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LEOcode Goes Live: A Dynamic Resource and Tool for Paper Historians, Conservators, Codicologists, and Art Historians

LEOcode (leocode.org) is a free, web-based resource that presents the results of detailed encoding and visualization of three internal manufactured patterns found in the papers contained in two notebooks[1] by Leonardo da Vinci (1452-1519): watermarks, chain line intervals, and laid line densities. Moving beyond Leonardo's papers, *LEOcode* provides easy-to-learn computational tools that can be used by anyone with an interest in precisely characterizing pre-machine European papers.

Computational "coding" is the process whereby a researcher examines and transforms a digital image of the watermark and chain lines in a sheet of paper into a numerical code that can be compared to codes derived from other papers. Computational coding is straightforward and uses readily available digital photographs of the recto and verso and a transmitted light digital photograph of the paper in question. The scale and resolution of the images do not need to be the same. The procedure involves:

- enhancement of the paper's internal structure (watermarks, chain line intervals, laid line densities) by the virtual removal of surface writing and drawing,
- marking and measurement of unique watermark features and chain line intervals and the generation of the codes,
- comparison and matching of the codes to identify paper moldmates and their probable twins.

The results of coding, i.e., moldmate matches, can be presented via static visualization graphs or by animated overlays. Dynamic looping videos appeal to the close looking skills of users. Their temporal nature, however, makes sharing animated overlays via traditional scholarly journals problematic. A resource like *LEOcode* allows for active engagement and decision-making on the part of the researcher. The site contains links to general information on the various aspects of the project, as well as line drawings of each moldmate group, every watermark type found in and shared between the two notebooks, and a growing accumulation of animated overlays. In addition, instructions for the use of the software suite are included, and available to researchers. The authors hope that increasing interest in the software will engender more opportunities for collaboration with other researchers.

Keywords: watermarks, moldmates, Leonardo da Vinci, animations, chain lines, laid lines

[1] The Codex Leicester (Gates Collection) and the Codex Arundel (British Library MS 263).