

THE PI PICTURE IN 1955*

Dr. Robert N. Colwell, School of Forestry, University of California, Berkeley, Calif.

EACH speaker on today's symposium has labored long and thoughtfully in order to distill into the few minutes allotted him certain concepts on which he might have spoken for several hours. Therefore some people might consider it quite presumptuous of the enthusiast who selected the title for my paper and who wrote the abstract of it, to announce that in "5 to 10 minutes" I would provide "a critical analysis of the papers and discussion presented at this annual meeting." Obviously, any such brief attempt to interpret the PI picture in 1955 must assume the form of a "flash" or "summary" report. Therefore, my interpretation will be limited to the listing of a few salient features, grouped under three main headings; Research, Training and Production.

RESEARCH

Judging from the papers presented at this Annual Meeting, current research needs in photo interpretation can be grouped under a few major headings as listed below:

1. THE NEED FOR MORE AND BETTER PHOTO INTERPRETATION KEYS

The fact that more than half of today's papers have dealt with keys is indicative of the importance ascribed to them in our current PI research effort. At the same time, there seems to be a much clearer understanding now than formerly, that keys are not advocated as the cure-all to every photo interpretation problem. With this point established, certain critics seem more willing to acknowledge that properly constructed keys can often serve a very useful purpose. But such acknowledgment, even at this late date in the PI keys program, strikes me as being largely a presumption on the part of keys makers and a belated concession on the part of their former opponents.

Very little objective testing of the effectiveness of keys has been performed to

date. Certainly such testing should be conducted soon, as advocated by Dr. Young. Thereby we should be able not only to demonstrate more convincingly the value of keys, but also to resolve many of the points of variance, expressed by today's speakers, as to the most suitable form of key—mechanical vs. textual, associative vs. subject, and dichotomous vs. integrated-selective.

2. THE NEED FOR A BETTER SELECTION OF PHOTO INTERPRETERS

Two important aspects of this problem have been discussed. The first relates to vision testing of the photo interpreter, as discussed in Dr. Rabben's paper, "The Eyes Have It" and in Mr. Moessner's paper, on "A Simple Test for Stereoscopic Perception." As Dr. Rabben pointed out, there is no single vision test that is completely adequate in this regard, since the photo interpreter needs more than mere stereoscopic acuity. Among the other requirements which he mentioned are: good distance vision, acceptable near vision, good reserves for accommodation and convergence, good extra-ocular muscle balance, and the visual capacity to maintain an exacting search for small details. A person having a very high rating in one of these vision tests, might prove on further testing to have the poorest *over-all* vision characteristics from the PI standpoint.

A second aspect was presented in Dr. Whitmore's paper entitled "Manpower for Military Photo Interpretation." The highlight of his paper is that this country has an adequate number of competent earth scientists available to fulfill our military photo interpretation requirements for terrain analysis, even in the event of total mobilization. But would our system of selection and assignment of personnel result in the proper placement of such experts in the event of another na-

* This is a part of the Symposium on Photo Interpretation Keys held on March 8, 1955 during the Society's Annual Meeting.

tional emergency? This question requires a negative answer unless recent major changes (*actual* changes, not merely theoretical ones) have been made in the system, unbeknownst to the present speaker.

In addition to the above, other criteria for selection of photo interpreters might well be developed, based on the individual's powers of observation and imagination, his powers of judgment and his overall mental acuity.

3. THE NEED FOR A RE-ALLOCATION OF FUNDS TO PERMIT MORE RESEARCH ON THE CIVIL ASPECTS OF PHOTO INTERPRETATION

While this need was not mentioned by any of today's speakers, it is a very real one. The simple fact is that military organizations now control, directly or indirectly, most of the funds currently available in this country for research in photo interpretation. As a result, non-military agencies such as universities, the National Research Council, and various branches of the Departments of Agriculture and Interior, frequently must turn to the Department of Defense for funds with which to perform photo interpretation research. This arrangement often (but by no means invariably) proves unsatisfactory to both the military and civil parties to the research contract. For example, the military contractor, under such an arrangement, often bemoans the fact that a PI contract with a university results in an end product which reflects so largely the academic or "ivory tower" approach as to have little direct military application. Conversely, the university scientists who are party to the same contract may be so frustrated by problems of military security and so unaware of what the military requirement really is, that their product is doomed to mediocrity, even if some of the finest intellects in the nation are working on it.

It is an excellent tribute to some of the people in this audience that the Department of Defense has seen fit to allocate sizeable funds for much-needed research in photo interpretation. But it is unfortunate that the military is so predominant in the control of PI research funds in this country that most civil research in PI is subservient to it.

4. THE NEED FOR A QUANTITATIVE AND QUALITATIVE EVALUATION OF THE PHOTO INTERPRETATION SYSTEM

As stated in Dr. Young's paper, there is a need for evaluating the present accuracy and efficiency of all phases of the photo interpretation system in terms of its usual end product—the PI report. Only by so doing can we recognize the weakest links of the chain and develop logical means of strengthening them. Until this is done we will continue to attack the over-all problem on a piece-meal, hit or miss basis and will be swayed more by catch phrases and witty analogies than by valid reasoning. Just one example will be cited to illustrate this point:

At one of our Society's Annual Meetings a few years ago, my friend Amrom Katz had this to say. "This matter of photographic interpretation strikes us as being a very much unbalanced situation, wherein we may take a million dollar airplane, a hundred thousand dollars worth of cameras, a half dozen rolls of film, one of which (for the K-40 camera) is going to cost about \$400 . . . we take off on a very hazardous mission in the sense of military and social economics . . . when the photo-interpreter gets around to abstracting the information he uses a 10 cent magnifying glass. The numerous reasons for this tremendous disparity between reconnaissance equipment and interpreter's equipment are simultaneously operational, historical, technical and illogical. . . . It is hoped that before too long proper balance will be restored."

It may very well be that we are much in need of a better stereoscope for interpreting aerial photos. But I submit that the reasoning cited above is specious and I would be willing to bet that a man as sharp as Amrom Katz had his tongue in his cheek when he wrote those words. But from Berkeley, California to Delft, Holland and from PI supervisor to peon, the argument is still advanced that surely we must need a better stereoscope simply because present day stereoscopes constitute a disproportionately inexpensive link in the photo interpretation chain. Since the end product of the PI effort usually is a report, might we not argue with equal logic for a very costly pencil with which to write that report?

At the expense of repeating my previously published views on this subject I will again side with the biologist Mitscherlich. Nearly 100 years ago he observed a similar series of links in the biological chain and wrote: "When a biological process is conditioned as to its rapidity by a number of factors, the increase in rate produced by unit increment of any lacking factor is proportional to the decrement of that factor from the optimum." Viewing this matter more realistically, then, it would seem that we should strive, now, for improvements at every limiting link in the photo-interpretation chain,* with the hope that each improvement will increase the accuracy of the final information derived. At the same time in allocating our over-all research and development effort in the photo-interpretation field, we would do well to allocate our energies toward the improvement of any limiting factor in direct proportion to the decrement of that factor from the optimum.

The problem of determining the "decrement of each factor from the optimum" is a tough one, but how can we help but agree that a logical step toward solving it is to implement Dr. Young's proposal for a qualitative and quantitative evaluation of the photo interpretation system?

TRAINING

As in the case of research, the training aspects of our PI picture in 1955 can be interpreted and reported upon under a few main headings as follows:

THE ACCELERATION OF TRAINING IN CIVIL APPLICATIONS OF PI

During this post-war decade, while military PI training first was in a decline because of demobilization and then reached a relatively stable state, civil PI training has grown quite remarkably in certain areas. For example, at the end of World War II there were only 2 or 3 schools in the U. S. where a student could receive any formal training in photo interpretation for forestry purposes. Today such a course is required for graduation in the majority of our forest schools, and is

* Those interested in one attempt to analyze the various links in the PI chain are referred to a paper presented at our PI symposium last year entitled "A Systematic Analysis of Some Factors Affecting Photographic Interpretation," PHOTOGRAMMETRIC ENGINEERING, June, 1954.

offered as an optional course in most of the remaining schools. A similar situation prevails in other professions which employ photos extensively. In addition, special PI field schools and "short courses" are being offered to various types of professional men who can afford a few days in which to learn PI techniques that might prove useful to them in their daily work.

SPECIAL SYMPOSIUM ON TRAINING

Perhaps the most significant development at this Annual Meeting from the standpoint of training is the special symposium on "Education in Photogrammetry" which is running concurrently with our PI symposium. Training in all aspects of photogrammetry, including PI, are being discussed at the symposium. Accordingly, those interested in the training aspects of PI would do well to read the proceedings of that symposium in this issue of PHOTOGRAMMETRIC ENGINEERING.

PUBLICATION OF THE JOINT PHOTO INTERPRETATION HANDBOOK

Work on this handbook has been progressing for the past several years. Its issuance within the past year represents the first time since World War II that an up-to-date handbook has been available to PI personnel in the armed forces. It is expected that the value of this handbook in our military PI training programs will be very great, indeed. One feature of the PI handbook, in contrast with the previous ones, is the relatively infrequent use of photographic illustrations. This seeming incongruity is explained by the fact that the publication of an increasing number of military PI keys and related documents provides adequate photographic supplements to the basic manual.

PUBLICATION OF A MANUAL ON METRICAL TECHNIQUES

During the past year, both military and civil versions of this manual have been published under the respective titles: "101 Keys to Metrical Photography" and "Photographic Measurements—101 Prob-

AUTHOR'S NOTE: For a highly significant analysis of civil and military PI training see Boston University Technical Note 119 "A Comparative Analysis of Curricula and Techniques Used in the Training of Photographic Interpreters," by S. A. Custer and S. R. Mayer.

lems and Solutions." Photo interpreters have long been criticized for their reluctance to make photo measurements which would support their qualitative interpretations. To the extent that such criticisms are valid, this manual should fill a real need, and therefore merits a brief review here. The comprehensiveness of the manual is indicated by the fact that it surveys the field of photogrammetry, broadly defined, from shutter calibration to stereoscopy, from lens optics to relief enhancement, and from image motion compensation to high altitude stereo techniques. Like all manuals, this one has certain limitations. In this case the limitations are mainly organizational. No logical remedy to this problem presents itself because of the tremendous breadth covered by the manual and the numerous inter-relationships to be found among its 101 problems.

This manual in either its military or civil form should be a welcome addition to the library of any photo interpreter, because it is of great potential value as a training aid for the making of quantitative interpretations. But until the PI thoroughly familiarizes himself with its contents and organization, the manual may lie there on the shelf with its pages unblemished by the pencilled notations and dog-eared corners that are a true measure of its usefulness.

PREPARATION OF A SOCIETY-SPONSORED MANUAL OF PHOTO INTERPRETATION

This was already reported upon by the present speaker earlier today so will not be described again here. Its potential significance in relation to the training of PI's is obvious since the most authoritative workers in various aspects of PI, both here and abroad, are being asked to contribute to it.

PRODUCTION

From the *military* PI standpoint, production, other than that already alluded to today, will be regarded as having a security classification beyond the purview of this audience.

From the *civil* PI standpoint, however, noteworthy production can be reported in each of several fields:

GEOLOGY

According to Robert L. Anderson of Geophoto Services, in 1954 over $\frac{3}{4}$ million

square miles of Photogeologic mapping by various companies and government agencies was completed in this country and foreign areas. This eyebrow-raising figure (equal to more than a fourth the area of the United States) has been accomplished by a mere handful of personnel. These photogeologists have covered more area, in less time, and at less cost, than anyone would have considered possible a mere ten years ago. Largely as a result of their excellent work, mineralogical discoveries of many kinds currently are being made at a rate heretofore considered unattainable.

FORESTRY

In California alone during the past year, experienced photo interpreters have classified nearly one million acres of timberland as to size class, stand density and vegetation type. The detail with which this work has been done is indicated by the fact that each timber stand covering more than 10 acres has been classified and mapped individually in all cases where it differed materially from surrounding stands in any of the above three respects. When one recalls that on the 1/20,000 scale photography with which this classification is done, a 10-acre ground area is represented by a square less than 0.4 inch on a side, he will recognize this as one more instance in which detailed photo interpretation by highly skilled personnel is proving of great practical value on an actual production basis. While California has been somewhat more progressive than certain other regions in the photo classification of its timber resources, similar work has been performed, or soon will be, in many other parts of the country.

SOILS

The mapping of soils in wildland areas has only recently advanced from the research stage to the production stage. In the past year, for example, approximately 600,000 acres of wildland soils classification has been performed in California by skilled photo interpreters. The success of this project has resulted in the formulation of plans for expanded production in the near future both in California and elsewhere.

GEOGRAPHY

Depending upon the definition of geography to which we subscribe, recent PI

production in this field has been little or great. If one considers that geography means literally to "write about the earth," then photo interpreters have been active indeed this past year—not only those just mentioned under the headings of Geology, Forestry and Soils, but many others as well. Among these are such men as Matthew Witenstein, who spoke this morning on urban area analysis—and those engaged in the production of PI keys, about which we have heard much today. Others, such as Professor Kirk Stone who is currently so active in the photogeographic interpretation of Arctic areas, have been highly effective producers in this field.

If, on the other hand, we agree with those who define geography as "the study of landscapes, regions, distributions or of the synthesis of the national and social sciences" then a different conclusion is indicated as to the productiveness of photo interpreters in this field. In this case we would be inclined to agree with our panel moderator Dr. John Roscoe who, at a recent AAAS meeting berated such geographers rather unmercifully for failing to use aerial photos as intensively or extensively as they should.

Perhaps the closest approximation to the truth in this regard is a recent statement by our Society's National President, Art Lundahl, as follows: "The full impact of the importance of photogeography has not yet been recorded and we are just becoming generally aware of the possibilities which it offers in combination with other earth science data, in the economic, scientific and cultural development of man."

SUMMARY

If I have correctly interpreted the PI picture in 1955, there has been much significant progress recently in the research, training and production aspects of PI—progress for which we can justly be proud. At the same time, in each of these aspects there remain many problems which should challenge a photo interpreter's stereoscopic and mental acuties to the utmost for a good while to come. This is a healthy situation—one which should assure a bright future for every able bodied PI, and one which should permit us to convert even the remaining skeptics who insist that "PI" stands for "peering idiot," into potential customers of our services, along with all the rest of mankind.

CLOSURE

DR. ROSCOE: We have had the largest turnout of any of the technical panels and, in fact, of any of the general sessions to date. Keeping this in mind, one can see there will be a genuine need indeed for the Manual on Photo Interpretation. All of you who may be called on by one of the author-editors should consider seriously your contributing in your field. This is a product of the Society as a whole and the help of everyone is needed.

NEWS NOTE

KODAK ISSUES PAMPHLET ON DIMENSIONAL STABILITY OF PHOTOGRAPHIC FILM

A new Eastman Kodak publication, "Dimensional Stability of Photographic Film," is available for distribution.

Dimensional stability of sheet film is of interest in a number of applications such as reproduction of mechanical drawings, topographic maps, color separations, and various other graphic arts and industrial uses. The leaflet is intended to explain why

photographic films change size and to provide some dimensional stability data for both cellulose ester and polystyrene base film sheets. The theory and types of expansion and shrinkage are discussed with suggestions given for handling film to minimize size changes. Also included in the leaflet is a table of average dimensional change values for Kodak Sheet Films.

Copies of the leaflet are available without cost from the Sales Service Division, Eastman Kodak Company, Rochester 4, New York.