

*The Interpretation of Unidentified Information**

A Basic Concept

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ABSTRACT: From experience the interpreter has concluded that knowledge and skill must be supported by technical procedures and equipment. He is an analyst who needs his own basic concept of his source material—photography.

All unprocessed photographic information is unidentified and must be interpreted objectively and systematically. The photograph documents (a) the point of record revealing "observer to object" relationship; (b) manner of record, camera, film, etc.; and (c) content of record.

The interpretation is to be reported in simple, direct terms, free from coloration or evasiveness. The purpose is to communicate physical evidence and correlated data to an ultimate user.

INTRODUCTION

THE photo interpreter has completed a significant stage of development. In World War II he learned to apply some of the skill of the photogrammetrist and of the intelligence officer. By means of such knowledge and a mixture of imagination and extemporization, he performed ably, creating a demand for information from photography not previously fulfilled. The result has been a tremendous interest in the photograph,—an interest sustained and encouraged by well-trained and, in many cases, dedicated men.

Subsequent to World War II and fortunately in time to be of use in the action in Korea, the additional resources of scientific and professional researchers were exploited to provide manuals, keys, and basic investigation of technical and human values. This harmony of relationship among photogrammetrist, scientist and photo interpreter has provided a wealth of substantial, tested experience upon which to draw for the future. The photogrammetrist has provided technical knowledge, precision instruments and tested working practices. The researcher has

provided knowledge, insight and intellectual tools. The interpreter is now responsible for their use.

This much having been accomplished, the interpreter must prepare for future growth. He is about to undertake new and challenging tasks. New men must be trained. Old skills must be preserved. New problems and new solutions must be undertaken.

It seems proper, before going forward, to summarize a basic concept for the interpreter.

THE PURPOSE

The purpose of this paper is to summarize a basic photo interpretation concept:

First.—That the photograph is a record of unidentified information, and

Secondly.—That the interpreter must establish the validity of the photograph as a record and he must identify selected information in a systematic and objective manner.

THE PHOTOGRAPH

The daily use of photography in mapping, reconnaissance, and illustration and the

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constant demand for information, and more information, has dulled the interpreter's creative imagination and blunted his resourcefulness. This must be changed.

Fresh, vigorous, constructive analysis of the photograph is required. Interpret the photograph as if it were new to your experience. Consider it of unknown source and its content unidentified information; it is raw information, unprocessed as intelligence and unverified. It is taken and filed. It does not communicate itself. It must be sought out. Stored as film on a shelf, it rests there. It may be overlooked, or ignored, and its content lost to the interpreter.

The photograph is the primary source of information for the interpreter. It contains information not available through other means of collection, or it substantiates information obtained through other collection.

To be of use this information must be studied, evaluated, and organized. It must be communicated to a user. Such information may be limited or extensive. It may have one or many users.

The air photo of distant wastelands, unused for years in a cartographer's vault, may yield clues to undeveloped mineral wealth—if it is studied carefully by interpreters trained in geology. Random oblique views of nearby rural areas, once prosperous farms but now marginal scrub growth acreage, may show the potential site of profitable industrial development,—if studied by one skilled in urban area planning. The accidental, badly processed intelligence view, the one view in a hundred, or the exposure nearly thrown away, may lead to the discovery of significant military information;—if tested and confirmed by a military specialist.

But the interpreter is not a specialist in all fields. One exposure does not contain all information; instead it contains varying levels of information.

The photograph is a direct or indirect record of only the amount of detail within the camera's field of view.

It is a record of an instant of the earth's phenomena limited by weather, conditions of exposure and the performance of cameras and film.

The photograph is incomplete. It limits the area and conditions photographed. A single exposure may require confirmation of camera station and other directional

information. The content may be further limited by the accidental placement of a cloud or shadow.

The photograph must be placed in context, and the interpreter in identifying information must preserve the relationship of photography to intelligence processing. He should examine the photography (his primary source) before utilizing his supporting data (his secondary sources).

The photograph provides a record of the characteristics of the area, of the geometry of the camera station, and even provides its own testimony concerning the degradation of the recording and reproduction. Thus, the interpreter considers.

- a. The geometry of the camera station
- b. The degradation of recording and reproduction, and
- c. The characteristics of the area itself.

The geometry of the camera station has plagued the photogrammetrist so persistently that he has developed instruments and techniques for correcting its inflexible properties. The interpreter, less concerned with the instrumentation, welcomes the unique geometry because it is an almost indestructible clue to directional information. Since the interpreter is actually a vicarious observer, it is important in the geometric relationship of observer to object, to know the precise location of each. One of the primary steps of identification will therefore be to establish the camera station, or point of observation. It is important that the interpreter not limit himself to vertical coverage but adapt himself, as well, to tilted and terrestrial views.

With respect to the degrading of recording and reproduction, it will be necessary for the interpreter to identify changes of geometric distortion which may affect the reliability of the record of measurements. He must be prepared to cope with the effect of limiting conditions of exposure upon the reliability of image characteristics.

With respect to the image characteristics, the interpreter must exhaust the photograph of all record of mensural and other physical characteristics of an observable nature. These are:

- a. Shape
- b. Size

- c. Pattern
- d. Tone
- e. Texture
- f. Shadow, and
- g. Site

THE USER

The user is the ultimate consumer. He determines the requirement and therefore the level of interpretation.

The user is not concerned with the problems of interpretation. Often he is not concerned with the problems of reconnaissance. He has a legitimate need for information which may have been recorded in photography, as a convenience of collection. His request, in fact, is that selected information of use to him be extracted from the photography, be digested, and, thence, be communicated to him in the most reliable and expeditious manner.

Depending upon the needs of the user, the photograph may be exhaustively studied, or scarcely viewed at all.

The user establishes the requirement which may or may not have been taken into consideration during reconnaissance. Because of this the level of recorded information may be balanced properly or adversely against the interpretation effort to be employed. Photogrammetrists recognizing this have established rigid standards for mapping photography. But it is not within the authority of an interpreter to reject substandard or inadequate photography. The lower the level of information presented to him, the greater the intellectual demand he must make upon his resources.

In satisfying the user the interpreter is to extract the appropriate information necessary to:

- a. Answer specific questions directly as factual, when supported by valid test.
- b. State the reliability of information
- c. Isolate what is not identified.
- d. State limitations of identity.

This hypothetical first user will not, however, have exhausted the recorded detail of the photograph. The interpreter may subsequently be called upon to re-interpret the area in another field of interest or knowledge. Some of the verification established in the first interpretation

may be pertinent, or additional verifications may be required

THE INTERPRETER

Photo Interpretation is the task of studying unidentified photo imagery for the purpose of establishing identity and deducing its significance. The results of the interpretation must be communicated in an orderly, objective, and expeditious manner.

The level of information contained in the photograph and the requirements of the user interact, and, in a broad sense, establish the extent of interpretation resources to be used.

The interpreter should examine his photography, establish its limits of reliability and proceed to extract all useful directional information and all directly observable features. He will annotate, measure and describe these results qualifying them when appropriate as to lower and upper limits of gross error. He should state what mensural correction he has utilized to reduce gross error. He should relate all mensural values to the best available independent sources, for example known image dimensions, or cartographic data.

Each task should be approached as new. The interpreter will restrict himself, primarily, to the information that is requested by the user. All tests of measurement and description are to be applied before any attempt is undertaken to deduce non-observable information.

Interpretation should proceed from the general to the particular;—from natural to cultural features, from large area and cultural groupings, to smaller, particular functional groupings. In this procedure, the basic unidentified features yield to identification at no great expense of effort since areas of general knowledge lend themselves to tests of recognition, identification and academic knowledge usually within the experience of the new interpreter. Or such information can be made discoverable by an appropriate key or manual.

Having exhausted the photograph, he may turn, as necessary, to secondary source materials. These may include other photography, maps and documents.

All of the interpretation resources employed up to this point should be within the area of general interpretation skills.

Observable information will have been interpreted, that is measured, described and annotated, from the general to the particular in categorization in descending order. Since it is too early in the interpretation to determine the extent of specialized effort required, economy dictates that the maximum of organization and direct interpretation be performed by the first interpreter.

In evaluating his photography, he will assess his own capabilities. He will admit his limitations and seek assistance. This self-examination can be made even more objective through healthy skepticism of all things photographic. The issue is "What do I see; how can I test it?"

At the U. S. Naval Photographic Interpretation Center there is the continuing problem of training, and retraining, the civilian photo interpreters. Some are experienced; some are new to the work. We have not experienced difficulty in training in specialized fields because the interpreter naturally seeks a field suited to his talents, thence to pursue excellence in it. Since the men we train rise to high levels of responsibility, broad well-grounded experience is necessary.

Our interest therefore has been in laying a foundation of knowledge and sound working practices which lead to systematic interpretation.

The interpretation, prepared up to the level of general experience, is now ready for the review by a qualified specialist within the field of specialization indicated by the factual report.

The report will have summarized the observable and generally deducible information and the metrical properties of the photography. It will indicate, or have correlated, the secondary source materials used. By virtue of its factual and orderly presentation, the reviewing specialist can in the most economic manner:

- a. Concur in the deduced identifications, if valid.
- b. Further identify, or correct, incomplete aspects of the interpretation.

Any remaining unidentified information will be clearly called to the attention of the user in a direct and unequivocal manner.

Where are the manuals, keys and guides

to train potentially capable persons and make them experienced interpreters? Where are the rules for orderly analysis? Perhaps they exist. Perhaps they are only projected.

In practise the interpreter may best perform his task in the following manner.

- Step 1. Approach each task as of grave concern
- Step 2. Limit study to areas of concern to the user
- Step 3. Test the photograph for practical photogrammetric values
- Step 4. Plant interpretation sequence and concentrate on observable clues, temporarily foregoing deduction
- Step 5. Annotate boundary limits of each selected site.
- Step 6. Measure, describe, and identify general function categories
- Step 7. Subdivide the general site by further annotation of particular features
- Step 8. Measure, describe, and identify sub-categories insofar as supported by test
- Step 9. Isolate unidentified features, and seek additional clues
- Step 10. Complete remaining factual organization
- Step 11. Re-attack remaining unidentified features in terms of accumulated evidence of general and particular relationships.

At this stage the basic task of the interpreter is essentially complete.

Sufficient factual evidence will now be annotated and described to permit almost anyone to make general identifications.

Sufficient particular information will have been interpreted to permit a more selective identification from a punch card key or other manual.

As for further identification by the interpreter himself, it appears that his competence will increase through experience. As he learns, he may extend the limits of his deduction. But with each advance he should be able to provide a rational description of his method of relating observable data to deduction.

CONCLUSION

In conclusion, the interpreter utilizes photography, direct and indirect, well

resolved or badly resolved, as an unidentified primary source of information. He measures, describes, and annotates all observable information and organizes it factually so that he may make appropriate deductive identification within generalized experience. He then turns to specialized resources and completes the interpretation to the levels of accuracy and detail required by the users of photographic interpretation.

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APPENDIX A

A TENTATIVE LISTING OF CHECK-OFF QUESTIONS

Assume that the Photo Interpreter is to identify image patterns on or near the ground. The following are questions which would occur to him in the course of analysis and deduction.

1. Is the pattern location related to: (a) Land, (b) Water, (c) Continent, (d) Subcontinent, (e) Regional, (f) Local?
2. Is the frequency of its occurrence: (a) Continuing, (b) Transient, (c) Repetitious?
3. Is it seasonal, i.e.: (a) Spring, (b) Summer, (c) Fall, (d) Winter?
4. Is it (a) common or (b) uncommon?
5. Is it apparently (a) natural or (b) cultural?
6. Is the pattern (a) random or (b) systematic?
7. Is the tone of the pattern; (a) Consistent (b) Lighter, or (c) Darker?
8. Does the unit vary in (a) size, or (b) shape?
9. Is the pattern a unit in itself or subject to breakdown of identity.
10. Is the pattern near or related to similar patterns?
11. Is it of (a) the same, or (b) different datum?
12. Is it related to (a) similar, or (b) dissimilar water bodies?
13. Is it related to (a) similar, or (b) dissimilar landforms?
- *14. To what major natural or activity does it apparently relate. (a) Natural: (1) Coastal Waters, (2) Lakes and Rivers Inland Waters, (3) Forest and Cover, (4) Mineral, (b) Culture: (1) Agricultural, (2) Residential, (3) Commercial, (4) Industrial, (5) Transportation, (6) Storage, (7) Military, (c) Oceanography, (d) Meteorology, (e) Specify other.
15. Note and evaluate effect of following: (a) Surrounding areas on tone, size, and shape of pattern. (b) Distance or nearness on tone, size, and shape of pattern. (c) Scale on image tone, size, and shape of pattern. (d) Tilt, bearing or dip on tone, size, and shape of pattern. (e) Exposure, filters, or degradation on tone, size, and shape of pattern. (f) Recording sequence on tone, size, and shape of pattern.

NOTE—The terms are used for brevity but refer to the recognized image characteristics which through study and experience are associated with the physical evidence of natural and human activity regardless of resolution or degradation of image properties.

DISCUSSION OF MR. SEYMOUR'S PAPER

MR. BELCHER: A system of method and orderly procedure; a much needed discipline. The only sensible and scientific substitute for a problem. I asked a man, "when you drive over the roads and look at the ground, how do you arrive at a classification for the land?" His answer was, "I just can't tell you; it's like playing a violin: I can do it, but I can't explain how." So in this work we need less violin playing and more discipline and orderly process.

MR. KATZ (Rand Corporation, Santa Monica): While I found the paper extremely interesting, I don't think that the title or its promise was really borne out. A fundamental problem is how do you identify something that you have never seen before. While I didn't expect a complete answer, the title implied that it would be one of the things discussed.

In attempting to describe the PI process in such as words, numbers, charts, lines, it is quite frustrating to explain how one recognized the gestalt. It doesn't readily lend itself to numerical analysis. An attempt to do this will only obscure the real facts, as exemplified by our experience in World War II with the system of identifying ships, airplanes, by looking at a piece of the tail, piece of the propeller and all that. After all had had a little experience,

that system wasn't used; it was done by recognizing the gestalt.

In fact, in this is found a clue as to why electronic photointerpreters are going to be at least two technical horizons away. The electronic photo interpreter which would have to be programmed with a series of steps, infinitely more complicated, is not about to be made available.

The fundamental analysis is something with which at least I cannot agree—I hope I'm not outnumbered here.

MR. SEYMOUR: I thank Mr. Katz for his direct and forceful remarks, because I'm sure quite a few here feel the same way. I have a different line of thought which to my mind completely justifies the paper. Many of you here are now experienced specialists, but you have forgotten what blundering mistakes you made when you started. I see these mistakes every day made by new analysts brought into the employ of the Government. Few experts like Heifetz are around to show the novices how to do the job. The few experts called upon for technical advice are so few in number that we feel their advice and services are priceless.

I value Mr. Katz's efforts. Unfortunately, there aren't enough Katzes; there are too many like you and me. We do our job as well as we can until somebody better comes along.

I accepted the title of the paper hoping it would be provocative and make you realize that until you look at a photograph, everything is unidentified. What you've been doing too often is identifying things by virtue of your experience; you haven't been analyzing your experience; this does not help in making you capable for providing guidance to younger men. As Mr. Belcher said, the man who tells you the results of his analysis and not how he made it, is of no help to the student.

So I presented this subject in a way I hoped would get you to thinking in terms of the younger and less experienced men.

Even experienced men engaged in military or semi-military work move to new areas. There is then a "loaded" area that is not responsive to guessing or basing findings on pure experience. So even the best man often goes back through a sys-

tem of discipline and analysis to check himself, because nature has lots of whims.

MR. LAYLANDER (Photogeologist): Is there any comparison between the gestalt system of training, such perhaps as studying case histories and getting information by rapid observance, scanning, as opposed to the atomic approach?

MR. SEYMOUR: I can't answer that except by observation. It is because of my observations that I am troubled by this subject. Who teaches the teacher? That is the real problem. Some of us are in the position of being teachers, but we haven't actually investigated our own limits, our own faults, our own shortcomings. And frankly, the results would prove Mr. Katz's statement. The people who do the the job purely on the basis of their experience in the long haul would do a much better job. I would be much surprised if people working systematically and in an orderly manner even approach the performance of the photo interpreter who is operating as a pure genius.

MR. KATZ: There are many violinists playing the violin who are not Heifetzes. I'm talking about those who play the violin after very little instruction.

In approaching a subject you must attempt to break it down by bits and pieces. Such as the tuning operation. After that, whether it be violin teaching or aircraft identification, you'll find this is never done by any method other than the gestalt system. This was true throughout World War II and the Korean War and is true today. An aircraft observer is not taught to examine the tail, the fuselage, the propellers, and the jets and add these together and consult a key. He is given much training, a lot of experience in flash identification. This is obviously and completely the Gestalt system.

To get back to the problem of unknown objects. I think it is apparent to all, that in future years we will be looking more and more at things we had never seen before, because never before built. So there's obviously no context, no experience or library to draw upon.

I'm thinking of a personal experience. On my first flight over the Connecticut Valley I saw for the first time white patches apparently on the ground. I en-

quired and was told this was cheesecloth under which tobacco was growing. If pictures of this area are given to a photo interpreter and he doesn't know about this growing of tobacco under cheesecloth, he will be unable to figure out what that white stuff is.

I'm sure all of us have had experiences just like that and this was the sort of problem that I thought was meant by the title of the paper.

MR. SEYMOUR: Either I do not understand my own presentation, or it was too brief. Because I thought that was exactly what we were discussing. I thought that the solution to this dilemma would be that the young man, or the older man, who is interested in time and economy would waste no time in trying to guess what the cheesecloth was but would have said at the outset, "I don't know what they are. Let's gather some information and then I will carry this to someone who very likely will know and we will then get an answer in the most rapid and economical fashion."

I thought too that I had limited the discussion explaining the concepts of organization up to the levels of general intelligence identification.

Mr. Katz' example is pertinent, but I would have preferred my solution. I would rather have that man study the photograph, organize all the data he could and then say, "Within an area on this photograph there are 72 white squares of material which appear to be slightly up in the air and have rather opaque characteristics; these squares are of a certain length, have a certain pattern and are in an area of the terrain where certain things may be taking place." Then, utilizing some of the ideas suggested by Mr. Heath, the other analyst would bring his broader experience to bear, but he

wouldn't have to study through using the stereoscope, and he probably would get the answer in the quickest, shortest and best manner.

MR. BELCHER: If the man had looked through a stereoscope, as he should, he would have noticed that the white cloth is about four feet off the ground; very seldom do solid colors float up in the air like that.

MR. CHENEY: What we need is a book—I don't want to use the word "key"—that will be a companion piece to volumes on land forms information, probably on a geographical or regional basis and which would be broken down into the geometrical shapes. Through drawing on experiences from men all over the world, try to make this book a real encyclopedia of geometrical shapes that are seen. Most things do have a definite shape and usually a pattern of distribution.

COL. ASHBAUGH (Director of the Department of Photography at the Engineer School): I merely want to add that I think these men are saying fundamentally that no key, no machine, no gadget that can be manufactured will ever take the place of fundamental education. We must never lose sight of the fact that to arrive at photo interpreters or whatever you want to call them, we first must take your daughter, my daughter, your son, my son, through the fundamental college process of engineering, geology, soils and so on.

MR. BELCHER: I thank the audience for the splendid reception today and these people who have come from various parts of the country.

I appreciate the cooperation of the audience, the convention management and each of the individual speakers.