Dot Spread according to Yule-Nielsen

TECHKON APPLICATION NOTE 3

1 Murray-Davies Formula

The measurement of dot spread values (dot percentage) DP, based on density measurements in reflection, is calculated with the well-known Murray-Davies formula:

$$DP = \frac{1-10^{-DD}}{1-10^{-SD}} \cdot 100\ (\%)$$

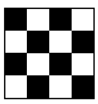
where SD is solid density,
and DD is dot density.

The dot spread thus calculated is the apparent dot spread as perceived visually. It comprises a geometric and a visual part:

$$DP_{apparent} = DP_{geometric} + DP_{visual}$$

The visual part is caused primarily by light trapping. The dot spread measured with a densitometer on prints is thus always higher than the real goemetric dot spread. The latter can be recognized with, for example, a magnifying glass.

The relationship between these quantities can be explained best using square dots. Through a magnifying glass a dot spread of 50 % looks like a chessboard where the edges of the dots just touch each other:



$DP_{geometric} = 50\ \%$

Measuring such a dot structure with a reflection densitometer would yield a value of perhaps 65 %, as the visual part could amount to 15 %.

As transparent originals (films) do not have light trapping, the dot spread as measured corresponds to the geometric value.

2 Dot Spread according to Yule-Nielsen

The Yule-Nielsen formula enables the dot spread as measured to be modified to yield just the geometric part. The Yule-Nielsen formula is an extended version of the Murray-Davies formula; Yule-Nielsen incorporates the root factor n giving:

$$DP = \frac{1-10^{-\frac{DD}{n}}}{1-10^{-\frac{SD}{n}}} \cdot (100\ \%)$$

When n > 1, Yule-Nielsen yields a lower dot spread than Murray-Davies. Correspondingly with a value of n < 1 in Yule-Nielsen a higher dot spread is calculated than would result from the Murray-Davies formula.

n > 1	DP gets lower
n < 1	DP gets higher

In order to get the real geometric dot spread, the root factor n must be > 1, e.g. 2.0 or 2.8.

3 Why Yule-Nielsen?

For prints, only the apparent dot spread is important, and so the Yule-Nielsen formula is not suitable. Printing plates represent, however, a different situation, as the need is to determine just the geometric dot spread, since the areas are moistened by ink and print.

The CtP (Computer-to-Plate) process needs a basis for calibrating the platesetters directly, because film is not used. Films with step wedges can be easily checked with the TECHKON densitometers T 120 and RT 120 and the imagesetters can be calibrated by the dot percentage measurements.

As film is not involved in CtP, the printing plate must yield reliable values. The procedure is as follows:

1. A step wedge with square dots is exposed onto the printing plate.

2. Using a magnifying glass, a patch which shows as close to 50 % as possible is selected.

3. This patch is measured with a reflection densitometer (RT 120, R 410/e, SD 620). With the instrument in Yule-Nielsen mode the measured value is adjusted to 50 %. The Yule-Nielsen root factor n required is then calculated by the instrument and stored internally.

After having been set up in this way, the densitometer yields dot percentage values suitable for the calibration of platesetters.

4 Yule-Nielsen in TECHKON densitometers

TECHKON densitometer models SD 620, R 410/e and RT 120 are equipped with the Yule-Nielsen mode. The Yule-Nielsen root factor n is implemented as follows:

1. The %1 mode (R 410 and R 410e) or the R-% mode (RT 120) is selected and dot gain is determined using the Murray-Davies formula by measuring the solid and dot densities.

2. The indicated dot gain value can be adjusted to any desired value. The root factor n necessary for the correction is calculated automatically and stored.

Densitometer models R 410 and R 410e offer the root factor n only in %1 mode, not in %2 mode. The root factor n is shown in the display if it is not equal to 1. Model RT 120 offers the root factor n in modes R-% and R-% NEG; it is shown in the display during the calibration if it differs from 1.

The operator's manuals of the densitometers give a more detailed description.

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