

The forgotten die: experiments in coin edge imaging

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High-resolution images of the obverse and reverse of most coins are now widely available, either online or in printed catalogues. Images of the edges of the coins, in contrast, are either absent or show only a limited section.

For coins with a grained or plain edge, this is of little consequence. But where an edge inscription is present, the lack of photographs showing the entire circumference in a single view is a major obstacle to the researcher and collector.

This post reviews and compares currently available techniques for coin edge imaging at minimal cost.

Before the advent of digital photography, the solution was to roll the edge of the coin in a length of plasticine, producing a mirror-image of the inscription. This could then be cast in plaster to produce a right-reading model.

This appears to be the technique used by Linecar and Stone in *English Proof and Pattern Crown-Size Pieces 1658–1960* (London: Spink & Son, 1968) to reproduce the edges of the Petition and Reddite crowns (see next page). This gives a satisfactory result in the case of the four-word inscription on the Reddite crown, but the 34 words arranged in two lines on the Petition crown are scarcely legible.

Furthermore, owners or custodians of rare or valuable specimens may be reluctant to have them rolled in plasticine, with the possibility of mechanical damage or unwanted residues that this would entail.



Edge inscription of Simon's 'Petition' Crown, No. 6



Edge inscription of Simon's 'Reddite' Crown, Nos. 7 and 7A

Illustration of the edge inscriptions of the Petition and Reddite crowns, reproduced from H. A. Linecar and A. G. Stone, English Proof and Pattern Crown-Size Pieces 1658–1960 (London: Spink & Son, 1968), p. 9.

The direct imaging techniques explored here fall into two categories:

- overlaying multiple images recorded as the coin is rotated through 360°
- use of an optical device to display the entire edge in one view

I. Image overlay technique

The principle here is to make multiple still images from a fixed point as the coin is rotated through 360°. Apart from the usual camera and lighting, the only equipment required is a calibrated turntable with a central support for the coin. This can be made by gluing a 360° protractor (£3) to a 4-inch ball-bearing turntable (£5) and then adding a plastic cylinder (diameter 20 mm, height 10 mm) to act as a support.



A simple calibrated turntable made for less than £10

The camera is positioned with the optical axis of the lens aligned with the centre of the coin's edge. Manual focus is recommended, with a small aperture to give sufficient depth of field. Multiple images are then recorded as the coin is rotated step by step through 360°. Trial and error has shown that 36 shots at 10° intervals gives satisfactory results. At 20°, the curvature of the edge becomes apparent in the final image.

The resulting 36 images look like this (only first 8 shown for clarity):



The next step is to combine the resulting images into a single continuous view of the edge.

Standard panorama tools in image-processing software such as Photoshop are not well suited to this task. They are designed to align overlapping views of a static scene taken as the camera is moved or rotated from a fixed point. In the present case, however, the camera remains fixed while the coin itself is rotated, so conventional panorama stitching is unlikely to produce a satisfactory result. In practice, manual stitching “by eye” proved to be the most straightforward solution. This is achieved by clicking and dragging each image so that it overlaps the image to its left. The eight images above are thus stitched as follows:



To stitch all 36 images is quite laborious, but with practice can be achieved in less than half an hour. The result is a very long image (the circumference of a crown-sized coin is more than 120 mm) that is easy to view on screen but difficult to reproduce in print:



For ease of reading, it can be mathematically converted to an annular shape by translating the rectangular coordinates to polar:



The image capture process is quite laborious using a manual turntable and prone to human error in accurate positioning at fixed intervals. The author therefore designed and built a motorised turntable programmed to rotate the coin through 360° in either 32, 64 or 128 steps. It also incorporates a shutter release jack for connection to modern cameras and an infrared LED to trigger older cameras. The turntable is controlled from a smartphone. Total cost of components: less than £50.



Once set up with the coin in position, the entire rotation and image capture process is automatic and takes only two or three minutes for 32 shots (11.25°). Given the greater repeatability of the stepper motor compared with manual positioning, the stitching process is easier because the overlap between successive frames is more consistent.

Apart from coins, this technique may also be of use to collectors, dealers and researchers of military medals, where the edge inscription identifying the recipient can be a major factor in the medal's value and interest.

If the inscription is not too long, a linear presentation of the edge inscription is feasible.



Edge of a medal awarded to the author's grandfather Sam, Stoker 1st Class on H.M.S. Orion at the Battle of Jutland.

II. Use of an optical device

To capture the edge in a single image, the use of a parabolic (strictly paraboloidal) mirror is a convenient solution. When a coin is placed on a support within the parabolic mirror, an image of the entire edge is reflected in the mirror and can be photographed in one shot. It can then be flipped using image processing software to produce a circular right-reading image of the edge.

Fortunately, parabolic mirrors are readily available for a modest sum due to their use in an optical illusion toy called a Mirascope (£12). This consists of two opposing parabolic mirrors, with an opening in the centre of the top mirror. When an object is placed on the bottom mirror, a real image of the object appears to float in the opening.



The Mirascope. An image of the ladybird placed on the bottom mirror appears to float over the hole in the top mirror.

For the purposes of coin edge imaging, only the bottom mirror is required. The apparent size and distortion both change as the coin is raised above the bottom of the mirror, so finding the optimum height requires some experimentation. For this purpose, 1-inch black plastic drainpipe cut to various lengths can be used as a support, topped with a felt disk to protect the face of the coin.

Ideally, the mirror should be placed in a light tent (with the opening at the top) to avoid extraneous reflections, and LED panels placed on either side of the tent to provide even illumination. A ring light (not flash) mounted on the lens also gives good results.

To minimise distortion, it is particularly important to have the optical axis of the camera lens aligned with the centre of the coin. This is most easily achieved by making slight adjustments to the angle of the camera rather than trying to finely adjust the position of the coin and its support in the mirror. For this reason, a tripod with an adjustable head is more appropriate than a copy stand.

Manual focus is strongly recommended, as otherwise the camera may autofocus on the coin rather than the reflected edge image. A small aperture (high f-number) is advisable to obtain sufficient depth of field.

The resulting image requires only minimal post-processing: flipping to obtain a right-reading image, cropping of the unwanted central area, and possibly rotation.

The cheap plastic mirror gives a reasonable result, though with some distortion of the image. A much better result can be obtained with a slightly more expensive glass mirror (£22).



Conclusion

The parabolic mirror technique enables quick capture of an edge image in one shot, requires minimal post-processing and provides reasonable resolution with little distortion (when a glass mirror is used). The image overlay technique requires multiple shots, time-consuming post-processing and provides higher resolution, though with a visible join when rendered as an annulus.

For coins, the mirror technique offers the advantages of rapid image capture and minimal post-processing, while medals with a clasp are more readily accommodated by the image-overlay technique.

Future work will include experimenting with mirror images of more challenging coins and an improved version of the motorised turntable to overcome the sinusoidal “wobble” of the platform that is visible in the linear images.

It is hoped that this post will encourage others to experiment with coin edge imaging, especially photographers more skilled than the author.

