Institute for Learning and Research Technology

VADS Fine Art Project Digital Capture Pilot Study

Case Study for the pragmatic direct digital capture of artworks from the Surrey Institute of Art and Design

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1. Introduction

This case study outlines the Direct Digital Capture of artworks within the Visual Arts Data Service's (VADS)[1] [1] Fine Art Project pilot study at the Surrey Institute of Art and Design (SIAD).

The intention of this pilot study was to establish a pragmatic image capture methodology for art colleges and other institutes wishing to use lower-end professional digital cameras to create a 'born-digital' image collection.

1.1 The VADS Fine Art Project

The VADS Fine Art Project[2] [2] aims to bring together, through a distributed digitisation model, artworks from across Higher Education Institutes (HEIs) that can serve to exemplify the history and achievement of fine art education and practice in this country since its inception in the 1850s.

In the initial stages of the project, a survey was sent out to all the Higher Education Institutions in the UK that taught fine art, in order to elicit whether or not student and staff work had been kept or documented. From this survey it was found that many colleges failed or had ceased to collect artworks due to the cost implications of purchasing, storing and insuring the works, leading to the output of many art colleges remaining undocumented.

As the Fine Art Project progressed, protocols for the digital capture, documentation and copyright clearance of work were established. These were then used to collect works from around the country to be included in the National Fine Art Education Digital Collection. However, given their inherent useable and easily applicable nature, it was thought the same protocols could be just as useful to digitally capture, document and rights-clear works within HEIs as and when they were being produced. This would make it far easier and affordable for colleges to capture and maintain collections of their present and past work, as well as offering additional benefits such as making them widely available on the Internet or for other publishing requirements.

1.2 Budget and time restrictions

To undertake this pilot study, The Technical Advisory Service for Images[3] [3] (TASI) at the Institute for Learning and Research Technology[4] [4] was asked by VADS to establish the infrastructure and methodology for direct digital capture of a range of art works from the students and staff of the Surrey Institute of Art and Design.

The budget for all camera equipment and software used within the pilot study was £5000.

The time provided for all practical work on the project was 14 days.

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[1] [1]VADS, http://vads.ahds.ac.uk

[2] [2]Fine Art Project, http://fineart.ac.uk

[3] [3] TASI, http://www.tasi.ac.uk

[4] [4] ILRT, http://www.ilrt.bris.ac.uk/

2. Choice of Equipment

2.1 Project Requirements for the Digital Camera

For the purposes of this particular project a camera system was required to digitally capture a range of artworks: from painting to sculpture, from print to installation. A digital master image archive needed to be created from which, a range of digital delivery surrogate images could be created for delivery over the Internet from the VADS Web site.

2.2 Camera Attributes Required

Before the outset of the project a number of essential camera attributes were identified.

Ease of use - versatility:

The camera system had to be easy enough to be used by an average arts college photographic technician. It would need to be of the 35mm SLR type that is familiar to most amateur and professional photographers. Although it was foreseen that a large amount of the capture would be with the camera working in a studio situation, it was important that the camera was versatile enough to be able to work un-tethered, handheld and able to capture moving objects if necessary.

Quality and Image size:

The camera had to provide the maximum of quality and images size as long as it is still able to fulfil the criteria outlined above. However it was realised that the need to provide versatility and to capture action would limit the choice to one of the single-shot 'matrix-array' cameras. The image size of these cameras is limited to the size of CCD or CMOS chip and is normally stated by the number of pixels (in Megapixels) contained on the imager.

Budget:

We worked within a strict budget that was considered typical of what might be available to a art college for this kind of use. As it was presumed that the college would have access to some computers (including laptops) for this work, they were not included within the budget of £5000.00. However this should cover the purchase of cameras, lenses, lighting, software and all other required peripheries.

2.3 The choice made:

Although £5,000 would seem like a fair budget for any camera purchase, professional digital capture equipment is expensive and some care and attention had to be taken to make sure that the best choice of equipment possible was purchased within the established budget.

The need for versatility and freedom from either camera stand or tethered host computer limits the available choice to cameras using the 'one-shot' technology used by current digital SLR cameras. This capture technology can not compete with scanning and multi-shot bodies: however it was hoped that the quality would be adequate for use within this kind of project and the equipment should be available at a price within our budget. Camera bodies of this type typically sell within the region of £1500 to £2000. It was expected that lighting would cost in the region of £1000, still leaving a reasonable budget for lenses, camera stands and other accessories including some Image Management Software.

Camera system:

At the time of ordering the equipment, there was a choice of 3 possible digital SLR camera bodies: Nikon D100, Fuji S2Pro and the Canon D60. The Nikon and the Fuji use Nikkor optics and a CCD imager whilst the Canon uses Canon optics and a CMOS imager. Without extensive testing of each camera system it was impossible to make a decision as to which might perform best for this project. However the decision was made by the fact that only the Nikon was easily available 'over-the-counter' without a long wait for delivery.

The Nikon D100 was therefore ordered and purchased. For lenses, the main choice was between buying a couple of more expensive zoom lenses or buying a wider choice of prime lenses. Although it could be argued that zoom lenses would give a more versatile camera system, preference was given to a wider selection of prime lenses. Prime lenses, as a rule, are sharper, less prone to 'barrel' and 'pincushion' distortion and have a wider maximum aperture which makes them easier to view through and focus with.

For these reasons the following lenses were purchased:

- A Nikkor 35mm Lens - Standard length (approx equivalent to 50mm with normal 135mm film camera)
- A Nikkor 60mm Macro lens - Long lens (approx equivalent to 85mm with normal 135mm film camera)
- A Nikkor 28mm Lens - Slightly Wide lens (approx equivalent to 35mm with normal 135mm film camera)

During this shoot, a number of personal lenses including a Nikkor 20mm and Nikkor 180mm were made available to back up those which were tested within this project. Of these only the 20mm was used - to provide a wider view than was available from the normal selection of lenses.

Other camera equipment:

As the camera system was required to capture a range of differing types of artwork, it was necessary to use the camera in a range of typical ways. This included using it on a copy-stand, so it was necessary to purchase a 90 degree viewing attachment for this purpose.

An external power-supply was also purchased to allow the camera to work from a mains supply whilst shooting and to charge the internal battery, although it should be noted that this is also necessary to undertake any cleaning of the CCD – so therefore imperative.

Two 256Mb Compact Flash Memory cards for use when camera is working in an un-tethered mode and the necessary card-readers and USB leads were also purchased.

Lighting:

As only the simplest of copy lighting was going to be used in this project, it was considered that a minimal lighting kit would be ample and therefore a Bowens *Esprit* two-head monobloc

kit was purchased. This kit was augmented by two small 60cm soft-boxes, a Sekonda flash meter and a spare flash lead also made by Bowens.

Camera Stands & Tripods:

A Manfroto Tripod appropriate for use with a 35mm camera was purchased. It was decided to not buy a copy-stand for use with this project as TASI had one available for use within the project, which could be borrowed. They are both bulky and expensive items to purchase for such a short project, never-the-less essential for this kind of photography. Other colleges would need to make provision for purchase of a reasonably large copystand.

Computer Equipment:

This capture workflow was based around the known availability of two laptop computers for the capture team during the capture process. One would be used by the photographer (TASI) to control the camera (when tethered) and collate technical metadata. The other would be used by the indexer (VADS) to collate indexing metadata. All data could then be mirrored between the two laptops during capture to keep all data backed up on at least two machines at any one time. It could be possible to undertake both these sets of tasks on one machine, however this would have implications on workflow as capture tasks and indexing tasks could not be done concurrently. It would also be necessary to provide some other ongoing backup of all images as they were created.

After the images had been captured they had to be optimised, prepared for archive and finally burnt to CD-R media. The optimisation work could not be undertaken on one of the laptops due to the deficiencies of their screens and therefore all images were moved to a TASI Image work-station with a 20in calibrated Sony Trinitron monitor.

As well as the computers outlined above, some other ancillary equipment was purchased to support the capture, optimisation and archive workflow during the project:

- External Hard Drive - A 40Gb FireWire/USB2 LaCie unit
- External CD-R - A 52x24x52 FireWire/USB2 LaCie unit

- A cross-over Ethernet cable for networking both laptops
- Various other cables and extensions as required

Software:

Specific software was required for operating the Nikon D100, image optimisation and for collating and storing the image-associated metadata:

- **Nikon Capture 3** - This software provided two aspects of required functionality. It allowed the Nikon D100 to be controlled via a tethered computer and also provided software that could open the proprietary RAW files, edit and optimise them before saving them in a TIFF or other format.
- **Nikon View 5** - This software provided image-viewing functionality that would allow the NEF files (RAW) to be viewed along with their tagged metadata (IPTC and EXIF).
- **Nikon NEF Photoshop Plug-ins** - These plug-ins are used in conjunction with Photoshop to allow the NEF files (RAW) to be opened within Adobe Photoshop for subsequent optimisation and saving.
- **Extensis Portfolio 6** - This Image Management System software was purchased by VADS for the purpose of collating all indexing and technical metadata during the production of the image collection. (See section 3 below)
- **Photoshop 6** - PS6 was used for all image optimisation *after* images had been captured. Within the workflow, Nikon Capture 3 was found to work more effectively and faster at providing the necessary quality control evaluation.

During the pilot study a range of other software was piloted, these included:

- **'Bibble'** from BibbleLabs (http://www.bibblelabs.com/) - a RAW image file converter/editor
- **IrfanView** (http://www.irfanview.com) - a Folder Viewer
- **'IMatch'** from Photools (http://www.photools.com) - Image Management software

All of these natively support the use of the Proprietary 'RAW' Nikon File Format (NEF) and provide varying access to the internal file metadata.

3. Image Management

At the time of establishing the methodology and infrastructure for this project, the main requirements for image management were a piece of software that had the ability to:

- Create and use a range of custom fields (based on VRA3).
- Provide viewing and browsing of thumbnails of each image with a mechanism for images to be retrieved from their storage and viewed full size with the ability to zoom.
- Allow searching and filtering for image records based upon the metadata held within the 'standard' and 'custom' fields.
- Provide custom 'views' enabling easy entering of metadata by photographer or indexer. i.e all 'indexing' metadata in one view and all 'technical' metadata in another view.
- Export image metadata within an industry standard form, simply and efficiently.
- Be easy to use, quickly learnt by users and versatile

As well as the requirements stated above it was imperative that the software was cheap enough to be purchased within our budget.

Three proprietary Image Management Systems (IMS) were considered for this project:

Extensis Portfolio 6 http://www.extensis.com/portfolio/

Canto Cumulus http://www.canto.com/

Fotoware Fotostation http://www.fotoware.com/Products/FotoStation%20Pro/

It is likely that all of these IMS would provide the necessary functionality to handle the tasks within this project. However, past experience had shown that the market leader Extensis Portfolio 6 provided the best range of functionality at a reasonable cost and was well supported.

It was decided to purchase and use Extensis Portfolio 6 as the IMS for this project.

3.1 Database Fields

Portfolio offers a range of standard fields that can be further extended with custom fields specified when the database is created.

VADS specified a list of fields/elements that they wished to use to collate data. These fields were standard for all parts of the VADS Fine Art Project:

The fields used were:

Native	Artist	Work	Image & Technical
Standard	*Custom*	*Custom*	*Custom*
Filename *	Artist – Name	Work – Approach	Image – Bit Depth
Image ID	Artist – Title	Work – Title	Image – Capture Device

Directory Path * Catalogued * Colour Mode * Created * Creator Mac Description Extension Win * File Size * File Type Mac * Height * Horizontal Res * Keywords Last Modified * Last Updated * Number of Pages * Path * Short Filename Win * Thumbnail Size * Vertical Resolution * Volume * Watermark URL Watermarked Width * Zone Mac	Artist – Gender Artist – Date Artist – Nationality Artist – Approach Artist – Biographic	Work – Type Work – Material Work – Measurements Work – Technique Work – Date Work – Location Work – Culture Work – Subject Work – Description Work – Style/Period Work – Rights owner Work – Notes	Image – Capture Software Image – Colour Space Image – Compression Image – Creator Image – Date Image – Optical Res Image – Raw Dimensions Image – Rights Owner Image – Type Tech – Aperture Tech – Focal Length Tech – ISO Tech – Lighting Tech – Shutter Speed

Native Fields:

These fields are all included within Portfolio as standard. Most (marked above with *) are automatically populated by Portfolio and will change to reflect any modification of the original image file.

Artist Fields:

These fields are all custom-built and added to Portfolio by project staff. Field headings are based upon the biographical metadata framework used by AXIS[5] [5] :who kindly gave permission for VADS to adopt their standard in order to record metadata relevant to the Artist.

Work Fields:

These fields are all custom and added to Portfolio by project staff. Field headings are based upon the Visual Resource Association's Core Version 3 metadata framework[6] [6] and were supplied by VADS to record metadata relevant to the original artwork.

Image Fields:

These fields are all custom and added to Portfolio by project staff. Field headings are based upon the VRA 3 metadata framework (with some further extended metadata) to record metadata relevant to the digital image.

Technical Fields:

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[5] [5]Axis: for Information on Visual Arts, http://www.axisartists.org/

[6] [6] VRA, http://www.vraweb.org/vracore3.htm (a single element set used to describe works of visual culture)

These fields are additional custom fields that were created to test the automatic population from the image files EXIF data.

3.2 Collating technical metadata

All technical metadata was entered as soon as possible after the image was captured. The exact method of this was dependent upon the workflow used (see section 5 – Workflow). Where possible the metadata was automatically entered from the tagged EXIF data, however this was rarely entirely reliable. All other technical metadata was entered afterwards by the photographer directly into the IMS.

After all images had been captured and optimised, all technical metadata added and quality checked by TASI the IMS database files and images were archived to CD-R and delivered to VADS (See section 4 – Preservation Strategy).

3.3 Portfolio 6 Screen-grabs

See Appendix for some visual examples of Portfolio 6 in action showing the custom views of both 'indexing' and 'technical' metadata.

4. Preservation Strategy

As the overall number of images that were being created within this project was relatively low (under 200), it was possible to undertake a preservation strategy that attempted to provide a secure future for the two important stages of the image within the workflow.

There are two possible approaches to choosing what image data should be preserved:

1) *All image data can be saved in a form as close to the original capture as possible.* This means that in the future, if for any reason it is required, it is always possible to go back to exactly what was originally captured, knowing that we have exactly what was originally created with no lost image data at all. As this image has not been optimised yet, it might not be visually the best or most accurate representation of the image data, but at least one knows that nothing has been lost from the image since its capture.

2) *All Image data can be saved after optimisation*. As the original image data might well require a fair amount of optimisation (or even interpolation in the case of RAW data), it can be considered desirable to archive the image after the image optimisation has been done, so it can be standardised and does not need to be redone in the future.

Both these approaches to choosing what image file to preserve can be well argued and if possible it is always best to 'play-safe' and save the image data in both forms, which is what was done for this project, so there are now two sets of 'Master Archive' images:

1) **Master RAW Archive:** These images have been kept in exactly the form that they came out of the camera. As this is a 'one-shot' camera, the initial form of this data is before the colour has been interpolated to create the missing colour information (each pixel can only read one colour - Red, Green or Blue - the additional colour for each pixel has to be interpolated from the surrounding pixels) and is therefore in a form that is called 'RAW' and is in a non-standard format needing the associated proprietary software to convert it to any other file format (such as TIFF).

The Nikon 'RAW' file is called the 'Nikon Electronic Exchange Format (or NEF). It has an internal colour depth of 14Bit/channel, but as it still only holds one channel of colour information for each pixel, it has a relatively small file-size. A TIFF file can only be made from the information held within the NEF format and is therefore a 2nd generation file with no more information than was held originally within the NEF (although being almost 3 times larger in size). As this is the case, it suggests that as long as one is able to convert these NEF files to a TIFF when necessary, there is little point in archiving them at this point within the TIFF format.

As this digital archive was to hold 'all' original data, a decision was made to also archive all versions of images shot during the project (not just the final version). In other words, this archive includes 'all' images that were shot during the SIAD project.

2) **Optimised RGB Archive:** These images have been optimised from the master NEF images and have been saved after all the optimisation has been undertaken on the images. They have been saved and are archived as uncompressed 8Bit/channel baseline RGB TIFF rev6 files. This is a standard file type and should make a good starting point for the subsequent creation of any delivery surrogate images that need to be made. This archive only includes images that were considered the 'best' or 'signed-off' version of each image. As a rule this means that there is only one image of each artwork, although in a handful of cases there are two versions (where a detail is considered to give more information than the overall image).

Both of these Archive sets should be considered as important parts of the preservation strategy and should be preserved.

4.1 Data back up and preservation during workflow

During the project every effort was made to keep all data (images, metadata and associated files) in at least two (normally three) different locations. This meant that at the end of each day, all data was copied from the TASI laptop to a mirrored folder on the VADS laptop. This was also backed up from the TASI laptop to the VADS external drive at a later stage. When TASI were away from SIAD and any data was changed (e.g. images optimised), the data could still be backed up to the VADS external drive, ensuring that all data was mirrored at all times, both by TASI and by VADS.

Once TASI had returned to the ILRT, all project data was moved to a local workstation for image optimisation, but was still backed up to the mirrored VADS external drive.

4.2 Image management system back-up

All metadata for this project was collected within a proprietary database - Extensis Portfolio 6. This database kept all image metadata including the location of all optimised TIFF files. The data can easily be exported from the Extensis Portfolio database as a text file. Portfolio follows the ASCII standard of using a ASCI 11 as the Vertical Tab character, delineating a line break within a field and the ASCII 29 character as the group separator. Most databases, such as MS Access and Filemaker Pro will support these standards.

After VADS had finished with the collation of all indexing metadata, they needed to migrate all project data from the Portfolio Database to their central delivery database, which provides the long-term security for this data.

4.3 Final back-up

After all required images had been optimised and saved as uncompressed 8Bit/channel RGB baseline TIFFs, they were burnt to CD-R along with all RAW master archive data and the current copy of the Extensis Portfolio 6 database which included all technical metadata

and partial indexing metadata. Two copies of these discs were made, with one set being delivered back to VADS and one kept in the TASI safe.

Along with the RAW image data files, each disc contained a selection of image reading software that could be used to read the proprietary NEF files contained on the disc (although only for the PC platform). The details of the contents of these discs was contained within a 'read-me' file and kept with the data at root level. (See appendix for examples).

5. Workflow

This project was a 'pilot study' and it was therefore possible to test workflows for use by Art Colleges endeavouring to digitise their own works. The SIAD project was typical in having a range of different modalities and sizes to the works that needed to be captured. For example:

- 2-D large works on canvas
- 2-D small works on paper
- 3-D large works on show in gallery
- 3-D small works to shoot in studio
- Installations or Studio shots
- Exteriors and Gallery shots
- Computer generated works

Each of these types of artwork requires a different workflow to provide the best opportunity of capturing them.

It was always the intention of this 'pilot study' to try to standardise the workflow as much as possible and to create an automated and objective capture system (although this proved much harder than originally expected).

In general these different workflows can be divided into two basic types:

5.1 Tethered mode – mainly for studio capture:

- Camera is directly attached to a computer allowing images to be directly downloaded to the computer and all camera controls to be operated from the computer
- Bringing works to the camera, rather than bringing the camera to the work. The camera is always on a tripod or stand
- Normally using studio flashlights, although due to the bright north-light available within the SIAD studios some experimentation was undertaken using the available ambient light rather than flash
- Quality Control is undertaken during the capture process with images viewed and signed off on the tethered computer
- Creation of a temporary image during capture process for use within Portfolio
- Image is loaded immediately into Portfolio 6 enabling all indexing and technical metadata to be collated at the time of capture

5.2 Un-tethered mode – mainly for location capture:

- Images are saved to on-camera storage (Compact Flash) and then batch downloaded via USB card reader to laptop at appropriate times in workflow
- Taking the camera to the artworks, enabling the capture of works in-situ or on show in a gallery space. Camera does not have to be on a tripod unless lighting conditions demand it
- Not normally (in this case) using studio flash lights: the project was lucky in that capture took place during phases of good weather. However under different circumstances it could have been necessary to provide flash light for each shot which would have made capture much slower
- Quality Control simply undertaken by reviewing current image on the LCD monitor on rear of camera and using the camera histogram feature. Images could not be finally signed-off until viewed at the end of each day within Nikon Capture or Photoshop
- Temporary images were batch created after being downloaded to laptop
- Sometimes images could not be added into Portfolio 6 until the end of each day, meaning that all metadata had to be collated well after the time of capture

5.3 Use of temporary images within the workflow:

It was imperative for this project to try and get the maximum quality out of the capture process. As described above, the Nikon D100 digital camera uses one-shot technology; it captures a 14Bit/channel 'RAW' file that can then be used to interpolate the missing colour data. However, it was not possible (without plug-ins) or advantageous (due to problems with changing file-extensions) to populate the Portfolio database with the 'RAW' NEF files. It was therefore necessary to create some form of temporary image file, so that a record might be created in Portfolio allowing the indexer to collate the appropriate metadata.

After the images had been captured and stored as 'RAW' NEF files, they were later opened, optimised and saved as TIFF files. These new optimised TIFF files then had to be linked back to their correct records within the Portfolio database. This work was undertaken using the 'change path' tool (within Portfolio) by TASI before delivery back to VADS. However it is likely to need to be undertaken again as and when the location of the images is changed.

5.4 Image optimisation:

All images were optimised using standard workflow procedures[7] [7]. This optimisation was undertaken within Photoshop 6, although there is no reason why it could not have been just as effectively undertaken within Nikon Capture Editor 3 or Bibble RAW converter (both ICC colour management aware), which were both experimented with during research for this project.

The optimisation was undertaken on a Sony Trinitron Multiscan 400PS monitor calibrated with a ColorVision Spyder and PhotoCal 2.2 software to a gamma of 2.2 and a colour temperature of 6500^{o} K.[8] [8].

[7] [7] See TASI website, http://www.tasi.ac.uk/advice/creating/img_capt.html#img2

[8] [8] See TASI website, http://www.tasi.ac.uk/advice/creating/photoguide.html#pg8

Standard optimisation schedule:

The 'RAW' NEF files were opened within Photoshop 6 using the NEF import plug-ins supplied by Nikon and installed within Photoshop 6. The NEF files are initially opened within Photoshop in an internal 16Bit/channel RGB form. They then had the following optimisation undertaken upon them:

- Cropping and orientation
- Tonal optimisation using levels - setting highlight and shadow point
    - Shadow point set to 5,5,5 - RGB
    - Highlight point set to 245,245,245 - RGB
- Grey point/colour correction – initially using grey card (Macbeth ColorChecker or Kodak Q13) or white wall as guide but still checked subjectively

Other than that, no independent colour correction was deemed necessary or useful with this optimisation; the images were simply calibrated to grey and left like that

- Image repair as necessary - This was minimal within these images, normally just cleaning backgrounds or removing a 'hair-in-the-gate' found in later images
- Un-sharp Masking (USM) - Very subtle (120% 1.0 pix, 2 levels in Photoshop 6). Although, it is thought likely that they will need a little more USM applied within the production of surrogates for delivery
- Mode conversion from 16Bit/channel NEF format to 8Bit/channel RGB TIFF
- Assigned Adobe RGB 1998 colour profile (this is not a transformation as they were already in the equivalent Nikon Space, which is identical)
- Saved as uncompressed baseline 8Bit/channel RGB TIFF rev6 in PC byte order within the Adobe RGB (1998) colour space

In some cases it was necessary to undertaken some 'perspective correction'. This could be for a number or reasons; either the original canvas was incorrectly constructed and skewed or the camera ‘was not’ or ‘could not’ be positioned immediately above the work making the image distorted. If perspective correction was required, the order of work was changed and the mode conversion undertaken before the perspective correction as this function can only be undertaken with the file in 8Bit/Channel mode.

5.5 The use of temporary images to allow indexing:

At the time of capture, all images were saved in their 'RAW' NEF file format. They were saved in this format until such time as they could be optimised. However, as mentioned above it was necessary to have some form of temporary image file loaded into Portfolio to allow a record to be made and the indexing collated for that image.

It was therefore necessary to have two workflows, each dependant upon whether the camera was being used in tethered or un-tethered mode.

Tethered mode:

Within the tethered workflow an image file (TIFF) was exported from Nikon Capture Editor as soon as it was signed off by the operator. This image could then be transferred over a local Ethernet network to the indexing machine where it was saved into a 'watched' folder and automatically entered into Portfolio 6 for immediate use by the indexer.

Un-tethered mode:

Within the un-tethered workflow, all images had to be batch downloaded (from memory card to laptop by USB) at appropriate times in the workflow. These files could then be either saved as TIFF or JPEG (as they are only temporary files there is no quality or preservation issue). However, although using JPEG did provide some extra speed, it was found to also create some problems when updating the linkage metadata due to the change of extension of the file from TIF to JPG.

5.6 Identifying artworks, images and records:

Despite great care and attention there were still problems with linking indexing metadata to the relevant work and its associated record within Portfolio 6. It was originally hoped that this could be automated, at least whilst working within the 'tethered camera' workflow (which was much better) however, it still provided many challenges to the production team.

VADS collected the indexing metadata from the artists on hand-written paper, however these documents had no visual connection to the works they represented or unique identifier (this can be best accomplished in a larger project by using bar-coding). In some cases the name of the artwork might provide sufficient information to recognise the work, but often this was not the case and the artist had to be asked to provide some small sketch to help in recognising the work when in a digital form.

This had many QA implications that needed addressing and required a different workflow for production within 'tethered' and 'un-tethered' mode.

Tethered mode:

Whilst working in the 'tethered' mode, the initial plan was to feedback the image file names from the photographer to the indexer, however this soon appeared to be very slow as it pretty much implied that both photographer and indexer needed to be working on the same image at the same time.

After some consideration, it was decided to make use of the IPTC information headers within the NEF image file. These IPTC metadata tags can be used by the photographer to enter

relevant metadata to the image file at the time of capture on the tethered laptop computer. In this workflow the photographer recorded some basic indexing metadata into the IPTC fields of the NEF files. The metadata recorded was only: Author, Work Title, Collection (SIAD), modality (painting, sculpture etc.) and date of capture. This information could then be read by the indexer using the Nikon View 5 software and transferred to the relevant record within Portfolio 6. Although this added an extra process within the capture workflow, it meant that all the images made whilst capturing in the tethered mode had an internal record of their basic metadata. As this metadata was within the 'RAW' NEF files and the files were being archived in this form, it meant that whatever happened, the images could always be identified.

It should have been possible to automate this process so that the tagged metadata could be read directly from the image file to fill the appropriate fields of the Portfolio Database. However despite spending some time experimenting, this functionality was only ever partially fulfilled and was then found to be both time consuming and fiddly. It was never reliable enough to be used within the production workflow. It is certainly worthy of more experimentation, as a little further work in this area could easily provide big benefits in reliability and automation of the workflow.

Un-tethered mode:

Unfortunately it was not always practical to work within 'tethered' mode during this project as at times, the camera had to be used outside the studio and therefore both un-tethered from a computer and not even on a tripod. Thus, the image tagging functionality was unable to be accommodated into the un-tethered workflow.

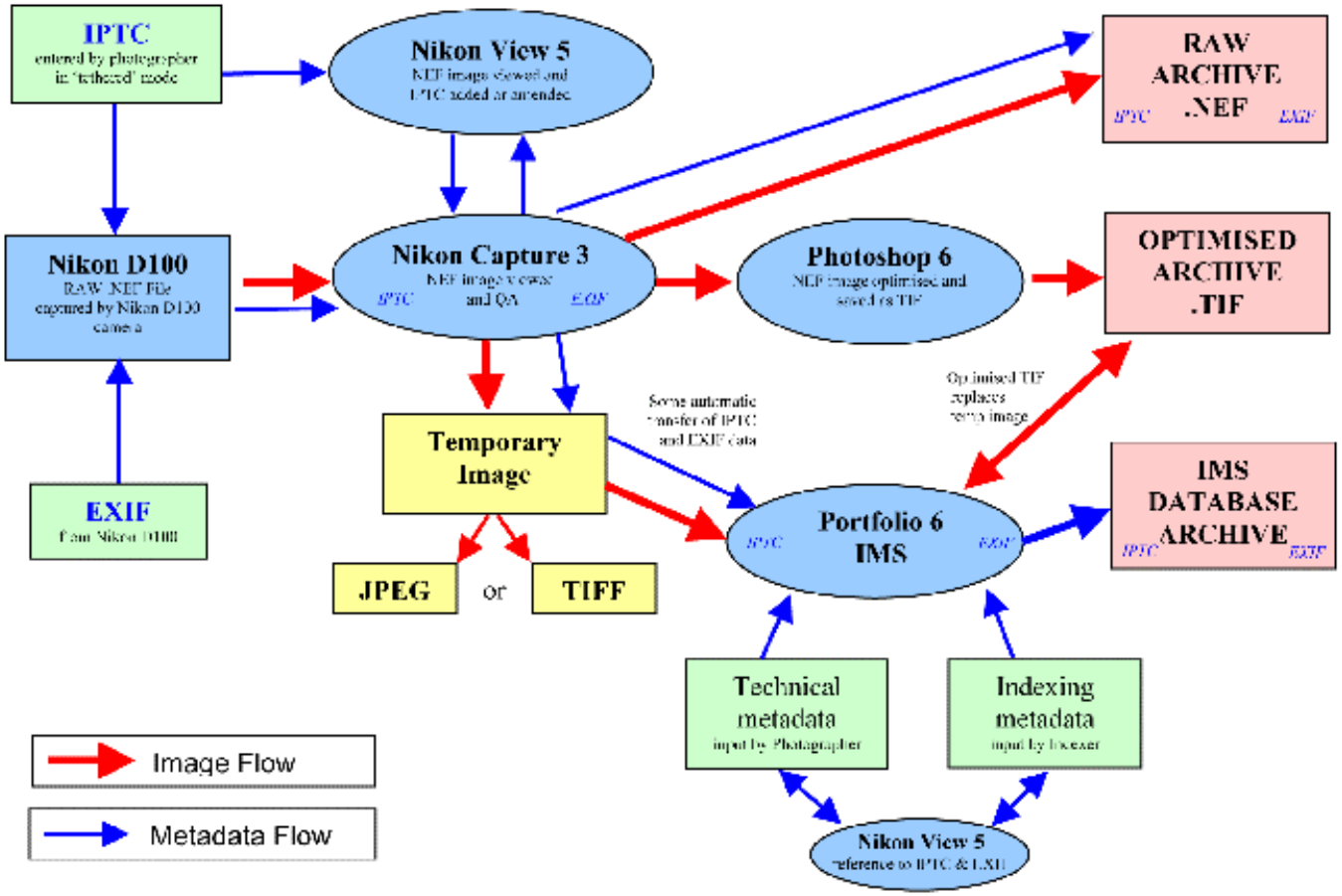
Therefore, the only technique that could be used to match images to records was to download a batch of images from the camera to the laptop, create temporary images, enter them into Portfolio 6 and finally add the indexing metadata directly there. The indexer would then follow on behind the photographer working with Portfolio 6 to input the metadata after correlation with the original artwork and its 'paper-based' metadata.

All in all, the 'tethered' workflow was much preferable in terms of efficiency, accuracy and reliability, however it could not offer the same level of versatility when attached to a laptop. It would take more research to ascertain which of these workflows was faster and it would certainly depend on the volume of work that needed to be captured.

On the other hand, it is true that a photographer could work faster if they did not have to enter the basic metadata into the IPTC fields. Another factor in slowing down the workflow was that the tethered laptop was a vast encumbrance that certainly limited the versatility of the camera. However, this must be balanced against the need (in the un-tethered mode) for the indexer to return to the artworks and undertake some research before the metadata could be accurately entered. In some, or indeed most, cases this should be easy enough, but if the works were hard to identify, it could certainly introduce inefficiencies and slowness.

5.7 Image naming & numbering:

It was decided to allow the camera software to number all image files internally using a simple system. A 'si' suffix (for Surrey Institute) followed by an underscore and a number from 0001-9999, with an extension dependent upon the type of file: so for example, si_0001.NEF or si_0248.TIFF. As there were going to be many times when it would take two to four attempts at capturing an image which was of acceptable quality to the photographer (or when many versions of file were shot for later editing), it was inevitable that the final delivered images would have a range of numbers that had many missing values within the series. A workflow was considered where each file was named by the photographer at the time of being signed-off, however this was considered likely to introduce faults (by operator error) and would also prevent the saving of a range of files for later use during optimisation.



5.8 Workflow Diagram

Showing the flow of images and metadata from capture to archive

6. Lessons learnt from the project

The capture element of the Fine Art Project pilot study undertaken by TASI was scheduled to take 13 days: including only 6 days set aside for all capture. Of course, a fair amount of time and effort had to be undertaken in initially establishing and setting up the methodology for this project. Most elements of a successful digitisation project are based upon the quality of the initial work establishing the correct infrastructure and methodology. Unfortunately, the time it takes to undertake this preparatory work satisfactorily will essentially be the same, whether the collection has 100 images or 100,000 images.

It was therefore necessary to undertake this work somewhat faster than TASI would normally recommend, relying on professional experience and knowledge rather than research and prototyping.

This is a list of some of the 'lessons learnt' during the pilot study; many are merely reminders of knowledge gained in the past but temporarily forgotten. Others are information that would have been discovered as part of a legitimate prototyping procedure for the development of the capture process. These could then be used to introduce changes to equipment or workflow that could have improved the workflow before the project started. They are put forward here as part of the knowledge gained from the 'pilot study'.

6.1 Camera issues

Camera quality - Within this pilot study, there was simply not enough time to undertake any rigorous and objective quality evaluation of the images created by the Nikon D100 Digital SLR. Subjectively, it appeared that overall, the Nikon D100 camera provided an image of a reasonable quality for the capture of these artworks, however it should be realised that these one-shot cameras are designed to provide versatility rather than necessarily quality. They are designed for the pragmatic capture of people, action and still-life on location as well as in the studio rather than simply to capture the highest quality images from flat artworks within the structured constraints of the studio. There is no way that this camera, or any other 'one-shot' camera (at this cost) can compare with cameras dedicated for this type of use at a cost of four to five times as much in terms of quality. However, whilst bearing all this in mind, the quality seemed just fine.

There are some particular areas of interest:

Colour Management - The Nikon D100 and the Nikon Capture software are both designed to work within the ICC colour management system. At the outset of this project it was hoped, in fact presumed, that the workflow would be easily designed to provide some level of automatic colour management for all images with a minimum of intervention from the photographer during capture or the image optimisation process. In fact this was anything but the case and really no automation was ever reliably introduced into the workflow, meaning that all images had to be individually colour corrected within the optimisation process. There are a number or reasons for this and the fact that within the project we endeavoured to trial so many different ways of using the camera and lighting the art-works, it is hardly surprising. However the main culprit for this was the Nikon D100 camera, or more accurately the internal software used to capture the 'RAW' NEF files and then interpolate the missing colour data when opening the file into the image editor. These cameras are designed to try and get the very best out of a limited amount of information from the CCD (which they do very well indeed), however this means that they continually change and adjust the internal processing algorithms to maximise the perceived quality. This makes it pretty much impossible to adjust any external influences on colour (from lighting or settings) as the camera appears to continually adjust its internal procedures to negate the adjustments made by the photographer. In use this has

meant that even though a batch of images might have been shot under almost identical conditions, with only slight changes of lighting or exposure, they can all show substantial shifts in colour, luminance levels and contrast.

Originally it was hoped that by capturing a 'calibration image' (Macbeth ColorChecker) at the beginning of each batch of images it would be possible to create one set of colour-corrections based upon this 'calibration image' which could then be used for all images within that batch. However, for the reasons established above, this never provided a reliable method for colour correction. Once this problem was realised, a standard Kodak Q13 grey-scale test target was included in the shots to provide a clear 'grey' key for later optimisation. At this stage, a Macbeth ColorChecker was not included within the capture area due its large size, however after the Kodak Q13 was not found to provide enough size for reliable measurement during capture, the Macbeth ColorChecker had to be utilised in the following way. Two shots were taken, one including the Macbeth ColorChecker and one not. The image including the Macbeth ColorChecker was optimised (using the test target) and then the adjustments used were copied to the other image.

All in all, this was a very disappointing situation and led to a much longer, more complicated and less objective colour management system than had been originally planned. It should be pointed out that there was little time available for testing the camera and for developing methodologies that provided effective colour management within the workflow. All development work had to be undertaken within the capture schedule and whilst shooting was in progress. With a reasonable amount of research time, it would be possible to improve this system dramatically. However, it is doubtful that it would ever be possible to really overcome the intrinsic and inbuilt quality issues that are inherent with using a system based upon a 'one-shot' matrix array capture system.

It should be noted that there were also difficulties with choosing from the default 'White-point settings' on the D100. Although there was a default 'flash' setting, it was presumed that this was set for the internal camera flash which has quite a warm colour tone and gave erroneous colours when used with the external studio flash lights. A custom point was tried, but in the end a ‘daylight’ setting was preferred and used.

Lack of sharpness - the images made with the D100 seemed to be really quite soft. This is of course only a subjective evaluation, made in comparison with some other cameras with the same pixel dimensions. However, comparison with a Leaf Volare camera (previously used by TASI), which is notably sharp (and uses the same lens and size of CCD), it was at times clearly disappointing.

It is quite possible that to some extent Nikon have deliberately incorporated this feature within the design of the camera (to deal with moiré problems), with the presumption that the image will be re-sharpened within optimisation anyway. See 'Optimisation - USM' at the end of this section for more details.

The bottom line is that by preference no sharpening should be used within this kind of work, but in this case some sharpening was almost obligatory to remove the overly-soft look of the images.

Image viewing - Being an SLR camera the primary method of viewing was through the optical system of the camera. It was noted that like most SLR cameras the viewing area is only about 95% of the image area, which can be a little frustrating when trying to accurately frame an image. One disappointment in operation of this camera is that it offered no 'live' view of the image from the CCD on either the LCD screen on the back of the camera or via the tethered connection to the attached laptop computer. This functionality is readily available within both 'low-end' digital compact cameras and of course in 'high-end' digital studio cameras, however it is not available at present with this camera or other one-shot SLR type cameras. This is trying as it is therefore impossible to set the camera up on a tripod or stand and use the tethered laptop to view the images. Of course an image could be reviewed once it had been captured, but this could not really help to frame images.

Image re-viewing - After the D100 had captured an image it automatically showed it upon the small LCD screen on the back of the camera. This display was woefully inadequate and unable to provide enough information from which any quality control decisions could be made as to the quality of the captured image, although it could, of course, at least show enough information to recognise the image. When the camera was used in the tethered mode, it was of course possible to directly download the image to the laptop and review it there within the Nikon Capture software (or indeed Photoshop) on the LCD screen. This was better, however, it must be said that it was only marginally so. The LCD monitors supplied with laptops (especially from Apple Mac) have improved significantly over the last few years, even so, the image available from the Toshiba laptop used for image capture was really not up to any rigorous quality control work. Of course, when working in the 'un-tethered' mode this approach was not possible, so in the end it was decided that the best approach was to simply work from the image histogram that was shown on the LCD on the rear of the camera. This worked adequately to gauge the exposure of the image, however the image still had to be re-checked properly at a later time before it could be signed off.

Vignetting - There was evidence of vignetting within some images, especially when using wide-angle lenses and capturing large flat objects (such as paintings). The exact extent and indeed the reasons for this problem were never really discovered, although it was noted that the Nikon Capture software offers vignette reduction, which does suggest that there is a recognised problem with this. In this project, uneven lighting was suspected to be the more likely reason caused by the flash-lighting rather than any internal problem with the camera (see below).

6.2 Other Image Quality issues

Lighting - There were continual problems with trying to create even lighting over the whole image area. There were quite a few possible reasons for this (see above) and during the short time of the project, it was never possible to undertake enough testing to be sure of the cause, however the 'lightboxes' purchased with the Bowens Flash lighting were considered to be the most likely culprit. These were purchased after advice from the salesman, but after six days of working with them, evidence suggests that they can not provide even coverage and in fact created a pronounced 'hot-spot'. This was fine for the majority of general photography, including the 3-D works undertaken during this project, but not really appropriate for capturing large 2-D works such as paintings. This problem was certainly exaggerated by both the lack of room available for photography (there was not enough space to ensure that the lights were far enough away from the work) and also the inability to cut out ambient lighting (which led to problems with colour correction for both light sources). Due to all these factors, it is most probably true that larger works (over 4ft square) are, to one level or another, unevenly lit, whereas smaller works should be unaffected. It is also true that the images from the later days are much less affected by such problems, as once they had been recognised, extra care was taken to alleviate them as much as possible.

There were also a few ‘snags’ with ambient lighting during the project. It was possible to work within the available studio space at SIAD, however there were certainly problems with using the flash lights in the studio when the ambient 'north-light' was often bright enough to effect the exposure of the light from the flash lights. On the last day of shooting, with the ambient 'north-light' being so strong a decision was made to forgo the flash entirely and work with only the ambient light. In general this worked well, however it would be a very limited approach to capture in general, as studios with reliable 'north-light' of sufficient strength are few and far between.

Un-square images - There were quite a few problems with un-square images. These were due to two main causes:

- the camera could be inaccurately set up above the artwork – either not central to work or pointed off centre
- the artwork (normally in this case a canvas) could have been made inaccurately and skewed to start off.

Unfortunately I suspect the second was more often a cause of problems. It is easy enough, during the optimisation process, to fix these 'faults' but there are possible issues about doing so; what happens if the canvas was made intentionally 'skew'?

Optimisation and Sharpening - The optimisation used within this project created high quality clean images, however there was, and still is, some lack of certainty on what was the best practice for the application of sharpening within the optimisation of the TIFF images. It is normally considered best practice to try and not use any sharpening within a master archive file and then to use just the minimum amount when preparing delivery surrogates. However, the files created by the Nikon D100 seemed really quite soft and were certainly not making best use of their pixel resolution. It is an unfortunate part of the design of many new digital cameras that the images are over-softened within their internal processing to avoid problems with moiré and other interference effects, presuming that the operator will use a heavy amount of Un-sharp Masking to bring the sharpness back again.

Within this project it was decided to use a minimal amount of USM (120%,1.0pix, 2 levels in PS6) across all files within the image optimisation schedule. This has introduced a small amount of correction that is present in all the optimised TIFF files. However, it is considered

likely that more sharpening will need to be applied at the time of creation of the next generation of surrogates.

6.3 Other lessons learnt

Equipment delivery - Although, of course all equipment was promised by the suppliers (Calumet) in time for the beginning of shooting, in fact there was quite a delay on some of the equipment. This led to limitations and hold-ups within the early days of the capture schedule. For example, the 35mm lens did not turn up till the last two days of shooting, which meant that the 28mm lens was used instead. This introduced a range of possible quality issues, including exaggerating the lighting problems and slowing accurate capture. It also prevented much of the equipment from having any 'testing' before being put immediately into action.

Establishing Image Management System - When estimating the time for digitisation projects, it is always easy to spend your time thinking about the capture infrastructure and forget the time taken to install, design and train users of the IMS. In this project, establishing the database and designing the user-interface, took over 2 days that had not really been included in original time estimations.

Networking problems - For the 'tethered' workflow it was necessary to network the photographer's and indexer's laptops together. Although one might presume this to be a trivial task, it was, in reality, a time consuming and exasperating task, that only became slightly easier over the extent of the pilot-study. No doubt if the project had been longer, there would have been time to ascertain best practice for this task, but every day it took far longer within this project than it should have and wasted valuable shooting time.

Identification issues - On the whole, the image identification systems within the workflow established for this project worked well enough, however it would be hard to overstress the importance of creating a link between the original artwork and the digital image created from it. Making sure that the collation of all metadata was undertaken as close to the capture as possible and organising a system that allows for a 'double-check' was critical. This was easily provided for within the 'tethered' mode of capture, but was worryingly a little harder to create and check within the 'un-tethered' mode. In the un-tethered mode, it was very easy for the photographer to get ahead of the indexer and create a batch of images for which the indexer had no metadata, necessitating that the indexer return to the works to try and collate the metadata at a later time. During the project, there was no indication that there were any identification problems whilst working in the un-tethered mode but it is possible that unidentified problems could lead to problems in the longer run unless some care is taken to tighten procedures.

Image Content/Shooting guidelines - As this pilot project was very small, and endeavoured to explore the many different approaches to capture it was not considered necessary to agree and standardise the image capture guidelines. However, in the future, it might be worth standardising the approach and documenting it. For instance; How should a painting be framed? Should the image contain the edges of the work or crop them? What angle should be used for 3-D works? What happens if a work needs more than one image or view to convey its intellectual content? What happens if the work requires a close-up image to really be understood? Within this project, these decisions were left to the photographer, however in the future it might be better to consider these questions and create some standards of best practice.

Image metadata tagging - Using the metadata tagging facility within the Nikon capture software and the Nikon NEF files provided many advantages to the workflow. When working in 'tethered' mode it enabled the photographer to reliably record the basic indexing metadata within the IPTC fields directly to the Archive Files for subsequent reading by the indexer.

When working in both modes it enabled the 'technical' metadata (which is automatically recorded within the EXIF data) to be exported to the Portfolio database. It is quite possible that further work could be undertaken to try and integrate and automate this 'image-tagging' functionality more directly within the workflow. At each stage of the workflow it appeared to have some partial support, but it was never able to join all parts of the system together to enable it to work in an integrated and automatic way.

7. Evaluation of Approach

At the end of this pilot study, it is possible to look back on a project that has created a range of high quality images that will hopefully be of great use to the SIAD and VADS for whom they were made.

However, in many ways this pilot study has only served to highlight many of the difficulties and problems associated with digitisation projects and particularly in attempting to undertake them with limited budget and/or time.

This pilot study had two main aims:

- To create a reliable and high quality direct digital capture system for a diverse collection of artworks belonging to an art college within the restricted budget of £5000 for equipment and 14 working days in which to plan, research, design, capture, optimise, enter in database and archive the captured images.
- To create a standardised methodology for this capture workflow and to document this to enable others to recreate this workflow knowing the system would produce images of an established high standard.

It was not intended to make any objective evaluation of the images created, in terms of their quality, accuracy or the speed of their creation and this was not undertaken. In fact it should be realised that little testing was undertaken before the project started and all evaluation was subjective and fed back into the ongoing creation of the workflow.

Aim one - creating capture workflow and infrastructure within budget of £5000

Quality, productivity and ease of use are hard to evaluate, without comparisons and objective standardisation. The images created are far from perfect and certainly in quality terms well below that expected from the high-end camera systems normally used for this kind of work. This was largely due to problems with the colour management and the softness of images.

On the other hand the images have been produced in a very pragmatic way within a low budget and, taking that into account, it might well be considered that they are really quite adequate for their purpose. In the end it is only the 'user' who will be able to say with authority if they fulfil the quality requirements expected of them. It will be interesting for VADS and SIAD to express their opinion on the quality of these images and whether they meet the standard that they expected.

With more time to experiment and test the equipment/software it would have been possible to make many other improvements to the workflow and indeed to the quality of the images. This is the crux of the matter; past experience has shown that with a larger budget and more time, it is quite possible to raise both the quality of the images and also standardise the workflow. However, with the equipment available within this budget and with the limited timescale, it was not really possible to do a great deal more.

Aim two - creating a standard and repeatable capture workflow based around this infrastructure

Although it was quite possible for someone with sufficient knowledge and experience to use this capture system to create a usable workflow and indeed to capture images of a reasonable quality, professional experience indicates that not enough work was undertaken during this pilot study to be able to standardise the approach to a level where it could be undertaken by someone with little or no prior experience in this kind of project. Or, indeed, if this kind of digital camera could be used within a workflow that could be standardised enough to provide an objectively evaluated output of known and established quality.

In reality, each part of the capture workflow needs specialised and experienced technical knowledge to set up.

- **Networking** - Establishing two networked laptops for the 'tethered' mode needs specialised networking experience - although not outside the knowledge of a good college IT department
- **Photography** - Establishing the lighting and accurate use of the camera needs a moderate to high level of photographic experience: although this might well be available within an art college
- **Database Managemen**t - Establishing the Image Management System, creating the fields and collating both indexing and technical metadata should have been one of the easier tasks, however this is still going to be taxing for someone who has never done this before, unless they have had some level of training
- **Digital Imaging** - The optimisation of image files, followed by their digital preservation are both subjective skills that would be better approached after some training and are hard to standardise to a level where no skill is required within the task.
- **Image Quality Control** - At present within the workflow established at this point, all quality evaluation and particularly colour correction has to be undertaken by the subjective evaluation of a skilled operator.

The bottom line is that if a standardised capture workflow is required, it is much easier to do so with capture devices (and software) designed for this kind of workflow. This inevitably means using much more expensive infrastructure and establishing rigorous quality control systems that can be based around objective evaluation systems. Unfortunately this is only likely to be possible within projects who can justify the required investment against the need for productivity within a larger digitisation project rather than for the 'small-time' pragmatic day-to-day capture required by an art college for this type of project.

The quality of the images captured within this pilot study are not great, and in comparison to those created on high-end digital cameras would be found disappointing. However on the other hand, they are not too bad either and would be perfectly adequate for many pragmatic uses within an art college. These cameras would also provide the art college with a versatile and easy to use method of creating ‘born digital’ images. So for the art college, who might not really need the highest level of quality, it might well be worth investing in this level of equipment, however, it will only pay dividends if the college is also prepared to make the additional investment in time and training for the staff who will be using it

Appendices

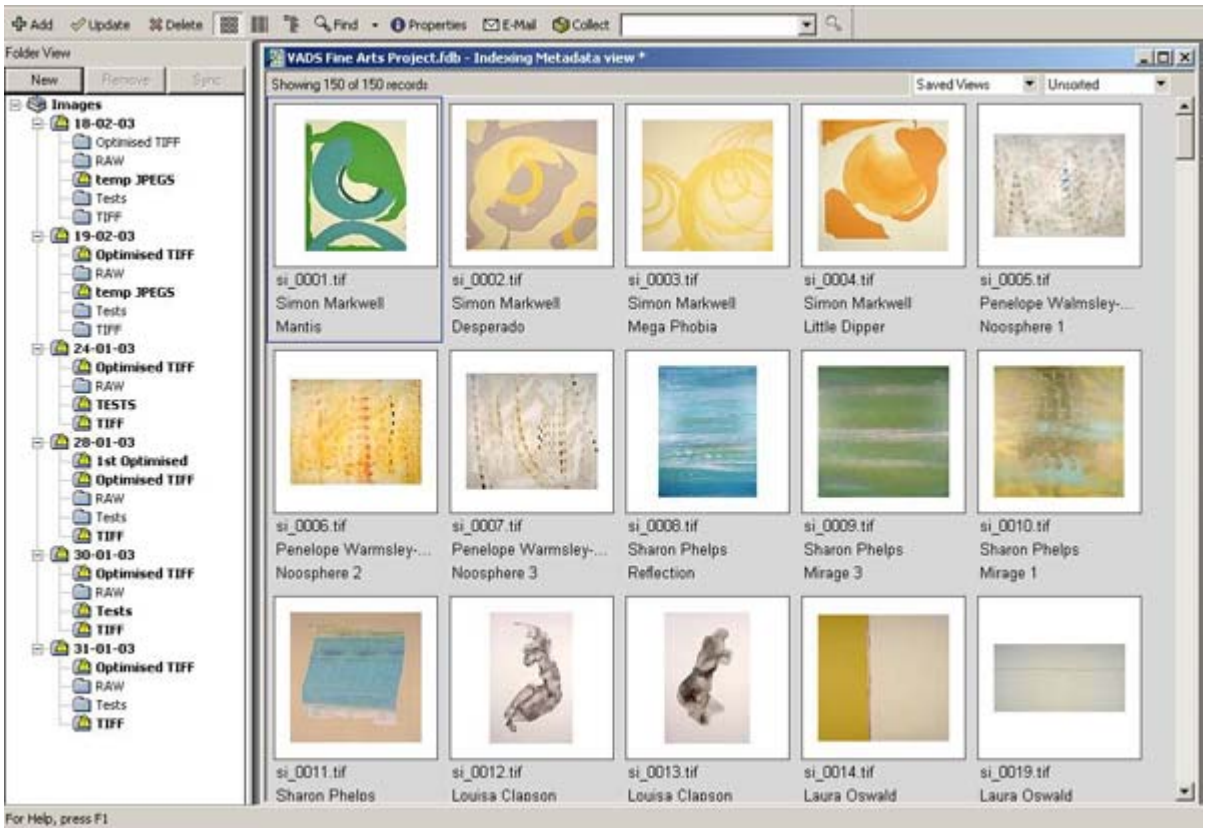
Extensis Portfolio 6 Image Management System

Portfolio 6 allows the collation of whatever metadata is required by the project and custom fields can be created to store it. A selection of these fields can then be presented within a saveable 'View' window, allowing a separate view for all indexing and technical metadata.

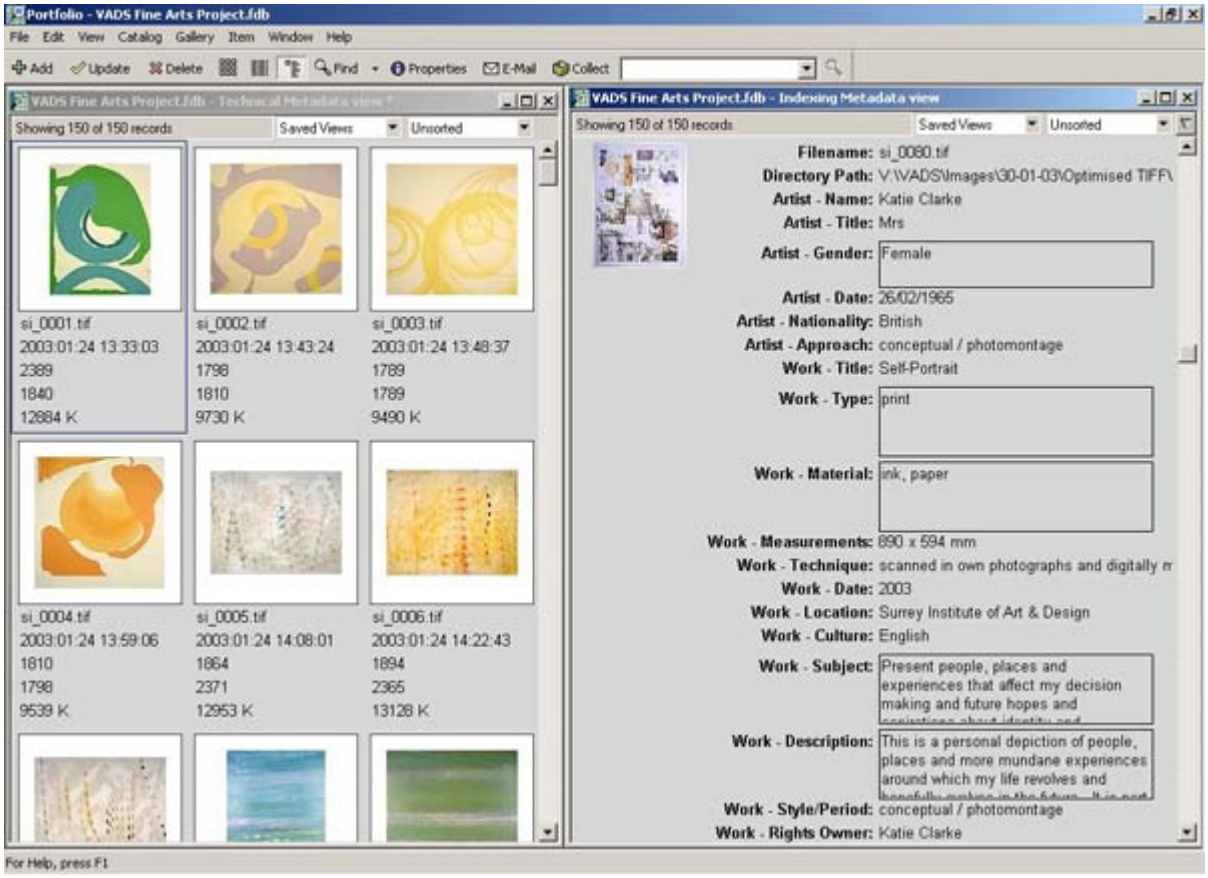
Portfolio 6 also allows the metadata and images to be viewed in a selection of 3 ways:

- Thumbnail view
- Record view
- List view

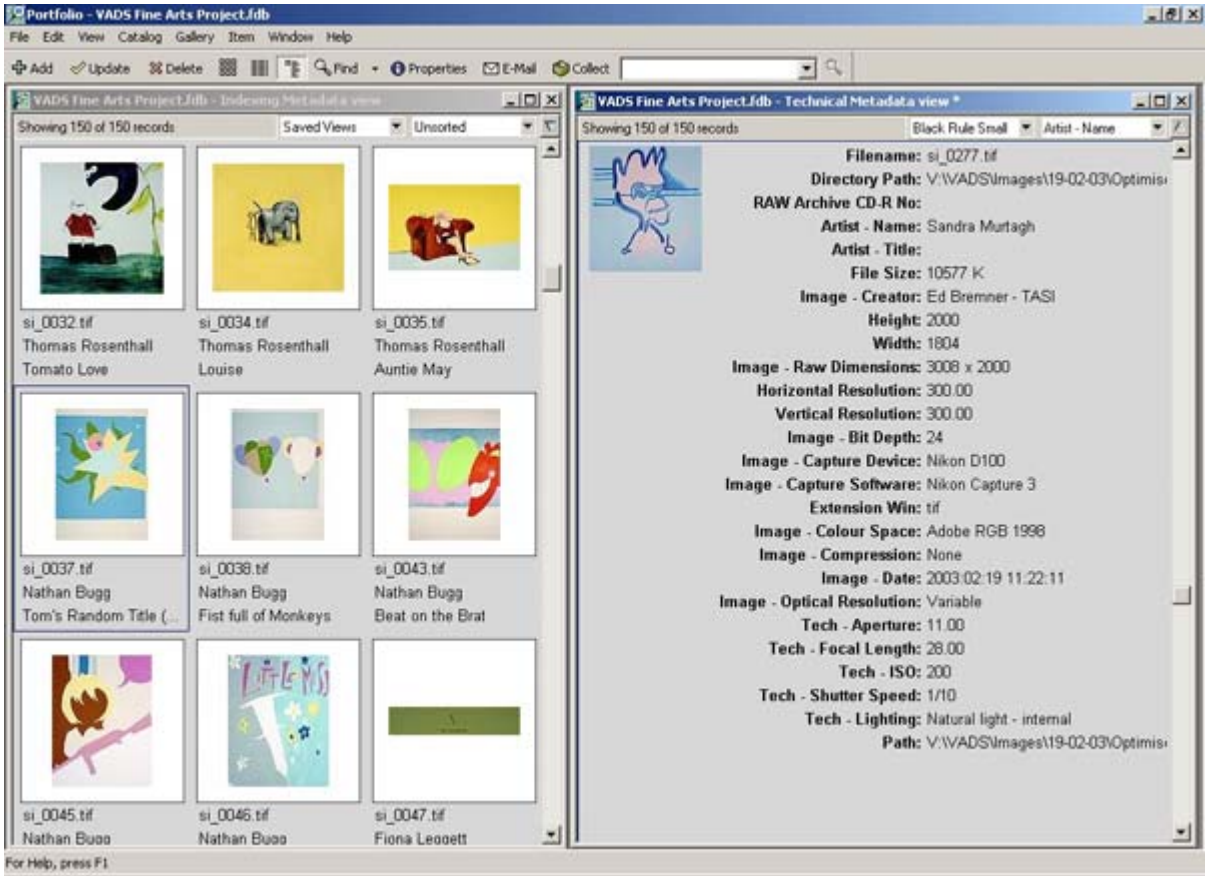
Each of which provides a customisable selection of the metadata fields stored within Portfolio 6. Examples of these views follows:



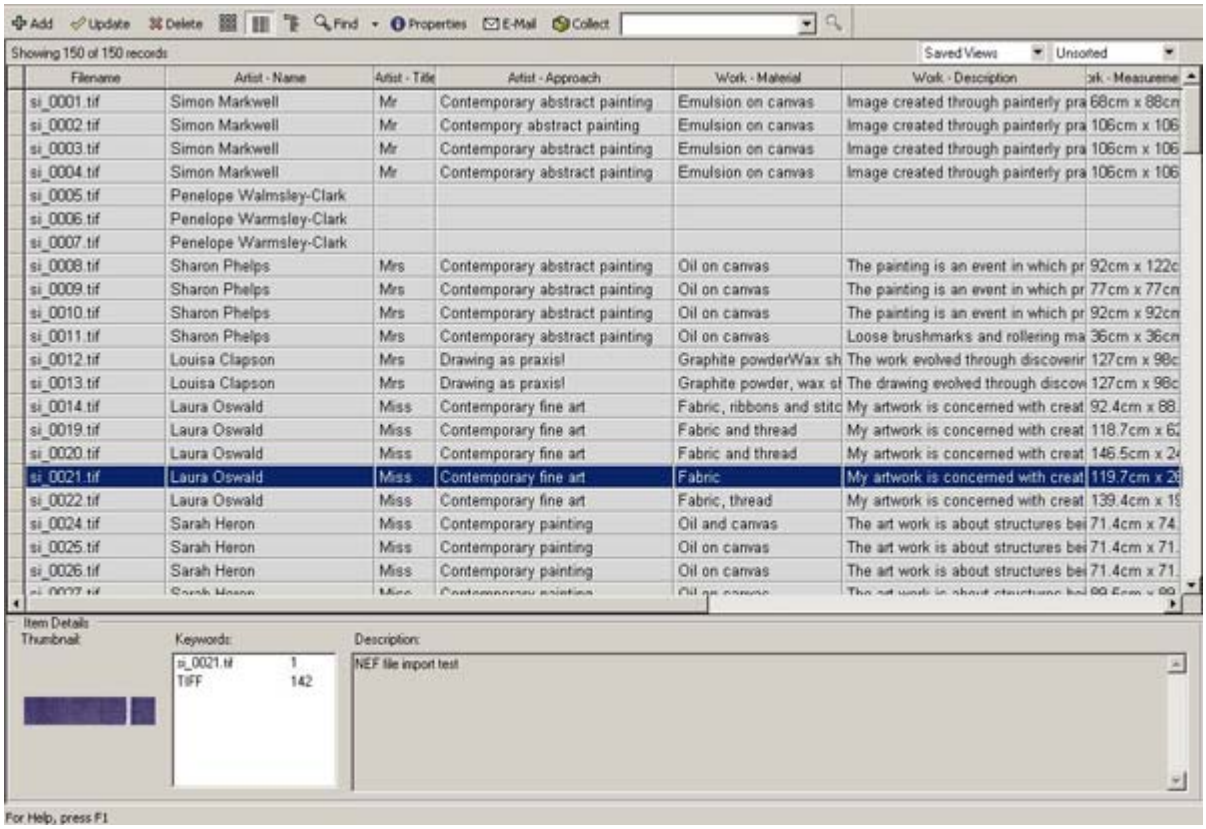
Portfolio 6 showing the 'Folder View' window and the 'Thumbnail View' of the Indexing metadata.



Portfolio 6 showing the 'Thumbnail View' of the technical metadata and the 'Form View' of the indexing metadata.



Portfolio 6 showing the 'Thumbnail View' of the indexing metadata and the 'Form View' of the technical metadata.



Portfolio 6 showing the 'Table View' of the Indexing metadata.

Master Archive Read-me Files

The following text files were included on the CD-R discs to provide supporting documentation for the contents of the discs. For further details see Section 4 – Preservation Strategy.

Info-Archive.txt

*** VADS Fine Art Project Master Archive *** 16/04/03

These images were captured with a Nikon D100 Digital SLR camera on the 24,28,30,31 Jan 2003 and 18,19 Feb 2003 at the Surrey Institute of Art & Design as part of the VADS Fine Art Project by the Technical Advisory Service for Images.

They are 3008 x 2000 pixel in size with a file size of approximately 9,710Kb when camera used tethered (or 4,700Kb in a lossless compressed form - when camera is used un-tethered - after si_00159) and saved in the NEF format.

The RAW files have been archived here on CD-R. These images are direct from the camera before any optimisation has been undertaken on them.

They are in a proprietary Nikon format called the Nikon Electronic image Format, otherwise better known by their extension .NEF. This is a 'Raw' 12 bit per channel file format that will need to be fully processed before it can be opened by normal image readers and saved in TIFF, PNG or other image format.

It is expected that the support for this and other 'RAW' formats will grow with time. However in the interest of digital preservation, the following pieces of software have also been burnt to CD-R to be stored alongside the master archive collection which may be used to open, view and save these NEF files.

On supporting disk:

Nikon Capture 3
Nikon View 5
Nikon NEF import plugins for Adobe Photoshop 5-7
Irfanview 3.8 and Plugins
Bibble Raw Data convertor (demo)

On each disk in a folder called software:

Nikon NEF import plugins for Adobe Photoshop 5-7
Irfanview 3.8 and plugins

It should also be noted that support for NEF has been included within both the popular image folder viewers ACDSee 5.0 and Irfanview 3.8

For further details please contact:

VADS at http://www.vads.ahds.ac.uk/

or

TASI at http://www.tasi.ac.uk/

Ed Bremner April 2003

Info-Disc-1

*** VADS Fine Art Project Master Archive *** 16/04/03

Master RAW Archive Disk One:

This disc includes the NEF Files from:

si_001 to si_0049

shot on:

24/01/03

28/01/03

Software:

Nikon 3 Capture

Nikon 5 View

Nikon NEF import plugins for Photoshop

Bibble (demo version)

Irfanview 3.8 and plugins

For further details please contact:

VADS at http://www.vads.ahds.ac.uk/

or

TASI at http://www.tasi.ac.uk/

Ed Bremner

April 2003

Info-Disc-1-opt

*** VADS Fine Art Project Master Archive *** 16/04/03

Master Optimised Archive Disk One:

Images from SIAD Pilot study

These images were captured with a Nikon D100 Digital SLR camera on the 24,28,30,31 Jan 2003 and 18,19 Feb 2003 at the Surrey Institute of Art & Design as part of the VADS Fine Art Project by the Technical Advisory Service for Images.

They are 3008 x 2000 pixel in size with a file size of approximately 9,710Kb when camera used tethered (or 4,700Kb in a lossless compressed form - when camera is used un-tethered - after si_00159) and saved in the NEF format.

This disc includes:

Portfolio Data

Optimised TIFFs from

24/01/03

28/01/03

30/01/03

These files are saved as uncompressed baseline RGB TIFF rev6 in PC byte order. They have been colour managed using the ICC system and are within the Adobe RGB (1998) colour space.

They have had the following optimisation:

Cropping & orientation

Levels - setting highlight and shadow point

Shadow point set to 5,5,5, RGB

Highlight point set to 245,245,245, RGB

Grey point/colour correction

No independent colour correction was deemed necessary or useful

Image repair as necessary

USM - Very subtle 120% 1.0pix, 2 levels in Photoshop 6.

It is likely that they will need a little more USM before delivery.

For further details please contact:

VADS at http://www.vads.ahds.ac.uk/ or TASI at http://www.tasi.ac.uk/

Ed Bremner April 2003

8. Glossary

- **ASCII standard:** American Standard Code for Information Interchange. The most common file format for text files in which each alpha, numeric, or special character is represented by a 7-bit binary number. There are 128 ASCII characters defined.

- **Barrel distortion:** The negative distortion that causes a square pattern to be imaged as barrel-shaped.

- **CCD:** Charge Coupled Device. Multiples of light-sensitive elements in cameras, detectors or scanning devices. The two main types being linear array and area array.

- **CMOS chip:** Complementary Metal Oxide Semiconductor. A type of detector within a digital camera.

- **Copy lighting:** Standard lighting for photography. Two lights on a copy stand, set up level and facing each other, with the lamp heads pointing down at 45 degrees to the subject. The aim is to produce an even light reading across the subject which should result in no reflection.

- **EXIF:** Exchangeable Image File Format. A standard for storing technical camera metadata, normally used within the JFIF file format. Most digital cameras now use the EXIF format. The format is part of the DCF (Design rule for Camera File system) standard created by JEIDA (Japan Electronic Industry Development Association) to encourage interoperability between imaging devices.

- **Hair-in-the-gate:** When the camera aperture or gate is obstructed by a foreign object, such as a hair.

- **Imager:** The device used to capture digital information to produce digital images.

- **Internal file metadata:** Metadata can be internal (file naming, directory structuring, file headers, OCR (Optical Character Recognition), SGML (Standard Generalized Markup Language)) or external (external indexes and databases). For example, TIFF file headers are instrumental in recording metadata internally; however, this metadata is usually lost when the TIFF files are converted to other file formats, such as JPEG or GIF.

- **Interpolation:** A sampling technique used to increase the size of an image file by creating more pixels and increasing the apparent resolution of an image. Interpolation examines the existing pixel information and creates additional pixels by averaging the existing values.

- **IPTC:** IPTC is The International Press Telecommunications Council, which was established in 1965 to safeguard the telecommunications interests of the World's Press. Since the late 1970's its activities have primarily focussed on developing and publishing Industry Standards for the interchange of news data.

- **Matrix array:** A type of detector arrangement within a digital camera. Contains image sensors in a two-dimensional configuration of rows or columns.

- **Moiré problems:** A problem which occurs under certain conditions in a digital photograph, also called Color Moiré. This is characterized by rainbow-coloured hues appearing in select areas of an image, occurring most often in images of mixed grey hair, denim and other textiles with a twill weave.

- **Nikkor optics:** Lenses made by and exclusively for Nikon cameras.

- **One-shot technology:** The Charged Couple Device (CCD) captures a single image instantly. The ‘one-shot’ technology is used to photograph moving objects.

- **Optimisation work:** Any Additional work undertaken on the original image to prepare it for use. This may include cropping, tonal correction, colour correction, resizing, sharpening and compression. See http://www.tasi.ac.uk/advice/creating/img_capt.html#img2

- **Pincushion distortion:** A type of distortion in which the horizontal and vertical lines of a square pattern bend inwards toward the centre. The distortion is most noticeable at the edges. The opposite of pincushion distortion is barrel distortion, and a third type of distortion, called trapezoid distortion, occurs when vertical lines are straight but not parallel with each other.

- **RAW:** The original data captured by a digital camera sensor. This uncompressed raw image, a “digital negative,” is often preferred by professional photographers because of the precise control over tonal range and image detail it allows.

- **Scanning and multi-shot bodies**: See http://www.tasi.ac.uk/advice/creating/camera.html#ca5

- **Vignetting:** Darkening of the image away from the centre caused by a drop in illuminance towards edges of image. Traditionally caused by bad lens design, now more likely caused by the angle of light falling upon the imager.

- **VRA3:** The *Visual Resources Association Core Categories, Version 3.0*; a metadata schema consisting of a single element set that can be applied as many times as necessary to create records to describe *works* of visual culture as well as the *images* that document them. The Data Standards Committee followed the "1:1 principle," developed by the Dublin Core community; only one object or resource may be described within a single metadata set.