

Watermark Identification in Rembrandt's Prints¹

The date of printing of Rembrandt's etchings need not match the date visible in the print. The print can be made years after the plate is finished.

The current approach to the matching of laid papers made on the same mold among Rembrandt's prints utilizes watermarks and the intersecting chain line patterns imprinted in the paper by the wires of the screen of the paper-making mold. The assumption is that all sheets from the same mold available for the production of Rembrandt's prints would be used in the same time period. The taxonomic results of manual classification of the watermarks in the papers of Rembrandt's prints are compiled by E. Hinterding in [Hinterding, 2006].

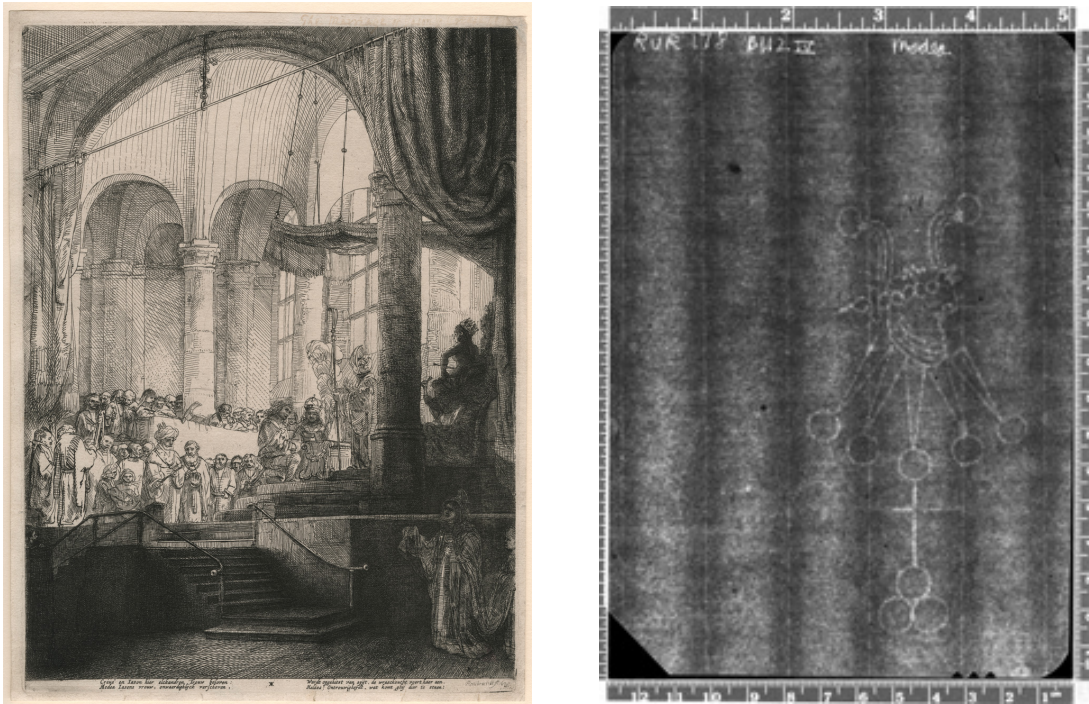


Figure 1: *Medea, or the Marriage of Jason and Creusa* (B112iv) with a beta-radiograph of its foolscap watermark from [Johnson, 2015]. The chain lines are the vertical features that are spaced approximately one inch apart (see top ruler) in the beta-radiograph.

We have access (provided by the Dutch University Institute for Art History) to scanned low-energy x-radiograph images of over 300 Rembrandt prints revealing their watermarks and the surrounding chain lines. [These files are not to be distributed outside the research group.]

¹This project description prepared by Prof. Rick Johnson for Cornell University ECE 6930 (MEng Design Project) in AY 2015-16.

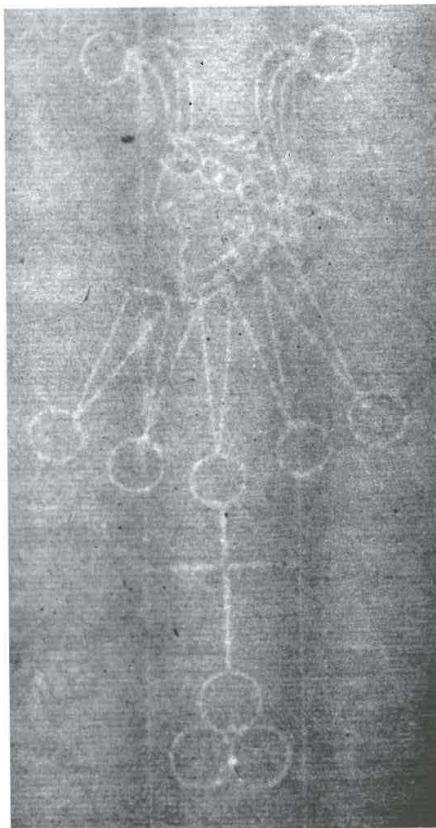
In addition, Dr. Hinterding has provided us with a revealing peak at the decision tree strategy he uses based on specific features that distinguish one (sub)type from another:

“Here is part of the magic of identifying identical watermarks, and I will start at the very beginning:

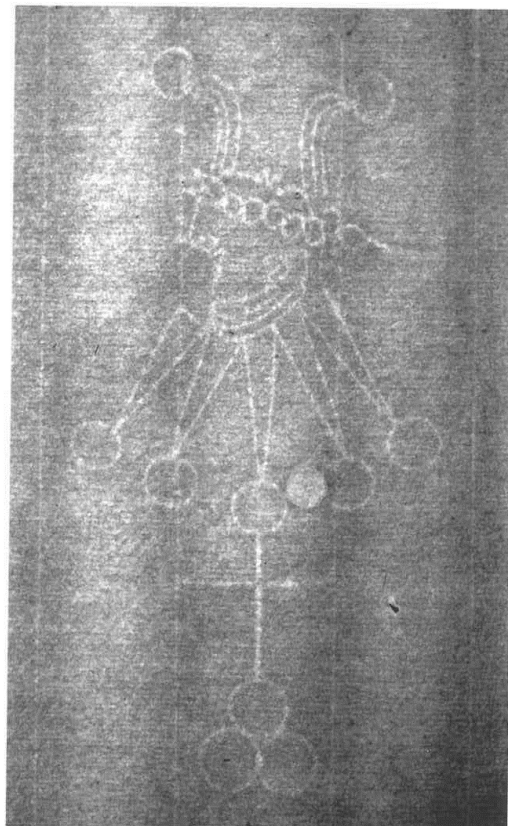
1. Identify the general type of watermark (coat of arms, foolscap, Strasbourg lily, countermark, basilisk, etc). This is fairly easy to see, but of course where I always start.
2. Identify the sub-type of the watermark, or as we call it 'the variant'. This deals with the descriptions under the heading of each variant (see the general catalogue in my dissertation, vol. 2).
 - In case of a countermark as general type, now look what the letters are, and go to that particular group in the catalogue.
 - In case of a foolscap, does it have seven points to its collar, or only five points?
 - In case of a Strasbourg lily, are there three bands under the crown (with jewels in the central band? What shape?), or only two bands under the crown? If there are three blank bands under the crown, what are the letters are underneath the watermark? The very common 'WR' (Wendell Riehel, from Strasbourg, but his initials are copied literally everywhere), or other initials. With other initials, go there in the catalogue. Is the crown (that always follows the same scheme or pattern) very elaborate and high, or fairly simple?
 - In case of an Arms of Amsterdam, are there elaborate curls around the crown surmounting the shield with the three X's (that is the actual arms of Amsterdam)? If not, is the crown completely plain, or are there small jewels visible there? Are the lions upholding the shield standing on a platform? Is the strip with the three X's delineated by a single line on each side, or by a double line on each side (compare variants A and B, both with double lines there)
3. Is there a chain line running through the centre of the watermark? This is a distinguishing feature as well. The ones with a chain line

running through the center, are indicated as "A' ", with an apostrophe after the initial/capital assigned to the variant. If not, we only assigned a capital, without the additional apostrophe.

But this is all fairly obvious, of course, and only divides various watermarks in various general groups and variants. But how to distinguish two very similar watermarks, and decide whether they are 'very similar, almost identical' or in fact 'identical'? As an example I will use two very similar watermarks, 'Foolscap, five-pointed collar', variant K.a.a. and variant K.a.b. (see photographs). Here I do a lot with how this watermark relates to and intersects with the chain lines.



Foolscap with five-pointed collar-K-a-a_MJV-FWC-149-A



Foolscap with five-pointed collar-K-a-b_CFL-2045

Figure 2: Foolscap with five-pointed collar: K-a-a (left) and K-a-b (right) from [Hinterding, 2006]

The differences:

- In variant K.a.a. the front peak of the jester's cap (above his eyes and nose) protrudes over the chainline, and the bell is completely

to the left of the chain line. In variant K.a.b. however, the bell intersects with the chainline, and hence is not exactly in the same position. This also makes clear that the bell - in relation to the peak of the cap - tilts a bit upwards, which is a nice distinction from ALL other Foolscaps, variant K.

- In variant K.a.a. outer contour of the uttermost right point of the collar reaches the back of the neck of the jester, whereas in variant K.a.b. this outline stops in 'mid-air', it does not reach the neck.
- In variant K.a.a. the second-left point of the collar just reaches the chainline, and at that very point the bell is attached to the point. IN the same mode, the second-right point of the collar just falls short of reaching the chain line. In variant K.a.b. the second-left point just falls OVER the chain line, whereas the second-right point also falls over the chain line (and does not stop in front of it, like in variant K.a.a.). Something similar applies to the transition of the second-right and the far-right points of the collar. This transition does not reach the neck in variant K.a.a., but it does in variant K.a.b.
- In variant K.a.a. there is a clear sewing knot between the lowest two rings underneath the watermark, showing as a white little spot. There is no such knot visible in variant K.a.b. (once you have seen more examples of the same watermark, you will realize that this knot shows up on all the same variants).
- In variant K.a.a. the second-left point of the collar is thinner than the same point in variant K.a.b. Etc.

Already from the bell that I started with it is clear that these two are not the same, and any watermark that is the same in all these features, must be identical. It is also interesting to compare these two with the other variants K, that are all very similar, but differ in details like the above. Hence they are not the same.”

The long-term goal of the project is to automate watermark identification in Rembrandt's prints. This could begin with developing tools that assist the manual matching described by Dr. Hinterding or attempt to replace some of the manual (sub)tasks with fully-automated versions. The short-term goal is deciding if the features to be used in identifying watermarks that have had different life histories need be scale-invariant.

In addition to [Hinterding, 2006], we will review 2 other PhD theses, one [Hiary, 2008] on automated strategies for extracting watermarks and the other [Staalduinen, 2010] on automated strategies primarily for extracting chain and laid line patterns.

- By the way, is the watermark in Figure 1 K-a-a or K-a-b or neither?
- How about the watermark partially visible in the raking light photo below in Figure 3 of a Rembrandt print at the Cornell University Johnson Museum? Is it K-a-a or K-a-b or neither? Or do you need more information to decide?

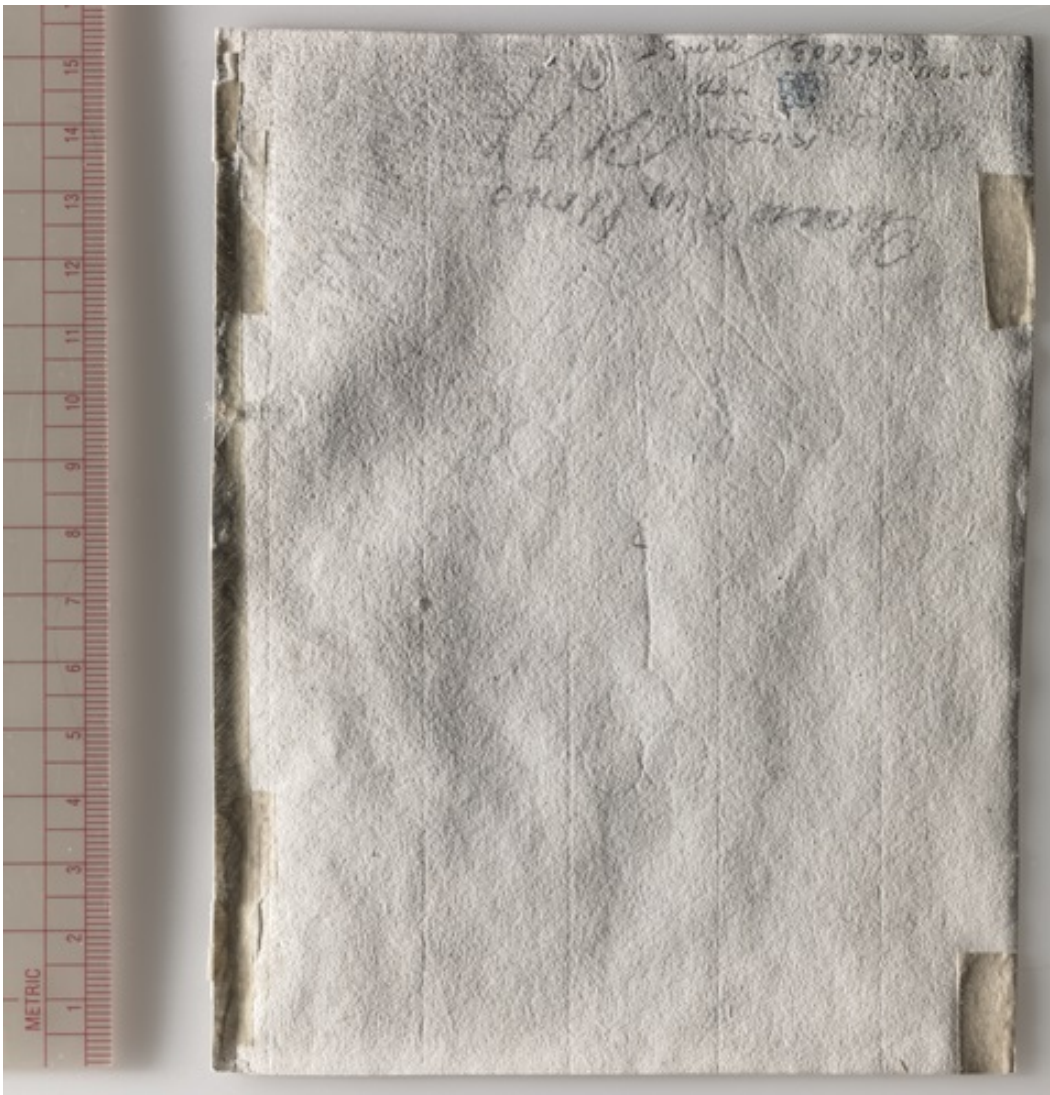


Figure 3: Vertical chain line impressions visible in raking light image of the back side of a Rembrandt etching "The Small Lion Hunt (with Two Lions)" on laid paper from [Doing, 2015]

References

- [Doing, 2015] P. Doing and C. R. Johnson, Jr., “On Applying Signal Processing to Computational Art History: An Interview,” *International Journal for Digital Art History*, issue 1, pp. 64-75, 2015.
- [Hinterding, 2006] Erik Hinterding, *Rembrandt as an Etcher: The Practice of Production and Distribution*, (dissertatie) Ouderkerk aan den IJssel, 3 vols., 2006.
- [Hiary, 2008] Hazem Ali Abd Al Faleh Al Hiary, *Paper-based Watermark Extraction with Image Processing*, PhD Thesis, University of Leeds, July 2008.
- [Johnson, 2015] C. R. Johnson, Jr., W. A. Sethares, M. H. Ellis, and S. Haqqi, “Hunting for Paper Moldmates Among Rembrandt’s Prints,” *IEEE Signal Processing Magazine* (Special Section on Signal Processing for Art Investigation), vol. 32, pp. 28-37, July 2015.
- [Staalduinen, 2010] Mark van Staalduinen, *Content-based Paper Retrieval Towards Reconstruction of Art History*, PhD Thesis, Technische Universiteit Delft, October 2010.