QUALITY ASSESSEMENT OF SENSITOMETRIC AND COPYING CHARACTERISTICS IN THE OFFSET PLATE COPY

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Abstract

Diverse techniques based on scientific photography are discussed for use in the evaluation of sensitometric and copying characteristics of offset plates. Advantages as well as disadvantages of extracting selected parameters from analytical fitted sensitometric and copying curves are outlined. In order to avoid approximation errors incurred by applying analytical methods to fit the shape of the characteristic curves, diverse techniques of unsupervised and supervised learning are employed to classify the quality of offset plates.

Introduction

Image transfer in conventional offset plate making denotes a duplication process in which the copy original and the light sensitive offset coating are exposed in close contact. The information transferred from the original onto the printing plate can be described as a two dimensional distribution of the optical density.

When the copy original is irradiated by light of proper spectral content optical signals arise which initiate a chemical process in the light sensitive coating that leads to changes in solubility adhesion or oleophoby of the light sensitive system. In the most conventional technique recording of information onto the printing plate is based on selective solubilities of the irradiated vs. nonirradiated coating areas in the developer bath. In this way, monometal plates with a photo soluble light sensitive coating can be classified as positive and those with a photohardening as negative plates.

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At the end of the copying process a characteristic coating thickness has been formed on areas of the offset plate, depending on the external irradiance distribution, on the optical properties of the system coating/aluminum base as well as on selectivity of the developer solution /1/.

To characterize transfer properties of printing plates it is obvious to employ evaluation techniques of scientific photography.
A useful method represents the fitting of the sensitometric and copying curves by applying analytical techniques similar to the quality assessment of film samples. Diverse photo physical parameters of the offset plates can be extracted from these fitted curves, illustrating their transfer properties. The exactness of the analytically fitted characteristic curves is limited with regard to homogeneous thickness of the copy layer and a locally reproducible character of the grain level of the aluminum base. In practise the uniform local character of the topography of the offset plate can not generally be assumed. Consequently the response data are scattered and a satisfactory approximation of an analytical function will often fail.
In order to overcome this problem techniques of the unsupervised and of the supervised learning are appropriated to provide a precise quality classification of the offset plates being investigated. Especially it will be shown that the use of the biplot technique based on the principal component analysis (PCA) as well as techniques of non-linear discriminant analysis may contribute to the achievment of an explorative analysis that extracts valuable information regarding the quality of the offset plate copied.

Review

The fact that the optical reflectance density is proportional to the thickness of the light sensitive coating, can be used for characterizing the effective exposure that leads to a difference in coating thickness.Thus attention was paid to the dependence of the optical reflection density on the logarithm of the relative exposure H/H_0. The function thus obtained corresponds to the well known characteristic curve (sensitometric curve) used for judging the density of films in photographic science /2/:

$$D = f(\lg H / H_0) \quad (1)$$

Optical phenomena like undercutting of light from the image elements of the original, or reflection and scattering of the incoming light from the structures of the grainy aluminum base of the light sensitive coating as well as other factors influence the image formation on the offset plate. Dimensional changes of copied details are the consequence. At different exposures onto the system original/ light sensitive coating/aluminum base, when a line is considered as a test object, the change of linewidth becomes a function of the relative exposure H/H_0 /2/:

$$\Delta LB = f(\lg H / H_0) \quad (2)$$

By means of these functions characteristic curve parameters can be obtained that describe the sensitometric and copying characteristics of offset printing plates.

In fact the light sensitive coating can be regarded as a three dimensional record of information.

In an analogous way, sensitometric parameters of offset plates denote such parameters that describe the information recording process as a change of coating thickness in terms of a function of the logarithm of the relative exposure /3/.

Additionally, the characteristic copying parameters can be interpreted from this point of view as exposure parameters of the information transfer regarding lateral dimensions of the plate and only in a limited sense as parameters depending on development, as would be the case if lateral diffusion of the solvent were involved.

Paying attention to practical relevance of sensitivity criteria, the practical sensitivity of presensitized printing plates is defined by the equation:

$$S_p = 1 / H_{ep} / H_0 \quad (3)$$

where H_{ep} is the exposure at which the spectral optical reflectance density is 0.05 units above its lowest value (for a photo soluble light sensitive coating) or 0.05 units below its highest value (for a photo hardening coating) /1,2/.

Further, it is possible to define a threshold or "limit sensitivity" by the expression:

$$S_s = 1 / H_{es} / H_0 \qquad (4)$$

H_{es} is understood as the exposure at which the optical reflectance density is 0.05 units below its highest value (for a photo soluble coating) or 0.05 units above its lowest value (for a photo hardening coating).
The definition of contrast of an offset plate is given by a relation containing the critical exposures H_{ep} and H_{es} in the following way /1,2/:

$$K = \lg (H_{ep} / H_{es}) \qquad (5)$$

The slope of the linearly increasing part of the sensitometric curve of an offset plate

$$\gamma_s = \Delta D / \Delta \lg H_e / H_0 \qquad (6)$$

is called sensitometric gradation according to the corresponding term in photographic science /2/.

Additionally, it was proposed to call the parameters which are directly related to detail rendering, copying characteristic parameters /1,2/. The reciprocal exposure below which the line width from the original onto the offset plate remains constant, is called copying sensitivity

$$S_k = 1/ H_{ek} / H_0 \qquad (7)$$

The latitude of exposure for the change in linewidth LB is defined as the difference of logarithms of exposures $H_{e'k}$ and H_{ek}

$$BS = \lg H_{e'k} / H_{ek} \qquad (8)$$

where H_{ek} leads to an increase in linewidth of 4 micrometers /1,2/.

Further the slope of the characteristic copying curve

$$\gamma_k = \Delta LB / \Delta \lg H_e / H_0 \qquad (9)$$

is called copying gradation /1,2/.

The resolution of an offset plate was defined as the limit

$$AV = 1 / 2c \qquad (10)$$

by which very fine and close lying linewidths c still become separately rendered or resolved.
To determine the resolution of offset plates, test objects containing line or bar patterns are used along with the copying process. These patterns on the copy original are arranged according to line or bar widths by varying the spacing from pattern to pattern /1/.
Selected characteristic curves of negative as well as positive offset plates are presented in figures 1 to 6.
The corresponding sensitometric and copying parameters are arranged in table 1.

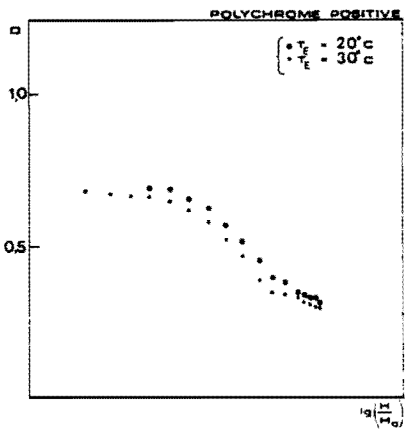

Fig. 1: Sensitometric characteristic curve of a selected Polychrome plate (GP II, positive) /3/

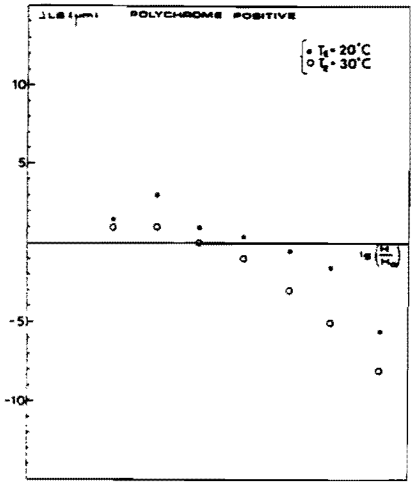

Fig. 2: Copying characteristic curve of a selected Polychrome plate (GP II, positive) /3/

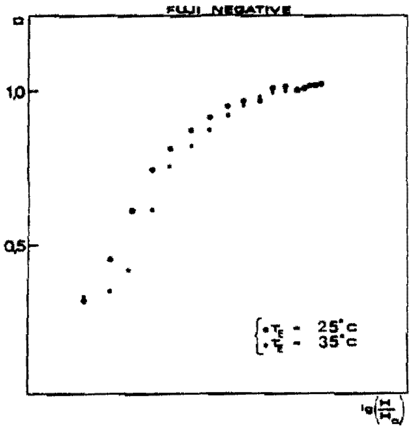

Fig. 3: Sensitometric characteristic curve of a selected Fuji plate (FNS, negative) /3/

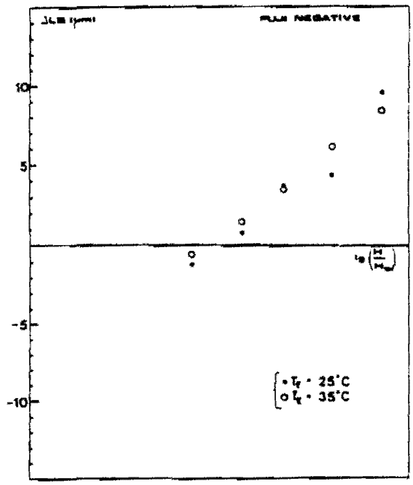

Fig. 4: Copying characteristic curve of a selected Fuji plate (FNS, negative) /3/

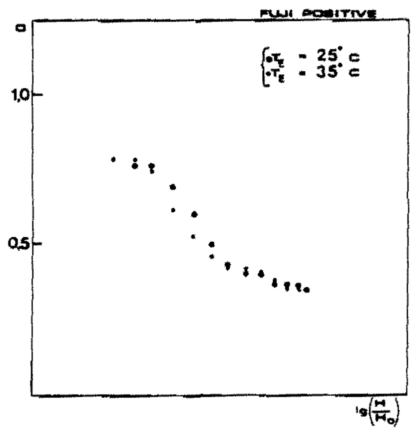

Fig.5: Sensitometric characteristic curve of a selected Fuji plate (FDP, positive) /3/

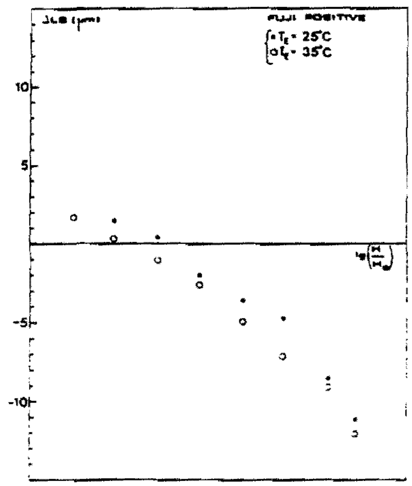

Fig. 6: Copying characteristic curve of a selected Fuji plate (FDP, positive) /3/

It can be seen that characteristic data of selected specimens are quite scattered. Consequently, characteristic parameters of the sensitometric and detail transfer curves must be faulty and probably show only limited reliability up to a certain point.In this situation it is useful to consider an alternate philosophy to classify properties of offset plate samples by means of selected methods of an explorative multivariable data analysis.

Table 1. Selected sensitometric and copying characteristic parameters of conventional offset plates /3/

	Development temperature (°C)	$\lg\left(\frac{H_{es}}{H_o}\right)$	$\lg\left(\frac{H_{ep}}{H_o}\right)$	$\lg\left(\frac{H_{eK}}{H_o}\right)$	$\lg\left(\frac{H'_{eK}}{H_o}\right)$	γ_K	S_p	S_K	K	BS
Fuji plate	25	0,693	1,163	1,49	1,62	15,1	0,0656	0,0324	0,49	0,13
FDP (positive)	35	0,637	1,414	1,136	1,55	13,7	0,0723	0,0731	0,5	0,41
Polychrome plate	20	0,693	1,223	1,66	2,06	10,1	0,0598	0,0219	0,63	0,4
GPII (positive)	30	0,637	1,223	1,534	1,836	13,3	0,0598	0,0292	0,59	0,3
Fuji plate	25	0,44	1,137	1,465	1,746	15,3	0,0729	0,0327	0,7	0,26
FNS (negative)	35	0,44	1,096	1,43	1,725	13,5	0,0604	0,0372	0,66	0,295

The application of unsupervised and supervised learning techniques to investigate the transfer of information in the copying process

The transfer of information by means of the offset printing process depends to a large extent on physical and chemical properties of the copying and printing process. Due to the scattering of the sensitometric and copying data in the offset copy an analytical fitting of the characteristic curves must often be unsatisfactory as mentioned above.The comparision becomes unwieldly, however, when many curves are being compared with each other. For a quick quantitative analysis of the data it becomes desirable to derive parameters which represent the quality scenario at a glance.

An analysis which reduces the dimensionality of a data set to an intrinsic minimum is PCA /4,5/. This technique is a method of examining a number of sets of multivariable response data to a smaller number of parameters which contain essentially all the information in the original data. These parameters are the so called scalar multiples of basic response vectors which, in linear combination, can reconstitute the experimentally observed differences among the response functions /5/.

Descriptive presentation of sensitometric and geometrical data by means of PCA and DA

To illustrate the efficiency of unsupervised and supervised learning techniques, selected characteristic data sets measured on copied offset plates will be presented by employing biplots /6/ resulting from principal component analysis and scattering graphs of the variance and discriminant analysis (DA). In order to show the algorithm of these methods selected sets of sensitometric and copying curves of offset plates will be analyzed.
Tests with solvents graded by consumption level to develop positive offset plates resulted in a matrix D of measured values of 78 (printing plates) x 11 (optical densities) /7/. Each of the 78 row vectors contained according to the exposure modulation which was realized by means of the areas of the copy of different transmittance, eleven optical densities D of the respective copied surface areas of the printing plate. 39 offset plates having a mechanically roughed and 39 offset plates with an electrolytically roughed, anodically oxidized aluminum base were investigated. For each type of plate three development procedures were carried out using the same development procedure. After the plates were developed the optical densities of the printing plate surface areas were measured by means of a densitometer according to the exposure modulation of 13 sampling tests taken from the developed plate reservoir of one development procedure. Due to a lack of clarity of the family of curves, however, it was nessecary to use PCA to evaluate the variability of data of the 78 sensitometric characteristics determined on the basis of $D = \log(H/H_0)$ - graphics.
The matrix D forms the starting position of the eigenvector analysis (Karhunen Loeve transformation) which has to be carried out /7/.

D =

0.270	0.345	0.675	0.670	0.889	0.997	1.080	1.040	1.108	1.133	1.153
0.283	0.342	0.447	0.612	0.845	0.943	1.087	1.108	1.117	1.143	1.155
0.273	0.313	0.422	0.632	0.833	0.923	1.002	1.067	1.108	1.124	1.153
0.303	0.332	0.637	0.422	0.885	0.907	0.907	1.063	1.108	1.105	1.137
0.295	0.378	0.538	0.728	0.900	0.950	1.038	1.103	1.147	1.167	1.157
0.302	0.376	0.319	0.712	0.930	0.990	1.067	1.140	1.123	1.163	1.168
0.323	0.406	0.360	0.448	0.882	0.946	1.088	1.085	1.107	1.167	1.175
0.317	0.408	0.532	0.756	0.946	1.015	1.080	1.118	1.133	1.147	1.143
0.340	0.448	0.627	0.883	0.962	1.017	1.077	1.132	1.152	1.158	1.140
0.398	0.522	0.457	0.863	1.010	1.055	1.112	1.157	1.158	1.167	1.170
0.438	0.552	0.463	0.820	0.982	1.065	1.117	1.140	1.128	1.138	1.140
0.368	0.448	0.768	0.865	1.018	1.063	1.098	1.133	1.123	1.138	1.163
0.723	0.798	0.263	0.968	1.037	1.073	1.107	1.138	1.147	1.163	1.173
0.272	0.382	0.358	0.768	0.932	1.055	1.088	1.122	1.140	1.208	1.208
0.272	0.390	0.430	0.783	0.990	0.983	1.043	1.117	1.145	1.172	1.193
0.327	0.335	0.722	0.900	1.017	1.047	1.120	1.175	1.192	1.213	1.220
0.333	0.538	0.715	0.393	1.034	1.092	1.142	1.198	1.209	1.217	1.227
0.303	0.425	0.767	0.938	1.058	1.095	1.163	1.185	1.207	1.210	1.221
0.313	0.503	0.683	0.675	1.000	1.027	1.050	1.127	1.143	1.173	1.187
0.400	0.637	0.800	0.553	1.047	1.133	1.187	1.206	1.213	1.224	1.227
0.350	0.533	0.713	0.870	1.000	1.067	1.103	1.147	1.157	1.186	1.187
0.367	0.700	0.880	0.903	1.085	1.120	1.167	1.190	1.206	1.216	1.225
0.470	0.610	0.743	0.887	1.017	1.030	1.005	1.090	1.107	1.123	1.137
0.517	0.623	0.737	0.247	0.903	1.003	1.063	1.107	1.120	1.140	1.147
0.617	0.737	0.847	0.943	1.040	1.080	1.097	1.120	1.150	1.188	1.177
0.728	0.803	0.884	0.940	1.093	1.095	1.103	1.120	1.123	1.137	1.130
0.290	0.343	0.464	0.638	0.792	0.853	0.910	1.006	1.042	1.042	1.084
0.272	0.349	0.472	0.624	0.795	0.850	0.917	1.012	1.056	1.085	1.100
0.290	0.353	0.460	0.615	0.780	0.863	0.915	1.025	1.060	1.093	1.100
0.270	0.303	0.508	0.686	0.832	0.910	0.977	1.050	1.063	1.108	1.140
0.290	0.303	0.495	0.675	0.802	0.950	0.970	1.032	1.075	1.080	1.090
0.320	0.487	0.641	0.791	0.908	0.965	0.975	1.028	1.047	1.088	1.090
0.315	0.470	0.567	0.715	0.880	0.931	0.962	1.020	1.045	1.052	1.080
0.290	0.398	0.551	0.721	0.882	0.937	0.968	1.045	1.050	1.061	1.077
0.311	0.416	0.389	0.792	0.892	0.953	0.986	1.020	1.060	1.085	1.087
0.370	0.483	0.425	0.771	0.915	0.980	1.025	1.057	1.080	1.087	1.096
0.470	0.372	0.705	0.851	0.950	1.000	1.017	1.058	1.077	1.140	1.128
0.490	0.578	0.726	0.835	0.945	0.987	1.050	1.080	1.105	1.125	1.130
0.550	0.662	0.805	0.917	0.985	1.040	1.092	1.132	1.157	1.190	1.229
0.290	0.337	0.415	0.533	0.725	0.815	0.873	0.953	0.990	1.013	1.055
0.265	0.308	0.358	0.478	0.672	0.733	0.820	0.912	0.965	0.985	1.033
0.273	0.303	0.355	0.475	0.662	0.748	0.808	0.887	0.935	0.975	1.028
0.263	0.325	0.395	0.502	0.697	0.777	0.853	0.932	0.960	0.965	1.027
0.273	0.330	0.427	0.548	0.733	0.795	0.865	0.943	0.957	1.007	1.038
0.285	0.362	0.485	0.630	0.795	0.860	0.903	0.980	1.005	1.032	1.067
0.328	0.415	0.507	0.638	0.705	0.862	0.937	0.997	1.018	1.038	1.067
0.290	0.367	0.482	0.612	0.748	0.867	0.932	0.990	1.018	1.040	1.065
0.328	0.425	0.543	0.655	0.840	0.888	0.940	0.993	1.025	1.043	1.075
0.352	0.497	0.600	0.727	0.867	0.882	0.935	0.978	1.000	1.027	1.047
0.473	0.608	0.685	0.810	0.913	0.957	0.995	1.032	1.047	1.084	1.067
0.593	0.698	0.775	0.868	0.917	0.962	1.017	1.030	1.060	1.053	1.088
0.805	0.880	0.882	0.943	0.992	1.013	1.040	1.087	1.088	1.097	1.103
0.273	0.340	0.407	0.500	0.698	0.815	0.862	0.963	0.991	1.020	1.045
0.265	0.320	0.397	0.487	0.605	0.762	0.835	0.920	0.950	0.995	1.030
0.265	0.313	0.377	0.495	0.632	0.770	0.840	0.917	0.950	0.985	1.030
0.280	0.325	0.397	0.500	0.693	0.765	0.847	0.932	0.962	0.990	1.035
0.280	0.335	0.422	0.547	0.721	0.791	0.805	0.950	0.965	1.008	1.030
0.280	0.387	0.462	0.621	0.800	0.855	0.912	0.997	1.000	1.025	1.060
0.325	0.417	0.520	0.665	0.787	0.865	0.962	1.000	1.025	1.040	1.070
0.300	0.383	0.515	0.631	0.780	0.871	0.932	0.985	1.023	1.040	1.065
0.335	0.425	0.550	0.671	0.821	0.890	0.957	0.990	1.027	1.040	1.070
0.360	0.492	0.600	0.711	0.837	0.895	0.955	0.988	1.000	1.035	1.050

The relation

$$C_{ij} = X_{ij} \Big/ \left(\sum_i \left(D_{ij} - \overline{D}_j \right)^2 \right)^{1/2} \qquad (11)$$

transforms the covariance matrix $X'X$ into the correlation coefficient matrix
$R = C'C$.

The matrix X follows from the transformation

$$X_{ij} = D_{ij} - \overline{D}_j \qquad (12)$$

$\overline{D}_j$ is the respective mean value of the column.
By successively employing the iteration algorithm after Hotelling /4/ the following eigenvalue problem:

$$\left(R_{ij} - \lambda_1 \delta_{ij}\right) u_1 = 0 \qquad (13)$$

$$\delta_{ij} = \begin{cases} 1 & i = j \\ 0 & i \neq j \end{cases} \qquad (14)$$

can be solved, where δ_{ij} is called the Kronecker symbol.
Being a homogenous equation, the system equation (13) has then and only then a non trivial solution $u_1 = 0$, if the coefficient determinant of the system becomes 0 for each value of u_1:

$$\left|R_{ij} - u_1 \delta_{ij}\right| = 0. \qquad (15)$$

The first eigenvector calculated is

$$u_1 = (\, 0.65\, , 0.8\, , 0.91\, , 0.97, 0.99\, , 0.98\, , 0.98\, , 0.96\, , 0.94\, , 0.93\, , 0.9\,)$$

and the corresponding eigenvalue refering to it has the value:

$\lambda_1 = 9.195.$
From the relation

$$\eta_K = \left(\sum_{i=1}^{K} \lambda_i \Big/ \mathrm{tr}\, C'C\right) 100\% \qquad (16)$$

we get the respective variance percentage, which is described by the determined k eigenvectors of the data matrix. It is for the vector u_1:

$\eta_1 = 83.6\%.$

For further representation of the residual variance of the data set the matrix:

$$R_1 = R - u_1' u_1 \qquad (17)$$

is established.

After solving the further eigenvalue problem

$$\left(R_1 - \lambda_2 \delta_{ij}\right) u_2 = 0 \qquad (18)$$

we get the second eigenvector

$u_2 = (0.7 , 0.55 , 0.38 , 0.1 , 0.0 , -0.09 , -0.15 , -0.26 , -0.3 , -0.34 , -0.37)$

as well as the second corresponding eigenvalue

$\lambda_2 = 1.4$.

The variance percentage which is described by the second eigenvector was calculated as $\eta_2 = 13,4\%$.

The coordinates (scores) C_{u1} and C_{u2} are multiplied by the factor $\sqrt{\frac{n}{p}}$ ($n = 78, p = 11$) to ensure the positioning of the object level, which is comparable to the distribution of the points of variables /6/, thus allowing a simultaneous representation of the object and variable clusters (biplot) /7/ shown in figure 7. Since the reconstruction fault of the original matrix is very small for this example (3%), the further calculation of eigenvectors is negligible.

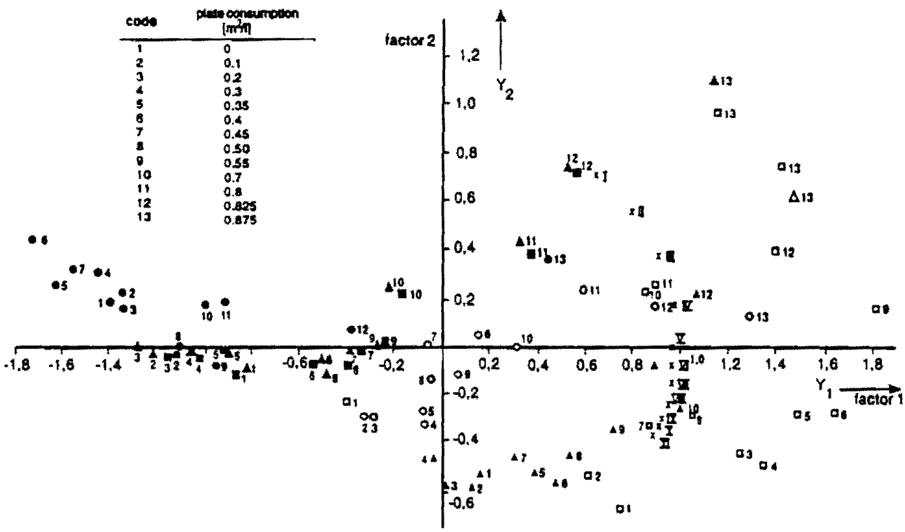

Fig. 7: Compact and simultane representation of samples and their optical densities in a bi-plot (▲ ○ □ - printing plates with alumina base roughed electrolytically; ▲ ● ■ - printing plates with alumina base roughed mechanically; quantity of plates to develop (in m^2/l developer): 1 - 0; 2 - 0.1; 3 - 0.2; 4 - 0.3; 5 - 0.35; 6 - 0.4; 7 - 0.45; 8 - 0.5; 9 - 0.55; 10 - 0.7; 11 - 0.8; 12 - 0.825; 13 - 0.875) I...XI - optical density values of printing plate surfaces; Y_1, Y_2 - scores

By applying PCA to the matrix D a data compression of 11 x 78 to 2x (11+78) numbers is obtained. Thus, in the case of a reconstruction fault of the optical density matrix of 3% there is a significant increase in the clarity of the problem "sensitometric properties of the offset plate-developer consumption level". The biplot shows a superposition of the offset plate samples (objects) and the optical densities (features). It can be seen that the optical density of that area of the offset plate which was copied with the fith grey scale has the highest weight on the first factorial axis. The optical densities of the areas copied by means of high exposure have the highest factorial weight on the second axis. It is remarkable that the weight of the optical density of the fith copied area is zero on the second factorial axis, i.e. that the variance component of the fith characteristic feature is represented only by the first eigenvector.

The samples of the kinds of groups of plates are distinguishable at first as two big clusters. Within these groups the printing plates of each

developing procedure form clusters. This result could be a consequence of the heterogenity of the sample set utilized.
A further cluster of samples clearly differs from the two groups of offset plates.
In comparision with the other samples all these objects are characterized especially by the fact that their optical densities are very close to those copied continuous tone areas which were irradiated by the highest exposure values. That is why these probes show considerably increased values for these optical densities. Representatives of this quantity have in common that they were developed with the help of solvents for which a weak development capacity is characteristic. In addition, a differentiation concerning the surface quality of the base as well as the development procedure is no longer possible. The knowledge of the classes of specimens can be presupposed because the development procedure is known. That means the samples of a whole development procedure are considered as an unique class. These **a priori** classes can be confirmed **a posteriori** and can be classifed by using the multivariable variance and discriminant analysis (supervised learning or pattern recognition in a narrow sense) /8/.

In our case these techniques were employed to analyze the sensitometric data set of the 39 offset plate samples having a mechanical grained aluminum base.
Findings of the multivariable variance analysis carried out show feature selections of importance to the optical densities to evaluate sensitometric characteristics. The optical densities of the areas exposed by employing the medium up to the high irradiance power range reveal the highest proof values (comp. table 2). In other words, the other optical values show redundancy.

Table 2: Optical densities on copied offset plates and their proof values selected by using multivariable variance analysis

Code of the optical densities D on the plate regarding to the grew level of the film copied	Proof value
2	1.2778
4	4.9960
5	4.6844
8	1.3103
9	3.3198
10	5.6515

From the selected features two linear combinations (discriminant functions) of the original parameter were established /9/.

$$DM_1 = -13,46\ D_2 + 28,14\ D_3 - 38,19\ D_5 + 41,03\ D_8 + 10,61\ D_9 - 27,26\ D_{10}$$

$$DM_2 = 10,96\ D_2 - 29,41\ D_3 + 29,07\ D_5 - 52,57\ D_8 + 129,1\ D_9 - 92,23\ D_{10}$$

and by means of these two linear combinations it is possible to visualize the variation of the offset samples regarding their sensitometric behavior in a comprehense diagram (fig. 8).
The plot of the discriminant features makes obvious an intersection of the **a priori** classes.

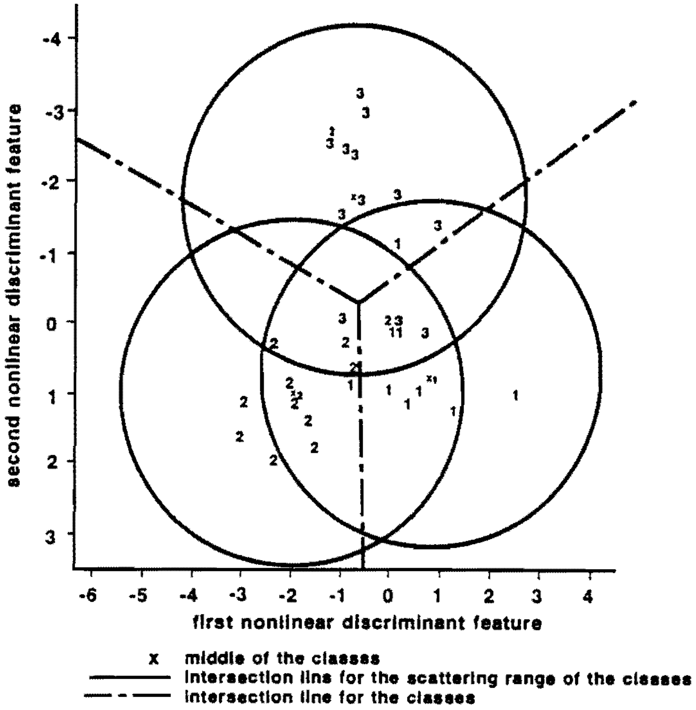

Fig. 8: Sensitometric property pattern of three sets of offset plates with mechanically roughed aluminum bases developed by using graded developer bath capacities /9/

However, plates which were positioned in the scattering range of the three a **priori** classes did not show a satisfactory sensitometric result /10/. These are the same specimens which reveal a narrow distance to the optical densities in the biplot.

Similary the copying data characteristics of the detail transfer were considered by means of multivariable data analysis. The starting point of this explorative analysis was the consideration of measured linewidth variations depending on the logarithm of the relative exposure H/H_0 shown in figure 9.

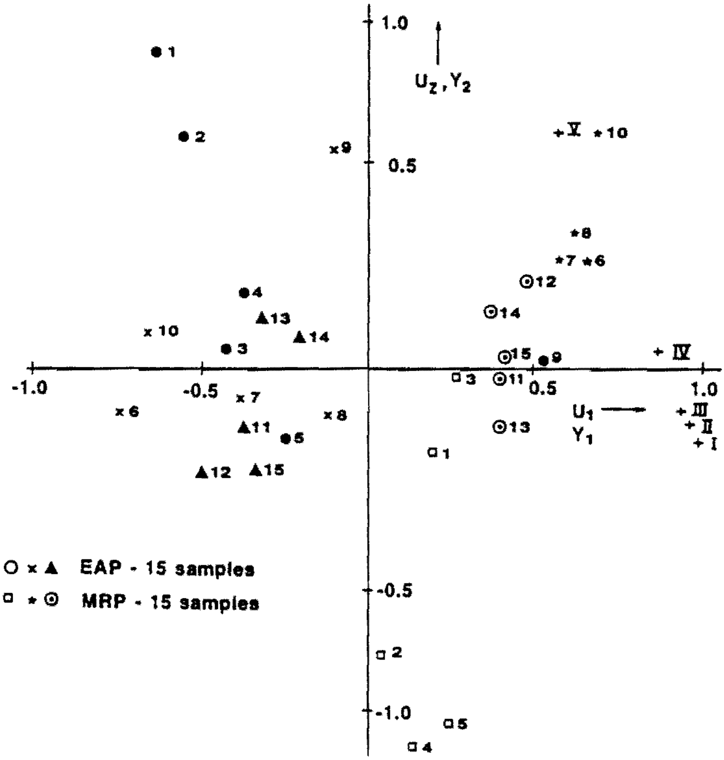

Figure 9 : Biplot of 30 offset plates investigated by copying five line fields with different widths /10/
I ...V line width deviations of offset plates after irradiation and development by utilizing graded developer capacities

Findings of the biplot do not show a dependence of the line width behavior on the developer capacity. An influence of the topography of the aluminum-base (mechanically or electrolytical roughed) can be seen on the detail transfer of the offset plates.

Conclusions

Sensitometric and detail transfer properties of offset plates obtained in the copying process are usually fitted by characteristic curves resulting in certain parameters.
Often reliable estimations of such parameters are not possible

because of stochastic disturbances due to inhomogenities in the copy layer and in the aluminum base as well as statistical measuring errors. Spectral decomposition of noisy optical and geometrical data should enable one to extract relevant information from optical densities and experimental values of line width deviations.
These features are influenced by exposure modulation and the capacity of the plate developer as well as the topography of the aluminum base.
In a first unsupervised approach by principal component analysis and biplot technique a different behavior of plates with mechanically or electrolytically roughed bases has been detected. In addition quality plates are clearly separated. Utilizing the derived principal components these "rejects" can serve as an indication of exhausted developer capacity. Thus low cost physical testing by developing preexposed filmstrips can replace chemical tests which at the moment yield only uncertain results.

In the second supervised approach multivariable variance - and discriminant analysis of predefined classes of plate values for a fixed type underlayer has been used to assure different conditions of developers. Furthermore feature selection revealed the most characteristic regions on the test strips. With these findings the biplot results can be weighted.
Furthermore a dependence of the line width on the developer capacity was not found.
Only the base topography showed an intrinsic effect on the geometrical data.