We Require Objective Measures of the Quality of Photographs Used for Interpretation

LYLE G. TROREY,[1] *Consulting Engineer*, AND
J. HARRY G. SMITH,[2] *Ass't Forester*

ABSTRACT: *Data are presented to illustrate the variations in opinion that may arise from subjective assessments of quality of aerial photographs used for detailed photo-mensurational studies of forest cover. The needs for development of objective measures of quality are outlined briefly.*

THERE is a real need for the development of a reliable assessment of the quality of aerial photographs to be used for interpretation purposes. This is particularly apparent when photographs are required for detailed photo-mensurational studies of forest cover. A substantial part of the differences in results obtained by investigators may be attributed to variables in the photographs under study, variables that may be independent of scale and kinds of camera and film.

Colwell (1954) prepared a scholarly analysis of factors affecting quality, perception, and interpretation of photographic images. Rogers (1956) drew attention to the problems involved in a comparison of results of photo-interpretation data from different studies. There seems to be no doubt that objective and directly measurable data, secured by standardized test procedures, are required in every aspect of photogrammetry. It is essential that the ordinary photo interpreter be able to transform his "guesstimate" into a statistically definable estimate.

At the end of a senior course in photogrammetry, students were asked to indicate order of preference of a number of different samples of aerial photography to be used for measurements of stand height, density, and crown width. The subject photography varied in flight altitude, focal length (and make) of lens, terrain, forest type and region.

It is to be understood that the different photographic samples are not comparable. Therefore conclusions as to the influence of scale, camera, and other variables, upon photographic quality should not be drawn from the data.

Table I shows the order of preference from 1, the best, to 7, the worst, given by eight students examining the photography. The data show the considered opinion of these individuals asked on the subjective basis of resolution of detail and definition, as they would appear to influence ease and reliability of photomensuration.

The last two columns show: under "all" the mean grading as determined after considering the observations of all eight students, and under "Spiers" the results of a similar subjective grading by J. J. K. Spiers, a post-graduate student well experienced in photo interpretation.

Spiers then re-assessed these same samples somewhat objectively, after actual photogrammetric measurement, upon the bases of: ease and precision of photo measurement of crown width (*CW*), of stand density (*CC*), of stand

[1] 626 West Pender Street, Vancouver 2, B.C.
[2] The Faculty of Forestry, University of British Columbia, Vancouver 8, B.C.

TABLE I

SUBJECTIVE RATINGS

Camera/cone	Scale, ft./in.	Individual Student Ratings								All	Spiers
		A	B	C	D	E	F	G	H		
		Order of preference									
12-in. Ross (b) open	1,200	2	1	1	1	1	1	1	2	1	1
6-in. RC-5A	950	4	4	3	6	6	2	5	6	4	6
12-in. Ross (c) mount	1,200	3	3	6	3	2	6	3	3	3	4
12-in. Metrogon	350	5	6	5	4	4	5	4	4	5	2
12-in. Ross (a) dense	1,200	1	2	2	2	3	3	2	1	2	3
6-in. Metrogon	1,320	7	7	7	7	5	7	7	7	7	5
6-in. Metrogon	600	6	5	4	5	7	4	6	5	6	7

height Ht., and ease of use—freedom from eye strain. He also graded the samples upon wholly subjective estimates of resolution of detail (F) and definition (D). The results are shown in Table II. Grading 1–2 indicates poor, 3–5 fair, 6–8 good, and 9, excellent.

TABLE II

SPIERS' SEMI-OBJECTIVE RATINGS

Camera/cone	Scale, ft./in.	Measurements of:				*To*	*R*	*D*	*Ts*	*T*	Order
		CW	*CC*	Ht.	Ease						
12-in. Ross (b) open	1,200	6	5	6	8	25	7	5	12	37	1
6-in. RC 5A	950	7	6	4	6	23	6	7	13	36	2
12-in. Ross (c) mount	1,200	5	5	7	7	24	5	6	11	35	3
12-in. Metrogon	350	4	3	8	5	20	4	6	10	30	4
12-in. Ross (a) dense	1,200	4	4	7	4	19	4	5	9	28	5
6-in. Metrogon	1,320	5	4	3	6	18	3	3	6	27	6
6-in. Metrogon	600	4	3	5	2	14	2	2	4	18	7

Semi-objective ratings: Crown Width *CW*, Stand Density *CC*, Stand Height Ht., ease of use—freedom from eye strain.

To = Total of objective ratings.

Purely subjective ratings: Resolution *R*, Definition *D*.

Ts = Total of subjective ratings.

T = Total of all gradings.

DISCUSSION OF DATA

In Table II, the numerical order of the samples is that of the rating, from the best data of these experiments. Table I is arranged in this same order. It is repeated that, because the samples are not comparable, conclusions should not be drawn with regard to comparative quality of the various samples.

The Ross (a) and (b) samples are identical *photographically*—prints off the same line, (a) is a dense stand, (b) is comparatively open, Ross (c) is with a different mount, thought to give less effective damping.

What is being graded is really effectiveness of recovery of certain ground information. There are two classes of variables: photographic factors; and subject matter; i.e. nature of the terrain and the forest cover. The importance of subject is reflected by the difference in grading between Ross (a) and (b); these samples are sensibly identical *photographically*, but the objective ratings of these two in Table II differ greatly.

It is proposed to repeat the experiments, using the same samples upon a different group of individuals. It will be of interest to see whether the order of grading, Table II, will be repeated. Development of objective measures of photographic quality could do much to standardize interpretation research and speed the development of optimum photography for use of photo-interpreters.

*Education and Research in the Mapping Sciences at the Ohio State University**

FREDERICK J. DOYLE, *Associate Professor of Photogrammetry, Institute of Geodesy, Photogrammetry, and Cartography, and Research Associate, Mapping and Charting Research Laboratory, The Ohio State University, Columbus, Ohio*

IN THE past several years many publications and addresses before various organizations have emphasized the increasing needs for more and better topographic maps. The facts are well known: that less than 25 per cent of the United States is covered by adequate maps; that the rate of obsolescence of existing maps is almost equal to the rate of production of new and revised maps; that untold millions of dollars are wasted in the planning of natural resource development, transportation, and manufacturing locations through lack of adequate maps and terrain knowledge; that the global defense commitments of the United States and efforts to improve the economic situation, particularly in the so-called under-developed countries, have been, and are being, seriously hampered by the lack of knowledge obtainable from topographic maps. Unfortunately these facts usually have been publicized primarily before such as the American Society of Photogrammetry, the American Congress of Surveying and Mapping, and similar organizations whose members are generally all too unhappily aware of the situation. Elsewhere lack of knowledge and concern is the general condition.

The reasons for the disparity between the demand and the supply are not hard to find. First, a scarcity of public funds assigned to the map producing agencies; second, a scarcity of trained scientists and technicians to execute the mapping projects; third, the lack of an adequate technology for the efficient acquisition and reduction of terrain data. It goes without saying that these reasons, particularly the second and third, are closely interrelated. The first is the easiest to alleviate, and it may be expected that when adequate personnel and techniques are available, sufficient funds will be forthcoming. But personnel and techniques cannot be voted into existence. The training of technologists, the education of scientists, and the research and development required for new methods are among the traditional objectives of a university.

In Europe this situation has long been recognized and there are established departments of surveying, geodesy, photogrammetry, and cartography in the technical universities of most countries. The mapping sciences are an acknowledged profession, and have been recognized by academic degrees for many years. Many fruitful developments have come from these efforts, and large numbers of excellent scientists have been educated.

In the United States the situation is quite different. Surveying and geodesy have traditionally fallen within the realm of civil engineering. Photogrammetry, if taught at all, may be in civil engineering, forestry, or geology, usually depending

* Prepared for oral presentation to Commission VI, Education, of the International Society of Photogrammetry, at the Eighth International Congress, Stockholm, Sweden, July 17–27, 1956.