The Effects of Doubling-Slurring on Grey Balance and Dot Tone Value Increase in Offset Printing

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Keywords*:* Print quality, printing ink, doubling-slurring, grey balance, density, tone value increase

Abstract

Being in connection with the developing science and technology there have been great developments during the recent years in the area of printing and the same developments still go on. One of the most important ones of these is the technological advances accomplished in the quality controls during the printings.

Together with the technological developments, quality-control in the printing can be implemented more objectively and with the same standard. Especially, the developments in the measurement devices such as spectrophotometer provide the achievement of correct measurements in color and density assessments. However, it is not possible to have the measurement of quality on the printed surface by only using these devices. Because, after proceeding to the clean printing, first doubling–slurring area must be viewed with the eyes on the control strips. If doubling-slurring problem is encountered in this area, there must not be a second measurement to follow unless the possible causes are eliminated. Because, even though the density of the ink, trapping values, etc., could be normal, there is the possibility to observe the artificial increase in tram tone values (dot gain out of tolerance) and then this situation is perceived as the printing is carried out with the ink having more density. The entire balances and force values of the machine must be done mechanically with Altona Test Suite or with the similar scale during the first installation. If these adjustments are not done during the installation or if they are deteriorated afterwards, doubling-slurring occurs. Having the printing force more than normal, blanket errors, rheological features of the ink, etc., L*a*b*, solid tone, trapping values must be measured with spectrophotometer after resolving doubling-slurring errors and the data must be interpreted according to ISO 12647-2:2004 and FOGRA standards.

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In general, dot tone value increase and grey balance problems are thought by the printing applicators to be caused by dot tone value increase and the problems of grey balance and by the printing pressure. Intensity values of the ink is firstly tried to be controlled in order to have the controls of dot tone increase and grey balance in the printing. Whereas, this is a wrong way of thinking on it's own. Because, dot tone value increase and grey balance problems causes is not only the abundance of the ink or the printing pressure. It is also required that the other effects causing this problems must also be examined. The study is done on the effects of doubling-slurring on grey balance and dot tone value increase. First the measurements of CMYK colors L*a*b*, dot tone value increase between 10%–100% and solid tone density values are measured on the test printing originals that are printed with standard conditions and having and not having doubling-slurring from UGRA 82 printing control scales.

In the study, the effects of doubling-slurring problem on the grey balance and dot tone value increase are researched visually and numerically and obtained data are put forward with the graphics.

Doubling

A portion of the ink in dot points printed on the paper by the first press unit in multi-colored prints is transferred (smudged) to the blanket of the next print unit with the paper, since they are fresh prints. Should unintentionally transmitted image (ink) from the first blanket to the second blanket is placed on the next paper in an adjusted way, then no problems shall occur. As a result of the printing of the ink remained weakly on the blanket on next sheets without adjustment, however, contours in shadows shapes occur next to the dots and stripes. The reason thereof is that the dot point in undried form from the first print is not in the previous print point on the blanket surface of second and third units. Thus the dot point is involved in a print to another location and the creation of a second print. This is called doubling. Doubling is the creation of a second dot next to the dot point. Doubling can be in all directions. Second dot point in the shape of contour generally appears in shadow form close to the primary dot in a smaller size. Ink film thickness of this shady area is smaller compared to the actual print. However, the ton value of the dot point formed a result of the incorporation of this shady dot with the actual dot point increases, which means that the actual dot point undergoes a deformation and grows in size. This leads to the intolerable dot gain.

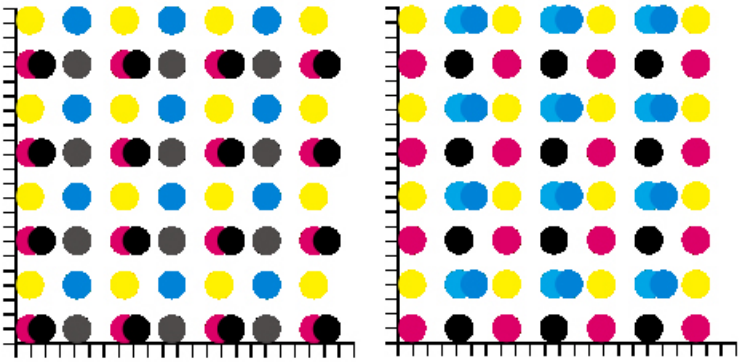


Figure 1. *Doubling-slurring images in the press.*

Slurring

Slurring is defined as the geometric shape transformation, edge stretching and rounding of the dot point. Slurring occurs in two forms, namely peripheral and lateral, which are associated with slurring in print direction and slurring in perpendicular direction to the direction of the print, respectively.

In slurring the print ink squashed excessively on the edges of dot points. It usually means the shape deformation in the direction of the print. Round dot point extends from the edges and takes the shape of ellipse. It can also occur on the edges of stripes and letters. Main factors of the slurring problem include overpressure between plate-blanket or blanket-paper, insufficient blanket tension, constantly moving blanket on the cylinder, ink adhesion and excessive amounts of ink. Errors are clearly visible in the striped area on the control strip.

As mentioned above, one of the main factors of slurring is the resistance shown by the ink against separation during the transfer into the paper from the blanket surface. Thus pressed surface of the paper stretches and separates from the blanket, and the remaining ink film on the blanket surface extends and changes its shape.

Slurring occurs when the rotating speeds of two cylinders (plate-blanket or blanket-impression cylinders) differentiate. Such slurring occurs only in the direction of rotation of the cylinders, which is the print direction. Stripes that are perpendicular to the print direction overlap and darkening is observed in these stripes. Parallel stripes spread.

Reasons for Doubling and Slurring

- Overage of the press power between the plate-blanket and blanket-impression cylinders

- Incompliance of plate and sub-plate feeding, blanket and sub-blanket feeding with the machine standards
- Selection of a wrong blanket (conventional blankets have more dot swelling)
- Improper stretching of the blanket
- Failure to fix the blanket in the direction of the stretching
- Failure to adjust the paper holding blades as per the paper weight
- Paper slurring in the blade depending on the sheets with wavy edges and static electrification
- Wearing of cylinder gears and bearings of the machine due to friction
- Over-adhesion of the ink
- Overage of the ink
- Insufficiency of paper tension in addition to the reasons given above in case of web press
- Diametral failure
- Transition of the undried image of the previous press to the next unite

Control of Doubling and Slurring

It is possible to visually determine the problem in doubling-slurring zones on the print control strips. There are micro striped zones in the doubling-slurring areas, in which they can be found nested and with the same thickness and the degrees of 0°, 45°, 90°. The densities of these micro stripes must be approximately equal. If there are apparent changes in the tone densities of micro stripes, they can be easily spotted and doubling-slurring is determined.

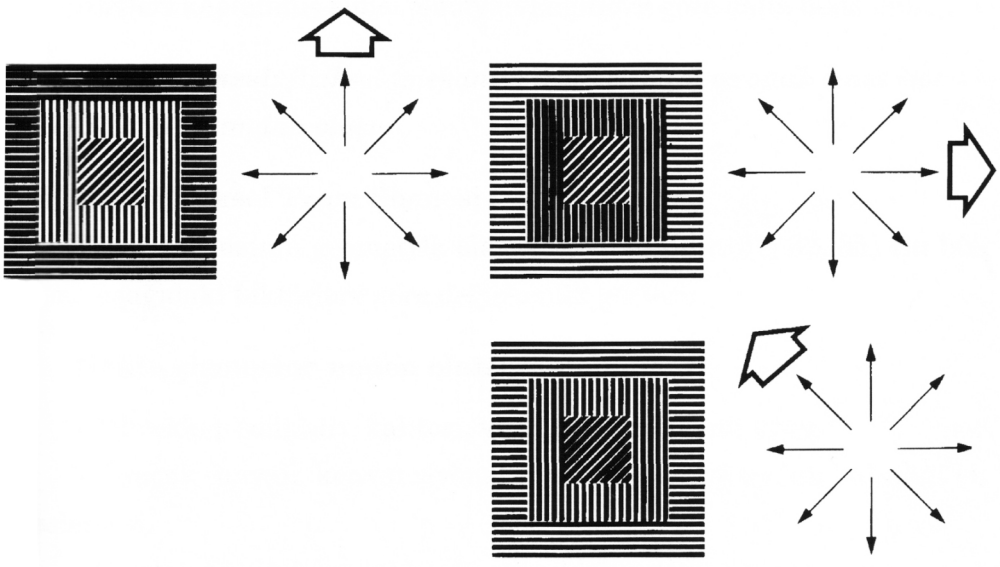


Figure 2. *Slurring direction in erroneous prints.*

If there are problems in doubling-slurring areas, then the problem should be resolved and the print should continue. Because all other quality control measurements performed before the resolution of the problem will differ from the standard values.

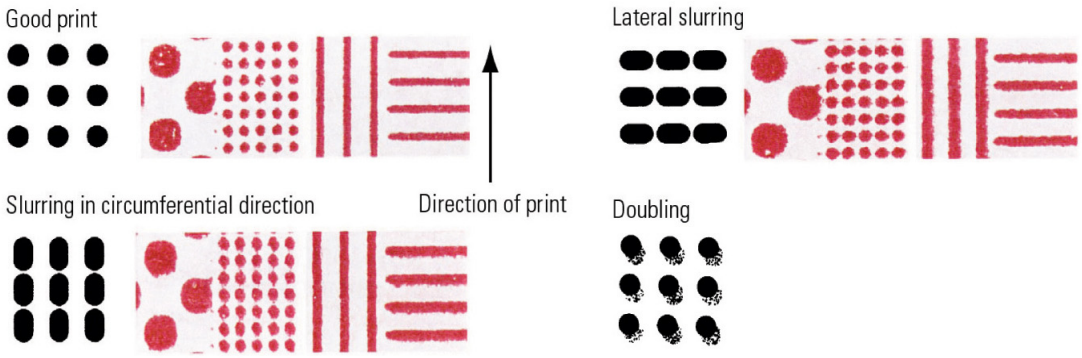


Figure 3. *Dot deformation caused by doubling and slurring.*

Material and Method

Press samples with and without doubling-slurring problems printed for test purposes were evaluated in this study.

170 gr/m^2 coated matt papers and Sun Chemical EOS Speed series inks were used in the print. Ipaksa brand thermal offset printing plates were prepared in Creo brand CTP plate exposure machine in compliance with the standards.

Presses were performed in a Heidelberg Speedmaster CD 102 print machine with IR drying in a size of 70x100 cm with 4 color units on an environment with a temperature of 22°C and a relative humidity of 55%.

Measurements were performed on the basis of test press samples with and without doubling-slurring problems. They were conducted and recorded spectrophotometrically (L*a*b) and densitometrically with Gretag Macbeth SpectroEye (measurement conditions: D50 illuminant, 2º observer, 0/45 or 45/0 geometry, black backing) (Table 1, 2, 3).

Test Prints

With doubling - slurring

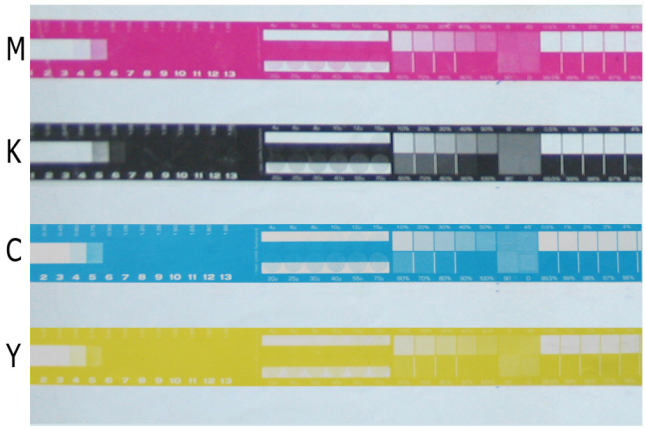


Image 1. *Examples of print scale with doubling-slurring.*

Without doubling - slurring

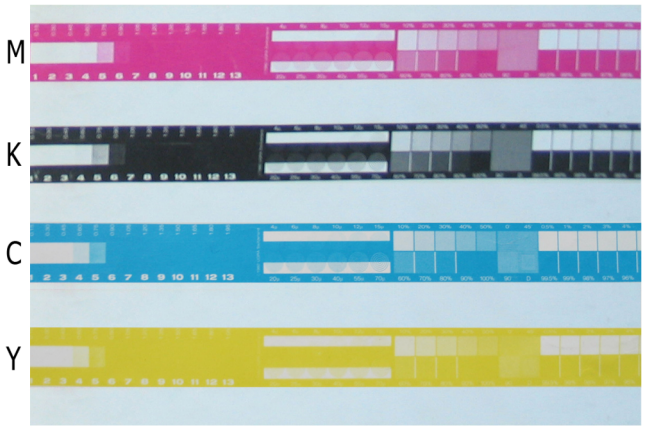


Image 2. *Examples of print scale without doubling-slurring.*

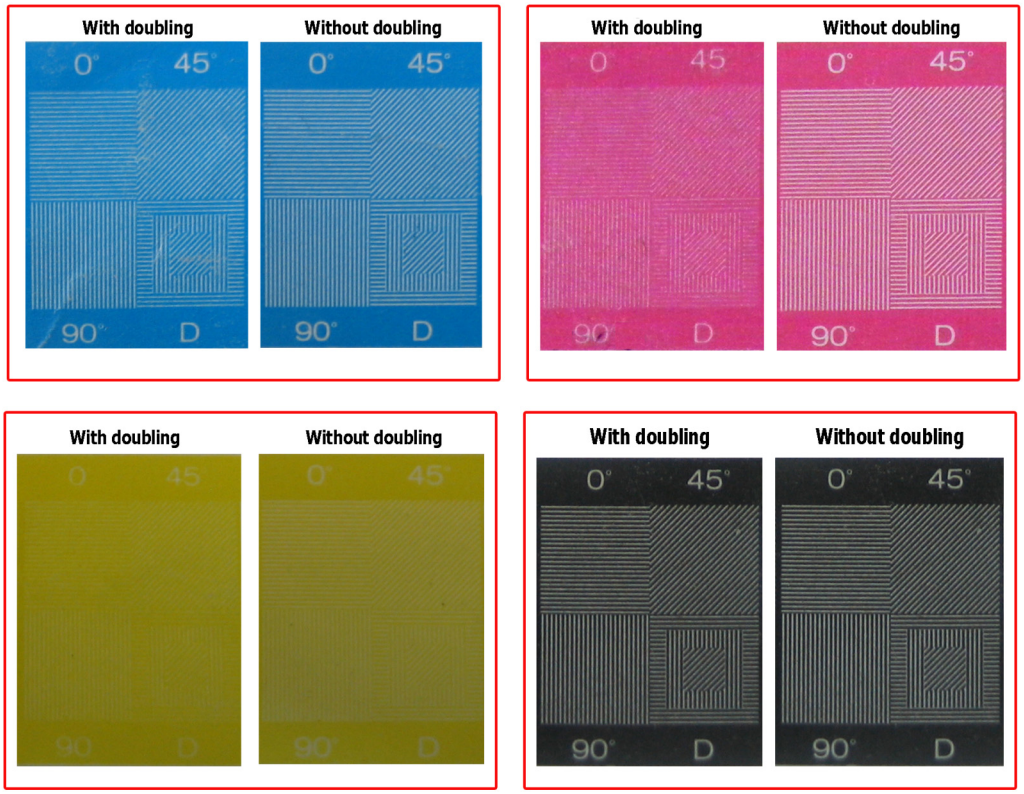


Image 3. *Images of the patches of prints with and without doubling-slurring on CMYK control strip.*

Table 1. *L*a*b* and solid tone density values in the print with doubling-slurring.*

	L*	a*	b*	Solid tone density
C	57,27	–33,47	–44,25	1,17
M	52,40	66,45	–3,69	1,10
Y	87,63	–6,27	83,34	1,10
K	29,03	1,26	0,54	1,27

Table 2. *L*a*b* and solid tone density values in the print without doubling-slurring.*

	L*	a*	b*	Solid tone density
C	59,64	–34,24	–41,77	1,08
M	52,92	65,63	–4,61	1,09
Y	88,04	–6,58	82,96	1,10
K	26,36	1,12	0,00	1,42

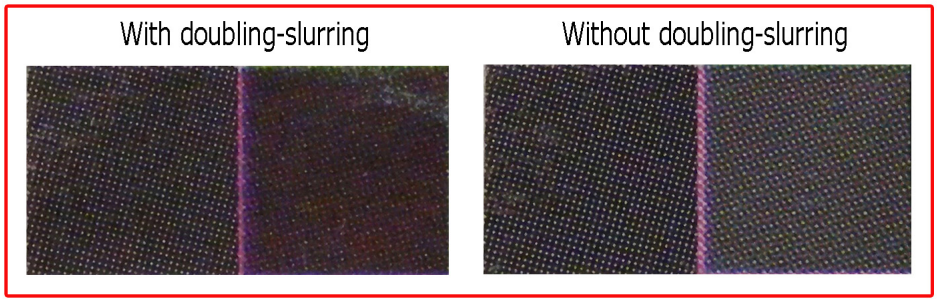


Image 4. *Images of the grey balance patches of prints with and without doubling on CMYK control strip.*

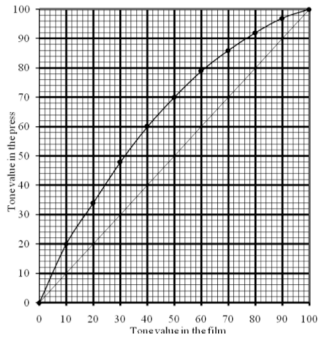
Table 3. *Dot tone value change.*

Film (%)	Print with doubling-slurring (%)					Print without doubling-slurring (%)			
	Cyan	Magenta	Yellow	Black		Cyan	Magenta	Yellow	Black
0	0	0	0	0		0	0	0	0
10	23	24	24	21		20	19	21	19
20	40	43	44	37		34	33	34	35
30	53	57	59	50		48	47	47	48
40	67	72	74	63		60	59	60	61
50	78	83	84	73		70	68	70	72
60	87	92	91	81		79	77	79	80
70	93	97	96	87		86	84	87	86
80	96	98	98	93		92	91	92	92
90	99	99	99	97		97	97	97	97
100	100	100	100	100		100	100	100	100

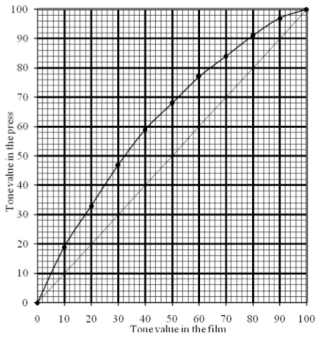
Tone value increase in the print.

g **Print without doubling-slurring**

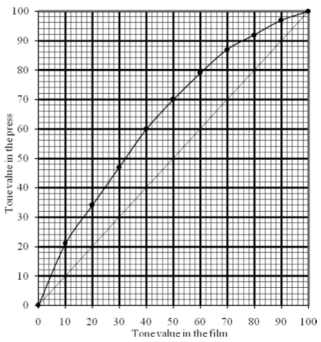
Tone Value Increase of Cyan



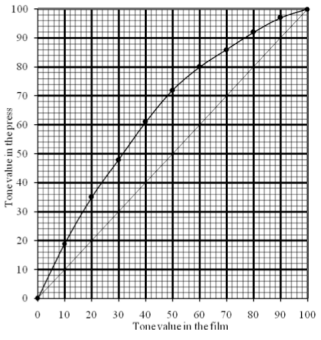
Tone Value Increase of Magenta



Tone Value Increase of Yellow



Tone Value Increase of Black



Conclusion

It was seen in the test print that even though the density and the L*a*b values (Table 1 and Table 2) are equal for magenta and yellow, the redness is visible in the region, where doubling exists in Image 1. The reason thereof could be interpreted as the surplus in the values of density values at the beginning, however the equality of density and L*a*b values reveals that the problem can't be the result of a density surplus, it is rather caused by doubling-slurring. Upon a review of the doubling-slurring patch, it is seen that there is a doubling-slurring problem in yellow and magenta as can be seen in Image 3.

Even though there are no differences in density and L*a*b values for magenta and yellow, an extremity is visible in tone value increases of the print with doubling, as can be seen in Table 3 and Graph 1. Doubling-slurring problem causes an artificial increase in the tone value. Tone value increase in the print without doubling is tolerable.

There are no doubling-slurring problem in cyan and black in sample print. There is a doubling-slurring problem in magenta and yellow and this resulted in over-redness in the print.

A problem occurred in the grey balance patch as a result of doubling-slurring of yellow and magenta. While grey balance is established in the region without doubling, a **grey balance** between the actual black and CMY black was not established in the region with doubling, as can be seen in Image 4. Doubling-slurring problem also affected the grey balance.

As a result the doubling-slurring problem causes an **excessive tone value increase** in the print; and **disturbance of the grey balance** and an artificial darkening in the color.

References

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