*

So after two brief, failed starts the project had arrived at *Version 3* (Fig. 15) and digitization commenced in earnest.

1. Place the slide on the apparatus with the frontside up
2. Turn off the overhead strobes
3. Capture the primary image in single mode lighting (transmissive)
4. Turn on the overhead strobes
5. Capture the frontside image in dual mode lighting
6. Turn the slide over
7. Capture the backside image in dual mode lighting

Metadata and Metadata and Metadata… Oh My!

Remarkably, just a few hours into the process, yet another key moment occurred when the image in Figure 16 came up. The capture technician immediately recognized the person in the image as Dizzy Gillespie. Previously, thoughts about embedding metadata describing the contents of the image had been omitted from the scope of this project. It was agreed that descriptive metadata would be handled in a subsequent project—which would require separate planning and funding—to take advantage of advances in crowdsourced transcription, automated OCR processing, third-party paid transcription, or some combination of available options.

While having a digital image of the metadata content of the slide mounts preserves all of that metadata and enables options for subsequent transcription processing from the digital files instead of directly from the original objects, the variability of how the metadata was added to the slide mounts would challenge the very best of any transcription model. Handwritten notes can elude the best OCR (Optical Character Recognition), multiple rotations of text on a single object further complicates automation, and most importantly—transcription of metadata from the mount is wholly separate from deriving descriptive metadata from the scene contained in the film.

The mount of the slide in Figure 16 does not have "Dizzy Gillespie" written on it anywhere. So how might future transcription methods recognize key people, for example, that are relatively easy for a person to detect, but that defy even the best of facial recognition software. Even human transcription of the image content is highly dependent on the knowledge base of the human doing the transcription. If the image of Dizzy Gillespie were sent to a transcription service provider, utilizing current Internet technology and human interpretation of the digital image—such that the image file would be visually evaluated by a person in some other region of the planet—what confidence would one have that an American historical figure would be accurately recognized? Even American evaluators of differing ages, interests, and cultural backgrounds would surely not recognize every person that might be captured in the images.

Our own team provided a good example of this—even among a group of individuals with above average levels of education, who had grown up with extensive contact with American culture, who were of varying age ranges, and possessed other selective factors for recognizing historical American figures, not all of the team members could recognize all of the figures encountered in just the 250 images of this project (Fig. 16, Fig. 17, Fig. 18, as examples).

The historical importance and cultural value of certain images is clearly impacted by the contents of the image itself. Missing any opportunity to capture key details of that content would have the effect of significantly diminishing the long-term utility and value of that image. An image in the DAMS that has Dizzy Gillespie in the image, but that does **NOT** have his name anywhere in the metadata is essentially invisible for nearly all purposes. If someone went to the DAMS to look for images of Dizzy Gillespie, their method will be to use the search capabilities, which rely solely on text-based information. With tens of millions of images in a DAMS, what are the chances that someone might stumble upon this one image based solely on visually browsing through thumbnails?

From this perspective, it was determined that catching the opportunity whenever it happened—during capture, during handling, during post-processing—the value of taking a brief amount of time to validate and add that metadata to the image file was an investment in the future that was well worth making.

As a measure to validate whether a person's recognition of a figure was indeed a correct recognition, a brief amount of time for double-checking was incorporated into the project. Asking a second person to look at the image was one step. Importantly, the method of asking the question matters. A leading question like, "Do you think that is Dizzy Gillespie?" can influence the perception of the person being asked and lead to a false confirmation. Instead, asking a neutral question like, "Do you recognize any of the people in this image?" can focus the attention on a key theme without unduly influencing the opinion.

Similarly, taking a few moments to perform a quick online search can often provide corroborating evidence—evidence that admittedly must be judged very carefully for accuracy, knowing that the Internet is not a perfectly reliable source of completely accurate information. So a balance must be struck with respect to making a reasonable effort to capture potentially important image content metadata. What is the right amount of time to spend on any one image? What defines "enough confidence" to decide that information is correct and should be added to the image metadata?

While the questions can quickly compound into complex matters that are not easily unraveled, automated or bulk processes cannot always replace serendipitous opportunities later. Rare opportunities are just that—rare. They may not come up at all, and they definitely may not come up a second time, so catching them when they do occur may well be the only opportunity.

Figure 16. *Capturing and embedding key content metadata somewhere in the overarching workflow—when, who, how... If "Dizzy Gillespie" is associated with this image somewhere in the metadata, being discoverable via text-based search methods significantly increases the value of the digital asset.*

Figure 17. *Embedded metadata—Red Buttons...*

***Figure 18**. Embedded metadata—Jesse Jackson...*

Conclusions

This project brought together a number of existing known issues into one unusual new combination. Yet, many organizations face the same need to digitize large numbers of 35mm mounted slides held in their collections.

The challenges our team faced will also be faced by our fellow organizations as they embark on their own digitization projects, and it is hoped that some of our workflow refinements, equipment development, and lessons learned may be of benefit to others.

With the completion of this initial project, some of our newly developed and refined procedures proved to be worthwhile and have become embedded in our daily practices.

Object handling is always a large portion of a project. Taking the effort to find small efficiency steps in the physical workflow pays off with every object handled. The development of a modular transparency digitization apparatus, and specifically a simple holder for 35mm slides played a big part in the smooth operation of this project.

When implementing a dual mode lighting environment to capture transmissive and reflective image elements in a single digital image, balancing the two modes of lighting can be tricky. Our next step in this regard for any larger project would be to purchase two more of the LED light panels that we used for the transmissive light source. Having three identical light sources (two panels above, one panel below) directly illuminating the different elements of the slides is a relatively small cost for a project of moderate size (on the order of $1,000USD for the light panels and stands to hold them) that would completely resolve the difficulties we encountered from using equipment that we already had on hand.

Often times, simple and inexpensive measures can have disproportional benefits. The use of electrical power strips arranged such that the capture technician can turn lights on and off from an ergonomically configured working position, instead of going to the light units themselves, can gain several seconds for every capture, and can further improve overall process quality—lights and other equipment can easily get bumped just slightly if the workflow includes operating the on/off switch on the unit.

Taking the time to create post-processing workflow templates and stored actions in the image processing software proved well worth the effort, both in the post-processing software steps and in the physical handling steps.

Incorporating workflow protocols to capture, validate, and record key metadata opportunities whenever they might happen—during capture, or post-processing, or handling—significantly increased the utility of those digital surrogates immediately. Having high value metadata embedded in the image files and loaded into the DAMS makes them discoverable and valuable right now, while other useful but less significant metadata (such as an original slide number printed on the mount) can be transcribed at a later time with no significant impact.

And lastly, building a team of colleagues with a wide range of skills, life experiences, favorite pastimes, and diversity in every respect pays dividends in myriad obvious and sometimes unexpected ways. The creative input and historical knowledge base of a diverse team is the soundest base for a successful project.

Image Copyright Notice

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Author Biographies

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