

Terahertz Imaging of Unreadable Manuscripts

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Abstract — Terahertz radiation is known to penetrate paper, and therefore terahertz imaging could be used to read what is unreadable at infrared and visible wavelength e.g. because the pages are sticking to each other, or the ink has disappeared leaving behind a physical modification of the paper, or cartouches were glued by the ancient writers on top of some hidden text. In spite of the various case studies from Terenzio Bembino Code of the sixth century A.D. to Carlo Emilio Gadda in the twentieth century, terahertz imaging has not been extensively applied to ancient parchment nor to modern paper manuscripts. The new text that will be brought to light by terahertz could bring about a radical revival of important literacy studies.

I. INTRODUCTION

FOR some time now, a number of methodologies such as infrared reflectography, NIR/VIS/UV spectrophotometry, X-Ray fluorescence have been used for the study of artistic artefacts (paintings, sculptures, archaeological findings) and, in certain cases, even to parchments [1]. However, no extensive use of these technologies has yet been made in relation to ancient and modern paper manuscripts (available from any period from sixth to twentieth century), in spite of the various case studies – from the Codice Bembino of Terenzio, to Carlo Emilio Gadda – in which they might fruitfully be implemented. In the case of manuscripts on paper, there is a clear advantage in using terahertz radiation, as it is only slightly attenuated by paper (as opposed to NIR/VIS/UV and also mid-infrared radiation) [2]. Terahertz imaging could then be used to “read a book through its cover” instead of “reading it by its cover”. In other words, by developing a technology capable to read the unreadable pages e.g. because the pages are sticking to each other, or the ink has disappeared leaving behind only a physical modification of the paper, or cartouches were glued by the ancient writers on top of some hidden text but cannot be removed without destroying the new text. With such “new” words brought to light, a radical revival of the level of studies in the field of historic manuscripts could arise.

II. PROPOSAL

As an interdisciplinary working group, we plan to test the application of terahertz imaging, possibly coupled to some kind of NIR/VIS/UV spectroscopic imaging, to the study of parchment and paper manuscripts. The final aim is to produce a transportable scanner prototype. This will make it possible to study written texts concealed under cartouches or other small pieces of paper, or hidden as a result of pages stuck together that became impossible to separate due to damage over time.

Beyond, terahertz imaging, another interesting possibility of

using the NIR/VIS/UV spectroscopy module that would be mounted on the instrument head to analyze unique texts written by hand, is to identify the succession of corrections, which would make it possible to distinguish between, and provide a digital representation of, glosses produced by different authors and corrections made with different inks at different chronological stages.

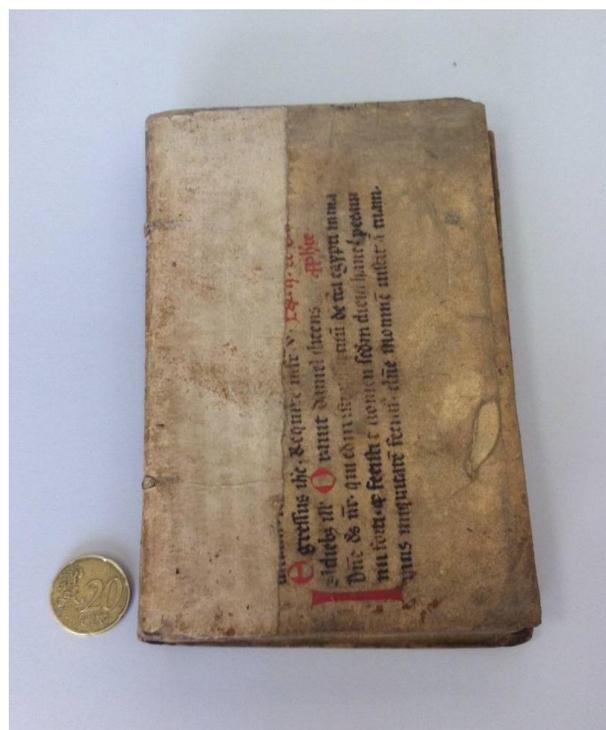


Fig. 1. An image of a typical historic manuscripts that could be studied by terahertz imaging. The text on the left side of the manuscript was covered by a paper layer that makes it unreadable.

III. SUMMARY

In conclusion, we propose a new method for studying manuscripts intended to bring back to light texts that have been lost or damaged over time, in order to preserve the largest heritage of written culture in Europe, interpret texts through the history of their corrections, and enter into the creative workshop of the great writers of the past.

REFERENCES

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