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BLAŽ BAROMIĆ 2018

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Cijenjene kolegice, cijenjeni kolege,

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Pred Vama je Zbornik sažetaka Konferencije koji sadrži sažetke znanstvenih radova kroz koje su pokrivene teme Konferencije: povijest tiskarstva, knjige i pisma, grafičke komunikacije i mediji, grafički dizajn, fotografija, izdavaštvo, priprema za tisak, tisak, dorada, ambalaža, sustav upravljanja bojom i kolorimetrija, materijali, postojanost papira i otisaka, kontrola kvalitete, marketing, ekologija i ostale teme vezane uz tiskarstvo, dizajn i grafičke komunikacije.

Radove, čije sažetke možete pronaći u ovom zborniku, recenzirali su članovi Međunarodnog znanstvenog i recenzijskog odbora Konferencije, no za sadržaj radova, podatke iznesene u njima i njihovu prezentaciju odgovaraju sami autori pojedinog rada.

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Urednik

Introduction Words

Dear Colleagues,

Welcome to the 22nd International Conference on Printing, Design and Graphic Communications Blaž Baromić!

The Proceedings of the 22nd International Conference on Printing, Design and Graphic Communications Blaž Baromić is in front of you. It contents abstracts of scientific papers covering Conference topics: History of printing, book and script, Graphic communications and media, Graphic design, Photography, Publishing, Prepress, Press, Postpress, Packaging, Color management, Materials, Paper and print durability, Quality control, Marketing, Ecology and other topics related to printing, design and graphic communications.

The book contains abstracts of the papers, which will be presented on the Conference. All papers are reviewed by members of the International scientific and review committee, however the contents and date of the papers and presentations are the sole responsibility of the authors.

Papers whose abstracts are published in the Book will be presented as invited lectures, oral presentations and posters and I hope that the Book of Abstracts will help you in active participation on the Conference.

I wish pleasant time in Senj and successful participation on the Conference to all authors, Conference participants, Conference organizers, members of Organizing and Scientific and Review Committees, sponsors and donators!

Editor

OPTIČKE KARAKTERISTIKE PAPIRA STARIH KNJIGA OBILJEŽENIH VODENIM ŽIGOVIMA

OPTICAL FEATURES OF WATERMARKED OLD BOOKS PAPER

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SAŽETAK

Tri toma prvog sveska knjige Nacionalne i sveučilišne knjižnice u Zagrebu (signatura: RIIF-4- 358- sv.1, RIIF-4- 358- sv.2, RIIF-4- 358- sv.3) preliminarno su istražena slikovnom analizom i spektroskopskim metodama. Optičke karakteristike starih papira analizirane su u odnosu na debljinu papira, reflektanciju i vizualni identitet vodenih žigova koje sadrže. Sličnost reflektancija naslovne i nasumično odabrane stranice mjerenih na tri toma prvog sveska knjige ukazuje na monotonu proizvodnju papira. Drugačiji tip papira s otisnutim zemljopisnim kartama trećeg toma prvog sveska knjige karakterizira njegova reflektancija jednako kao i različitost vodenog žiga. Stilizacija inicijala IMB rezultat je slikovne analize tipografskih vodenih žigova tri toma prvog sveska knjige stoga vodeni žigovi trebaju biti razmatrani kao vizualni identiteti s obzirom da su proizvođači papira razvijali njihovu tipografiju.

Ključne riječi: Optičke karakteristike papira, reflektancija, papir starih knjiga, vodeni žig, mreža papira

ABSTRACT

Three parts of first volume of a book in possession of the National and University library in Zagreb (call numbers: RIIF-4- 358- sv.1, RIIF-4- 358- sv.2, RIIF-4- 358- sv.3) were preliminary observed by image analysis and by spectrophotometric method. Regarding the optical features of these old books paper, these books were analyzed through paper thickness, watermarks characteristics and reflectance.

Similarity of reflectance measured on front pages and random pages for all volumes supported by the same watermarks reveals monotonous paper production. Measurements results showed that printed map paper of third part has been made from different type of paper according to its watermark and reflectance. Typeface stylization for initials IMB is image analysis result of typographic watermarks measured through three parts of the first volume, therefor watermarks should be treated as typographic logos since papermakers were developing visual identity through time.

Key words: Optical features, reflectance, old books paper, watermarks, paper grid

INTRODUCTION

Watermarks are European invention. They are not found in old Chinese or Arabian paper. This can be explained by the fact that papermakers in Europe began to use rigid paper moulds to which wire figures could be attached. [1] Watermarks are produced by thinning out of the fibres in the required shape and area. When the light passes through the paper the watermark is more translucent than the surrounding area and creates effect of the appearance of the image. The watermark provides information on the origin of the paper and high security paper and graphic product. [2] Today's use of watermarks is to determine where the paper was produced and to understand it's distribution. Watermark research differentiates between identical watermarks and variants. Watermarks that are considered identical are the same in all details. Both the impression of the wire figure and the placement on the mould and so are perfectly congruent, which can be tested by laying transparent copies one above the other. In contrast, watermarks that are classified as variants, as the term is used today, were clearly made with the same wire figure, but during the production process the shape of the figure changed, creating watermarks that are different from one another. [1]

The aim of this paper is to preliminary observe old book's paper comparing data measured by spectrophotometric method and image analysed watermarks relevant to papers reflectance. According to this task it was extremely important to treat watermarks as typographic logos because typeface constructions and deletions through three parts of the first volume of a book in possession of National and University library in Zagreb reveals development of the same initials through time.

EXPERIMENTAL PART

Experimental samples for optical features analysis were old book's paper in possession of the National and University library in Zagreb, *Scriptores rerum Hungaricarum veteres ac genuine* (call numbers: RIIF-4- 358- sv.1, RIIF-4- 358- sv.2, RIIF-4- 358- sv.3). Thickness of paper is measured with micrometer eleven times on different places. Front pages, random pages and map papers of each volume were preliminary observed by spectrophotometric method, measured twenty times on different places with white standard background so average reflectance are presented and compared through image analyzed watermarks characteristics. Papers reflectance measurements were processed using X-rite SpectroEye spectrophotometer in the interval of the wavelengths from 380 nm to 730 nm for every 10 nm, with standard illuminant D65 and 2 degree of observer. These measurements were analyzed by Technical Graphic Origin 6.0 Professional.

Lightness (L'), hue (H') and chroma (C') the color difference (ΔE) was calculated according to Equation 2. [3]

$$\left(\frac{\Delta L'}{k_L S_L}\right)^2+\left(\frac{\Delta C'}{k_C S_C}\right)^2+\left(\frac{\Delta H'}{k_H S_H}\right)^2+ R_T \frac{\Delta C'}{k_C S_C} \frac{\Delta H'}{k_H S_H}$$

(2)

Where:

ΔL' is the transformed lightness difference between old papers

ΔC' is the transformed chroma difference between old papers

ΔH' is the transformed hue difference between old papers
RT is the rotation function
k_L, k_C, k_H is the parametric factors for variation in the experimental conditions
S_L, S_C, S_H is the weighting functions.
Acceptable values of color difference (ΔE) are given in table 1, from which it can be concluded about paper optical features.

Table 1 Color difference tolerance [4]

ΔE values	Tolerance
<1	The color difference is not visible to the naked eye
1-2	Slightly color difference, optimal color difference
2-3,5	Moderately color difference
3,5-5	Noticeable color differences
5>	Significant color difference

RESULTS

Typeface and paper grid results

For better understanding reflectance results it is necessary to point out development of watermarks typeface (Table 2). Figure 1a shows typographic watermark detected in the first part of the first volume, including the map paper, observed according to watermarks shape and paper grid. This watermark can be split in four letters- IVIB or three letters- IVB, therefor deconstruction of typeface disables unique meaning. Another watermark (Figure 1b) detected in the second part of the first volume, observed according to watermarks shape and its grid, can be split in two or four letters- MB or IVIB. Watermarks characteristics of third part of the first volume are significantly different to the first and second parts (Figures c and d). Although watermark presented in Figure 1c seams to be made from three letters- JVB which may look different from previous watermarks, Bernstein- the memory of paper [5] data base of watermarks equals letters I and J, therefor watermark detected on front page and random page of the third part can be split in three letters- IVB or four letters IVIB. Finally, watermark detected in third part, Figure 1d, solved diversity of watermarks initials because it is made from absolutely separated three letters- IMB, which means that all previous watermarks where just typeface stylization for initials IMB. That means that all front pages and random pages for all volumes was made by the same papermakers, including map paper from the first volume, or was made for the same client.

Table 2 shows watermarks appearance through three parts of the first volume

	First part (1 vol.)	Second part (1 vol.)	Third part (1 vol.)
Front page	IVIB, IVB (IMB)	MB, IVIB (IMB)	JVB (IMB)
Random page	IVIB, IVB (IMB)	MB, IVIB (IMB)	JVB and IMB (IMB)
Map paper	IVIB, IVB (IMB)		Figurative watermark

Figure 1. Development of Watermarks initials IMB through time: Watermarks from the first part of the first volume, vectorized example from the book (a). Watermarks from the second part, vectorized example from the book (b). Watermarks from the third part, vectorized example from the book (c). Watermarks from the third part, vectorized example from the book (d).

Table 3 Characteristic of paper production grid on front pages

Label	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7
First part (1 vol.)	2,66	2,91	2,88	2,76	2,98	2,61
Second part (1 vol.)	2,66	3,08	2,88	2,74	2,81	2,95
Third part (1 vol.)	2,98	3,00	2,91	3,10	2,86	2,95

Distances between paper grids measured on front pages of three parts of the first volume showed frequently appearance of similar results, especially between front pages of first and second parts, therefor further research might reveal its potential benefits of providing information about paper production process without watermarks.

Reflectance results

Reflectance of front pages for three parts of the first volume are presented in Figure 2a. Results of this similar reflectance shows that renovated front page in third part has the lowest values, but the color difference between second and third renovated front page is not visible to the naked eye, while the color difference between front page of the first volume and renovated front page from the third part is in optimal range (Table 4). Paper thickness of renovated front page is improved for 30-35% (Table 5) compared to first and second part. Although reflectance (Figure 2b) measured on equally watermarked random page and map paper of the first part look similar they are quite lower for 10% ticker (Table 5) maps paper, and the color difference between these two papers are considered to be noticeable to the naked eye (Table 4). Monotony of the reflectance measured on random page papers in first and second volume with just 5% thickness differences between them (Table 5), and both characterized with the same watermarks, results moderately color difference (Table 4). Reflectance of map papers from first and third volumes with noticeable color difference between them are crossing at 620 nm, which indicates diversity of 23 % ticker (Table 5) map paper measured by spectrophotometric method in the third volume marked with different watermark (Table 2).

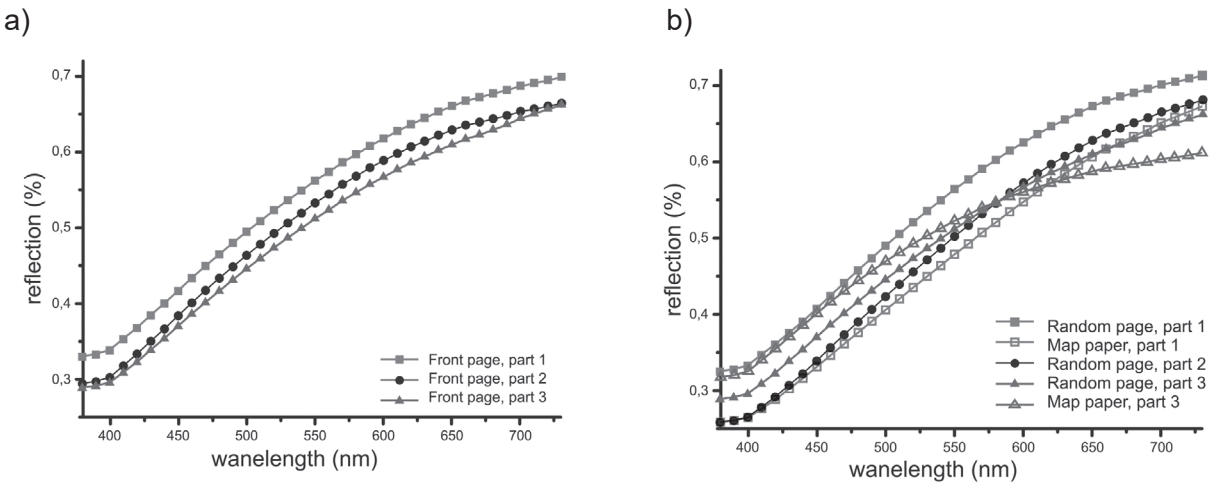

Figure 2. Reflectance values of front pages for three parts of the first volume (a). Reflectance values of random pages for three parts of the first volume and map paper from first and second part of the first volume (b).

Table 4 shows Euclidean color difference (ΔE_{00}) of measured papers

Paper color	Paper color	ΔE_{00}
Maps paper (1 volume)	Maps Paper (3 volume)	4,29
Front page (1 volume)	Front page (2 volume)	1,30
Front page (1 volume)	Front page (3 volume)	2,05
Front page (2 volume)	Front page (3 volume)	0,90
Random page (1 volume)	Random page (2 volume)	3,01
Random page (1 volume)	Random page (3 volume)	2,15
Random page (2 volume)	Random page (3 volume)	2,06
Random page (1 volume)	Maps paper (1 volume)	3,83

Table 5 paper thickness

	Front page, part 1	Front page, part 2	Front page, part 3	Random page, part 1	Random page, part 2	Random page, part 3	Random page, part 1	Map paper, part 3
No (N)	11	11	11	11	11	11	11	11
Median	9,0 µm	8,5 µm	13,5 µm	9,0 µm	9,0 µm	10,0 µm	10,0 µm	13,0 µm
Std. dev.	0,4	0,4	1,6	0,8	0,7	0,9	0,9	0,7

DISCUSSION

Since author of prologue Matthias Bel could be associated with initials IMB, it was assumed that these watermarks were made by papermakers for the same client in the book Scriptores rerum Hungaricarum veteres ac genuine. First part of the first volume was published in 1746, therefor, his publication in possession of the National and University library in Zagreb in the range of similar years was examined. In Compendium Hungariae geographicum, 1767 (call number: L VI E6) initials PO was found. Adparatus ad historiam Hungariae, 1775 (call number: RVI-4°-46) revealed several typographic watermarks: HIS, IN/NI and IL. Initials IDF was

found on random pages in three parts of the first volume of Notitia Hungariae novae historico-geographica, 1785, 1786, 1787 (call numbers: Lix. A7 1, Lix. A7 2, Lix. A7 3). This diversity of initials suggests that typographic watermarks IMB was produced by the same papermakers. From this example we can than conclude that papermakers realized importance of watermarks consistency because only watermark variants (technological reason) of initials IDF was found in first three parts of the first volume of Notitia Hungariae novae historico-geographica published in just three years. With exception of extra watermarks found in first part of the first volume with ample blank space. Frontispiece in this serial are watermarked with framed initials DFI below figurative rose. While watermarks from the first and second part are identical, watermark from the third part is it's variant (technological reason). Playing with letter I is interesting again because it is hard to easily explain why does using it at the beginning of initials DF on every random page in three parts of the first volume, and as the last on every extra decorated watermark on frontispiece of the serial, except as technical fault that no one has noticed even while watermarks platen was reconstructed during papermaking for the third part of the first volume. Since two typographic watermarks with initials IDF was made for publishing first part of the first volume error of random initial can be exclude. If displacement of letter I is usual appearance than initials MB might belong to Matthias Bel.

CONCLUSION

This preliminary research has provided several conclusions:

- Watermarks should be treated as typographic logos since papermakers were developing visual identity through time.
- According to watermarks all front pages and random pages were made for the same client, or made by the same papermakers, including map paper from the first volume.
- Similarity of reflectance measured on front pages and random pages for all volumes supported by the same watermarks reveals monotonous paper production.
- Restauration of the front page of the third part of the first volume improved thickness of the paper therefor reflectance is lower.
- Printed map paper of third part of the first volume has been made from different type of paper according to reflectance values and diversity of watermarks.

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