Digital Humanities Lab, University of Exeter

Highlight-based RTI: Workflow

Overview

This is a guide to taking RTI photographs without using the traditional RTI dome. Highlight-based RTI is a highly adaptable approach that can be used anywhere from archival settings to archaeological fieldwork, using equipment ranging from mobile phones to high-spec cameras. This workflow is designed to give a general overview and some tips, but you may need to experiment to adapt it to your needs and available equipment.

Equipment

Essential:

- Camera (any kind, including phone cameras)
- Tripod or camera stand
- Light source that can be moved (eg. handheld torch)
- Reflective black sphere(s) (black marbles can be borrowed from the DH Lab)

You may also find helpful:

- String
- Remote shutter release
- DH RTI mat (available for download as a separate file - print two copies)
- Blue tack
- Tripod weights
- Metadata spreadsheet template (available for download as a separate file)
- Colour card/scale
- Plain paper (black or white)

- Extra person – it is much easier to work in pairs or a group of 3

Basic workflow

Set up

1. Set up your object

Place on a flat surface:

- Your subject
- Reflective sphere(s) – select appropriate size and number
- Colour card and scale as appropriate

Consider how you want to crop the final RTI, and which objects might cast shadows on each other, when laying out the image. You will probably need to adjust their position as you go along.

The surface you put them on will be visible in the RTI, so you may want to place these items on some plain paper as a backdrop.

If you are using the DH RTI mat (see the 'Photography' section for information about this), set your items up on top of it, with your subject in the centre. You may want to cut a square of card or paper to put on top of the mat so it doesn't appear in the photos.

If photographing an object in situ, e.g. an inscription on a wall, the sphere will need to be mounted horizontally next to the object. Spheres with a screw attachment held by a separate tripod can be useful for this.

2. Check your camera

Make sure it has:

- Memory card (or sufficient storage space)
- Charged battery
- Remote shutter release – check this is working (see 'general tips' below for ideas)
- Choose a lens appropriate for the size of the subject and its distance from the camera. Macro lenses can produce excellent results, but be careful that they have a very limited field of view.
- Set to manual focus (if using a phone, you can download apps that allow you to control the focus)
- Set to manual mode

3. Set up your camera on a tripod

The camera must be firmly fixed in place, and perpendicular to the surface of the object. E.g. if your object is lying flat on a table, the camera should be positioned directly over it, pointing straight down (see image above).

> ***Important!*** When positioning the camera over an object, make sure the tripod is stable and not at any risk of tipping over. See 'general tips' below for suggestions to help.

When deciding on the distance between the camera and object, bear in mind that you will need to get both the sphere and object in the frame, but they will need to be far enough apart for them not to cast shadows on each other. You also need enough space to manoeuvre the torch around without the camera getting in the way. You may need to experiment with the height and position of the tripod and position of the object during setup.

4. Set the focus and exposure on your camera

Adjust the focus manually. Do not leave the camera on autofocus, or change the focus during photography, as you want the photos to be as consistent as possible.

Set the exposure settings (ISO, shutter speed and aperture). Ideally you want settings that will work for brighter images where the light is at a higher angle above the object, and darker images with the light at a much lower angle, without having to make adjustments in between. This can take some trial and error, so don't worry if it takes a while.

Some tips:

- Take test photos using the light conditions you will have during the actual photography
- Use manual mode if you want more precise results, but shutter priority (TV) can make it easier to get a better set of images if you just want a nice-looking interactive image.
- Keep ISO as low as you can – adjust shutter speed and aperture instead if possible
- Shorter shutter speeds are useful when using a hand-held torch
- Setting the ISO to auto can help reduce overexposure if you need to use manual mode
- Do not use full auto mode, as you need to control the shutter speed

If you are using a phone camera, there are various camera apps that allow you to control these settings. Open Camera is a free option for Android, and newer iPhones may have this feature built in, but there are many options available.

5. Check for problematic shadows

You don't want the sphere and subject to be casting shadows on each other (this can prevent the software from building the RTI correctly). To check this:

1. Set the camera to live view
2. Practice moving the torch/light source around the object, starting by going all the way around the object at a very low angle, and moving to a higher angle.
3. Keep looking through the camera to see if a shadow lands on either the sphere or the object. You may need one person to look through the camera and another person to move the torch.
4. If shadows are an issue, reposition the object, sphere, or whatever is casting the shadow. You may need to adjust the height of the tripod to fit everything in, or switch to a smaller sphere if you have one.
5. Repeat steps 2-4 until no shadows are cast on the sphere or subject.

6. Take a 'divider' photo

When you're ready to start photography, take an obviously different photo that shows where your 'actual' photoset starts. This makes it a lot easier to sort your photos out afterwards, especially if you've taken test photos during setup. Some easy options for doing this are taking a photo:

- With all the lights off
- With the lens cap on the camera
- While waving a hand in front of the camera lens
- With a piece of paper in front of the camera with any info about the photo set that you want to record

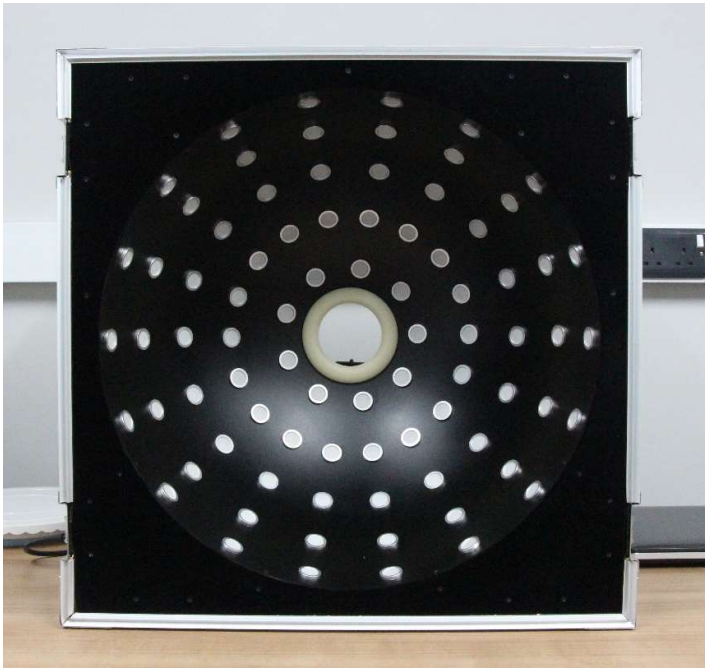
Be careful not to move the camera or change any settings while doing this.

Photography

During photography, shine the torch on the object and sphere from as many different angles and positions as you can, and take a photo at each position.

The light positions don't need to be in precise locations, but working methodically helps to ensure you get good light coverage. Imagine trying to replicate the positions of the lights in the RTI dome (see photo below). There are two most common ways of achieving this:

- Complete rings – work all the way round the object with the light at a low angle, then go all the way around again using a medium angle, then a high angle etc.
- 'Umbrella spokes' - work round the object once, taking multiple angles at each position - take a shot with low, medium and high angle lighting at one position, then move a short distance around the object and take the same angles from there etc.



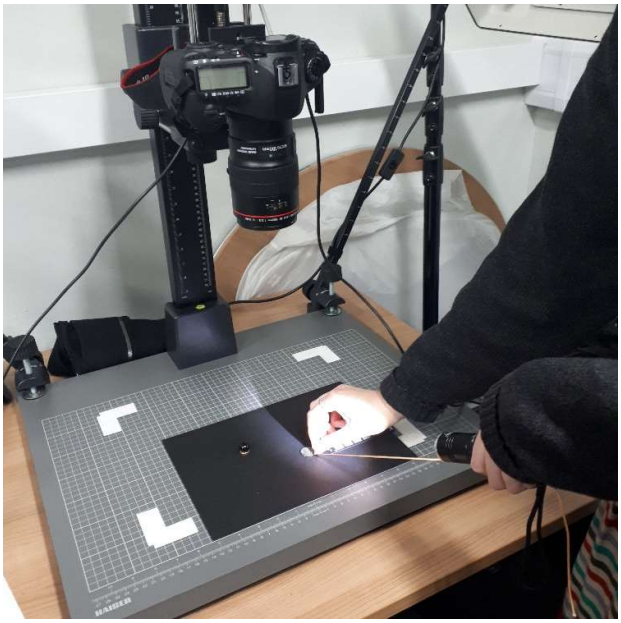
To help keep your light positions consistent, you can try using the DH lab's RTI mat (available to download as a separate file), which has positions marked around it. Print two copies of the mat to make a complete circle, and place it underneath your object with the object in the middle. You can then line the torch up with the lines marked on the mat to get more consistent spacing around the object. You may want to cut a smaller square of plain paper to put under the object so the mat doesn't actually appear in the RTI.

There is no strict rule for the number of photos to take, but aim for 3-4 rings of 10-20 photos each. The RTI mat has 16 positions marked.

Keeping the light at a consistent distance away from the object can help improve the quality of the final RTI. To help with this, you can use a piece of string to measure the distance away from the object:

1. Hold one end of the string in each hand (with one hand also holding the torch, or tie the string to the torch)

2. Place the hand without the torch just above the object (be careful not to accidentally knock it)
3. Pull the string tight by moving the hand with the torch away (keeping the torch at the position and angle you want and the light focussed on the object and sphere)
4. Keeping the torch in that position, move your hand and the string out of the way of the camera
5. Take the photo (it's much easier if another person does this)



Taking the photo using a remote shutter release is highly recommended to prevent you from accidentally moving or wobbling the camera while taking the photo (see 'general tips' below for suggestions).

This photography process can take a while to get the hang of, so take time to practice beforehand and decide what method works best for you.

Some tips:

- The torch, string and shutter release can be a lot for one person to juggle at once. If possible, have one person managing the torch and string, and another person controlling the shutter release
- Hold the torch as steady as you can
- Remember to light both the object and the sphere with the torch – it can be easy to forget the sphere!
- Moving the object, sphere, camera or focus ring during photography is likely to make it difficult to build the final RTI. If you accidentally move anything (even if only slightly), it is recommended to start that set of photography again. Taping or blue tacking things down where possible can help to avoid this (only where appropriate for the objects and equipment you're working with!)
- Take breaks during photography if you can – it can be quite demanding!

Processing the RTI

Processing the images into an RTI file requires the RelightLab software, which is free to download from https://vcg.isti.cnr.it/vcgtools/relight/. The DH Lab have produced separate guidance on using the software.

If you are doing RTI photography in the field, you will not see the final RTI result until after your return, and may not be able to go back and photograph the object again if something hasn't gone quite right. To help get a good RTI, we would recommend (if possible):

- Practice with your photography set up as much as you can before doing the real thing
- Take as much time as you can while taking the photos
- During/after photography, check your photos for obvious issues, eg. blurry photos, shadows over the object or sphere, lots of over- or under-exposed images
- Take more than one set of photos of each object so you have a backup in case there are issues with one set
- Take sets of photos with different camera settings, in case you find afterwards that the photos are over- or under-exposed
- Copy all photos into secure, backed up storage as soon as you can

General tips

Tripod stability *important!*

When using a tripod with a horizontal arm, make sure the tripod is stable and not at any risk of tipping over. This can easily damage your camera and the object you're trying to photograph. This is a particular risk with heavy DSLR cameras, but even a phone can tip a lightweight tripod over.

Some tripods have dedicated attachment points for counterweights, or you can use archival weights, bags of rice etc. to weigh down the legs. Make sure your setup is secure before putting it over an object, and if necessary have someone else supervise it while you do the photography.

Camera support options

Tripod legs can be an issue for positioning the torch, as they cast a lot of shadows and generally get in the way. Copystands or camera mounts with a single support column can be a better option if you have one available.

Reducing camera wobble

Do everything you can to reduce movement of the camera and object in relation to each other. Make sure your tripod or copystand is firmly fixed so the camera won't move around.

A remote shutter release can help a lot to reduce camera wobble while taking the photo. Wired or wireless remote shutters for phones and most cameras are cheaply available online. Some phones allow you to use voice activation or the volume controls on a set of headphones to trigger the camera shutter.

If you don't have a remote shutter, a timed shutter setting on the camera can help with wobble (although it won't prevent you from accidentally moving the camera while pressing the shutter).

Lighting

Try to use a torch or light source with an even light. To check this, shine it on a plain surface and look for brighter and darker patches.

Taking the photographs in a completely dark setting can improve the results. If this isn't possible, try to find somewhere with low, even and consistent lighting. You will need a brighter light if photographing with other ambient lights (eg. outside in daylight).

If you have a flashgun that can be used 'off-camera' this can also be used, it will give a nice bright, even illumination but be careful of the shadows, which can be harder to detect.

Spheres

A standard sized marble is fine for most medium sized objects. For very large objects such as inscriptions or tombstones, you may need a larger one, and for small objects such as coins, a smaller one may be more suitable. The DH lab can loan spheres of different sizes for some projects – get in touch with the Lab to discuss what we can offer.

Recording

Keep good records of your photography as you go along.

You can use the DH metadata spreadsheet template (available for download as a separate file) to keep track of the locations of your images and processed files. Download the template, rename it to something specific to your project and save it in the same folder as your RTI project files. You may need to alter the fields depending on what you need for your project.

As a minimum we recommend recording:

- The name/identifier of the object being photographed
- Which images are part of the RTI set
- Any photos that you don't want to include in the processed RTI
- The camera settings you used (these may be automatically recorded in the image metadata)
- The general photography setup and what type of camera you used

About this guide

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