ORIGINAL SCIENTIFIC PAPER

ACTA GRAPHICA 228

Black Twin Colors on Topographics Maps in Digital Print

Authors

Maja Matas*, Vilko Žiljak

Croatia
**E-mail: maja.matas@grf.hr*

Abstract:

Spot dyes join the double feature of the INFRAREDESIGN® theory. A large number of planned colors in graphics of topographic maps, are simulated in the press with only four process colorants. Achieved are seperated infromation for the visible and infrared spectrum. This introduces the protection of printed matter, protection of property, reduces the cost of spot printing of large numbers of layers. For the digital print technology simulation of the merge of "topographical colors" is extended to achieve Infrared graphics. The black color tone, a typical color in cartography, is associated with two dyes with different compositions and different properties in the infrared spectrum. Black twins are programmed for the digital printing form for the printing with CMYK process components, and according to the IRD® procedure.

Keywords:

INFRAREDESIGN®, Infrared Colorants, Spot Colors, Digital Print, Topographic Maps

1. Introduction

Conventionally, plans and geographic maps are printed in a high number of colors prepared as spot colors. Six colors are proposed in the representation of topographic maps. The law does not define dye composition for each printing technique. In the print of maps, experimental press, offset print and digital print are used. Topographic maps are produced with machines for experimental press and plotters. The press with big circulation is done in offset. Every combination defines another way of mixing and creating dyes, regardless of wheather they are hand mixed or an algorithm is used in the production of the print form. Every color can be made in a definite number tof ways for the same method of print. INFRAREDESIGN® comes into that field and brings the concept of security press.

In map press, different color layers in the computer graphics system are used for marking rivers, seas, green areas, roads, names, heights. Marking different elements: for the blue sea, black road lines, bridges, forests, orchards. This paper introduces the double condition of those layers and their respective colorants as twin colorants used for creating protection of the press, protection of the information (Žiljak Vujić, et al., 2014). Since all the planned colors are lead as extra records, the IRD® method increases the number of layers. Introduced are standards (Product specification, 2003) by the RGB system. For every real printing, for example offset or screen printing, colorant compositions are deveoped according to the Pantone recipes for the given RGB color tone. Manufacturers of dyes do not have a new idea about twin colors according to the response in the visual and infrared spectrum (Agić, 2013). The recipe and composition of twin dyes for the blue color tone is given on symposiums which confirms that the twins can be made with process colors (Uglješić, et al., 2014). Digital printing has limitations in the color choice and their respective printing forms. Possible are in the application of digital print special orders of spot dyes for the forensic field, document print, financial statements. In this paper we consider protective printing with the use of the standard process of dyes as shown in the works of authors who have developed the INFRAREDESIGN® technology (Matas, et al., 2013; Žiljak Stanimirović, 2013; Žiljak Stanimirović, 2014). Digital printing is mostly a four-color printing process with the dyes cyan, magenta, yellow and black. The layered print with a large number of different colors is simulated with dyes given in digital printing technology: four-color, six color or eight color. While the offset production uses the green spot color to indicate green spaces, digital printing will use several dyes to simulate that green. It is the same when marking hights. Instead of one brown blended for offset printing, digital printing will be dealt with three dyes: yellow, magenta and cyan. These are the same dyes, cyan, magenta and yellow, which will simulate all other line graphics on topographic maps.

All information from a large number of layers are connected through the CMYKIR procedure of connecting process dyes in the press or in the process of making printing forms. This applies to all types of printing, especially for digital print. According to IRD theory (Pap, 2010), twins or dyes are marked as V or Z. Both groups of dyes absorb solar light from 400 to 700 nm. Only the Z group of dyes absorbs the near and infrared spectrum for extraction of the Z information. ZRGB (Žiljak, 2011) cameras are used that that separate graphics designed specifically for the V range, and separately for Z range.

2. The simulation of spot colors

The paper applies the IRD® procedure only to the black color. Introduced is the dual state of the black cartographic colourant. Set is the infrared black dye twin of the black visual dye. Elements that are labeled with the black colors are mark in two ways. Separated are roads and names from the graphics that indicate the building. The first group is joined by the V black colorant and the second group is joined by the Z black dye with the Z value of 40% stake.

Table 1. spot colors for the simulation with process dyes

Index	Label	Representation	L*a*b	RGB
1	black 1, black 2	constructed objects and toponyms	0 , 0, 0	0, 0, 0
2	dark blue	line elements, hydrography symbols, water area titles	67, -21, -44	0, 175, 240
3	light blue	water area	91,-9, -11	200, 235, 250
4	green	hedges, line elements, symbols of vegetation	61, -53, 30	0, 170, 90
5	green 1	deciduous forests	89, -14, 25	210, 230, 175
6	dark brown	natural and artificial levees and incise	53, 9, 21	150, 120, 90

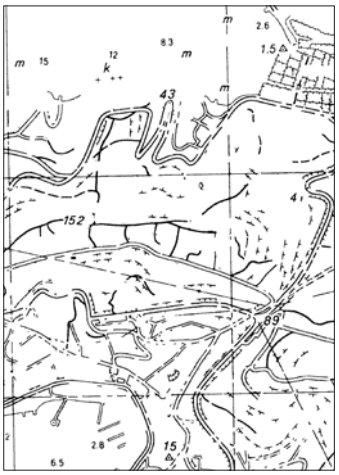

Figure 1. black color, Z layer, separated paths and roads

Figure 2. black color, V layer, buildings, names printed with V colorants with a composition that does not absorb the NIR light (R,G,B = 0%, 0%, 0% ; C,M,Y,= 33%, 33%, 33%)

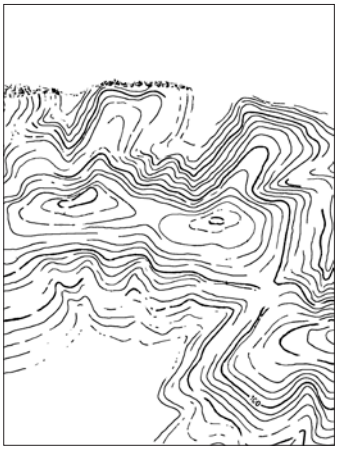

Figure 4. green 1 layer, area with deciduous forests; used is the screening method for wide green areas (RGB 210, 230, 175)

Figure 3. dark brown layer, marking area with natural and artificial levees and incise (RGB 150,120, 90)

Figure 5. green layer; emphesising with the darker green color borders of hedges and symbols of vegetation (RGB 0, 170, 90)

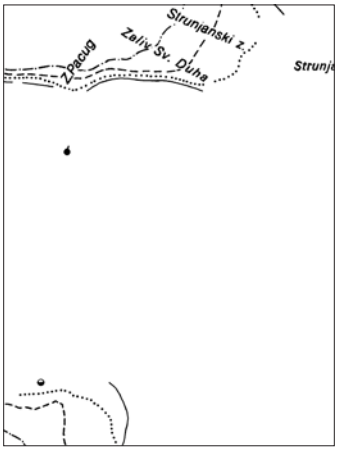

Figure 6. dark blue layer; the darker blue color marks sea, river, water area names which need to be visible inside the light blue of the water area (RGB 0, 175, 240)

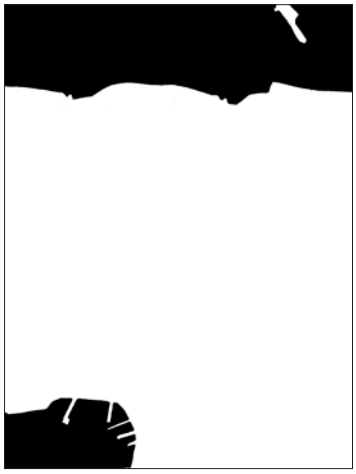

Figure 7. light blue layer; marking water areas (RGB 200, 235, 250)

Figure 8. joint of all layers for the four color process dyes

2.1. THE SIMULATION OF BLACK COLOR WITH V AND Z COLOR TWINS

Digital printing is available more than ever. At the same time, the production of forgeries is growing, and the need of digital document protection. Digital printing has introduced the possibility of small print runs. The quality of the registration is excellent and the simulation of halftone spot color dyes is satisfactory. Layers are merging, with the digital definitions, with different colors in the reproduction process dyes.

The plan in the area of Portorož, which is marked with a black color tone is separated into two layers. The purpose is to mark the black layers for the visual and infrared spectrum. Introduced is the term of two black colors: "black" – K1 and "carbon black" - K2. The same stakes of C, M, Y give the appearance of the black K1 color. In that sense we create different colors with mixing the K1 black color once, and next time the K2 - carbon black. This way of mixing will ensure that every color tone can have two states: the Vusial – V and the Visual Infrared – Z.

All of the layers 2-6 are intended only for the V range. For these layers, the performance of the digital press is used only with the C, M, Y colorants. The initial, original black layer is separated into two layers. The first is designed for the visual spectrum and the content of the second black layer is intended for viewing with an infrared camera. The ZRGB camera separates the information of the two black layers. The camera will extract and show the black Z layer. The ZRGB camera does not see the first layer, as it does not see any other layers of other information on a topographic map. (layer 1, uses the C, M, Y, K colorants, 20%, 20%, 20%, 40%,).

2.2. LAYERS FOR SPOT COLORS

Initially all layers coming from the memory are black and white before the merge. The colors for process printing are displayed only in the merger of all layers. The black Z dye is the twin color with the maximum response in the infrared spectrum. Merging the black layer prepared with the Z input, provides the security of the topographic map carrying the information for the ZRGB camera. The repoduction is carryes two images. Both show the same geographic area. The Z layer will be visible on 100 nm showing only paths and roads. Other constructed objects such as houses and the names of the area will not be visible in the IR spectrum. A safety system for reproduction and print is set with the dual state.

3. Conclusion

The technology of screening is used several times. First, every layer is joined by three process components depending on the achievement of the targeted color. Second, within the layer which has two shades of spot color definitions, „raster inside raster" is used. As in the examples in the blue layer, screening is used depending on the coverage the effect of darker blue or lighter blue is achieved. Also in the green layer where the screening method is used in digital print for the wide areas of forests and meadows and full color for the area names. The same colorant will have a different visual effect on the human eye – lighter green /darker green. The digital print has its benefits because it combines information from 7 layers into 4 printing forms. The printing form is excusivelly made from the black component. The work defines the usage of digital infrared protective print for the security of topographic plans and maps. The protection of topographic information in achieved through twin colors which integrate two spectrums – the visual and infrared. Created is a double state of the document. Digital printing and modern scanning technology allow easier information rearrangement. Is difficult to identify the original document with the correct information from the forgerie. Scanning and copying changes to information without authorization. Counterfeit plans and maps are printed and the age of digital manipulation requires a new dimension of map protection. Maps secured with the usage of the INFRAREDESIGN® technology cannot be photocopied, scanned or reproduced without losing the infrared component. Map production is expensive and time consuming, therefore it is important to secure copyrights for map owners. Topographic maps are state documents with data that needs to provide accurate data. Credibility is essential and the accuracy of the data guarantees the author.The work introduces improvement of the security of such document with topographic information with the possibility of infrared detection. The twin black dyes become carriers of double-separated state of the visual and infrared areas. This is a new way of document protection in all steps of the production and further usage. Twin dyes cannot be forget. Any altering attempt removes the infrared component.

References

Žiljak Vujić, J., Matas, M., Pogarčić, M., Žiljak Stanimirović, I., *Topographic Maps with Infrared Colors// Procedia Engineering*, 25th DAAAM Inter- national Symposium on Intelligent Manufacturing and Automation, 2014 / Katalinic, Branko (ur.). Vienna : DAAAM International, 2015. 928-935

Product specification, Croatian geodetic bureau, may 2003.

Agić, D., Agić, A., Bernašek, A., 2013 *Defining twin color pairs for developing comprehensive extended nir image parameters*, Politechnic & design; Vol. I, No. I, p: 27-32; ISSN 1849 - 1995;

Uglješić, V., Žiljak Stanimirović, I., Koprivnjak, S., Žiljak Vujić, J., Bernašek, A., 2014. *The twins dyes principle on the camouflage uniform*. Blaž Boromić

Matas, M., Rajendrakumar, A., Žiljak-Vujić, J., Hoić, A., 2013.

The role and significance of a designer in postage stamp design with infrared graphics. Tiskarstvo & dizajn / Žiljak-Vujić, Jana (ur.) Zagreb: FotoSoft, 2013. 11-13

Žiljak-Stanimirović, I., Žiljak-Vujić, J., Matas, M., 2013.

Infrared colorants as twins for security printing of documents and securities. International Circle of Educational Institutes for Graphic Arts: Technology and Management. 28-35, Toronto, Canada

Žiljak Stanimirović, I., Matas, M., Pogarčić, M., Žiljak Vujić, J., 2014. *Spot Colorant Twins for Infrared security print of Topographic Maps*, 46th Conference of the International Circle of Educational Institutes for Graphic Arts Technology and Management (IC), Greece

Pap, K., Žiljak, I., Žiljak-Vujic, J., 2010. *Image reproduction for near infrared spectrum and the Infraredesign theory*, Journal of Imaging Science and Technology, vol. 54, no. 1, pp. 10502-1-10502-9(9) (CC, SCI, SCI-Expanded)

Žiljak, V., Pap, K., Žiljak-Stanimirović, I., 2011. *Development of a prototype for zrgb infraredesign device*. Technical Gazette. 18 , 2; 153-159