Testing the personal stereoscopic measuring precision: further results.

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1. ABSTRACT

The H-test, a test for personal stereoscopic measuring precision, has been used at the Survey Department of Rijkswaterstaat for training and testing photogrammetrists since its introduction in 1979. Experiences and results, gained up to 1981, were published in 1982 (1). Over 100 persons have been tested until now. The results are summarized in this paper.

2. SOME STATISTICS

Since 1976 a number of 59 candidate photogrammetrists have been trained at the Survey Department. A trainee's capability to measure elevations by means of stereoscopy can be determined with the H-test. Most candidates score a standard deviation σ_1 of about 50 µm at photo scale at the beginning of their training. A majority, some 70% of the trainees, reaches the 20-30 µm range after 2-3 training months, and passes the 20 µm criterion after 3-9 months. Some need a year, or even longer. No or hardly any progress was made by a number of 9 trainees. Another 3 trainees succeeded in reaching the 20-30 µm range, however, a visual deficiency (see §4) stops further progress. From 2 trainees it is not yet clear to which group they are going to belong, their test results being very doubtful until now. So in fact 20-25% of the trainees do not have the capability to become a (good) photogrammetrist.
It should be stressed here, that all candidates succesfully passed tests for their natural stereoscopic acuity, before being admitted as a trainee. The TNO test for stereoscopic vision (a set of random dot stereograms), and the SSPO test for peripheric zones of the retina, are part of the recruitment procedure.
However, testing the stereoscopic acuity this way is absolutely insufficient for this purpose, as is once more clear now.

3. THE TIME A TRAINEE NEEDS TO BECOME A RELIABLE PHOTOGRAMMETRIC OBSERVER

As was stated before, a majority of the photogrammetric trainees needs 3-9 training months to meet the Survey Department's 20 µm criterion. A fully experienced observer's standard deviation will in general lie somewhere between 10 µm and 20 µm. This is a matter of personal skill. Having passed the 20 µm criterion, a trainee needs in general the experience of another 6-18 months to bring his measuring precision further up to his top.
However, an observer's measuring precision is not the only quality to be considered. The reliability is also important, i.e. his skill for trustworthy measuring difficult situations. For instance in bad photography with a lack of detail for correlation. Using data snooping, close analysis of aerial triangulation blocks, to which several photogrammetrists had their contribution, indicated significant differences between observers having about a two year's experience and those having an experience a couple of years longer. So nowadays in general the Survey Department puts operators on the hardest jobs only after some four years of experience. All periods given in this chapter are averages, rather big differences occur.

4. VISUAL DEFICIENCIES

Though having a reasonable stereoscopic vision, some 20-25% of the trainees do not have the capability for measuring elevations stereoscopically by means of floating marks. Most likely there are various deficiencies of the visual system (physiological and/or cerebral), preventing a candidate from getting acceptable measuring results. Thus far investigations made within the Department revealed one of the causes of a weak or even bad stereoscopic measuring capability; some kind of dominance of one eye.
This means, one half-mark is observed more sharply or intensively than the other.
Six out of the group of 105 persons, tested thus far, clearly appeared to have this kind of dominance, however, to different degrees. If a candidate has this kind of dominance only to a low degree, there is a fair chance illuminated floating marks of adjusted intensity will compensate for it. This, however, appeared to be of no use to one observer. So this deficiency may have different causes.
If not compensated, the H-test shows dominance produces weak, and in difficult situations even bad measuring results (see (1)). Consequently weak or bad results are also to be expected if an observer, who has no dominance, measures on an instrument with floating marks of unequal size and/or brightness!

However, until now there is little known and a lot be clarified about the visual system's features in stereoscopic measuring. Of course this is a task for specialists in this field. The Survey Department is glad to get the help of the Erasmus University of Rotterdam, Department of Biological and Medical Physics. It is intended to establish a research program, which should reveal the relevant visual deficiencies, so that more reliable and relevant recruitment tests can be developed.

5. A TENTATIVE TRAINING PROGRAM

The first part of the Department's photogrammetry training program is specifically aimed at height measurements, to determine as soon as possible after employment whether a trainee's stereoscopic measuring capability can be developed satisfactorily. This first phase consists of a number of orientation and restitution exercises, meant just to train the candidate in measuring by means of floating marks. Besides he measures each day 5 times some 30 points in an oriented model, of which measurements the standard deviation of the elevations is calculated. This model is to be replaced each week by another, to avoid correlated, therefore misleading results. If a trainee, starting at the 50 µm level reaches the 20-30 µm level within 2-3 months, this part of the training is finished. If so, his further training covers all photogrammetric aspects. If not, the trainee proceeds with part one - until progress is made, or until it is clear that no further progress can be expected.

6. CONCLUSIONS

1. Much has been invested to bring precision and reliability of photogrammetric point determination to a high standard, by improving instrumental precision, calculation techniques and error detection procedures. It is now time to have a closer look at the personal precision and reliability of photogrammetrists. To this respect the H-test shows differences between fully experienced observers up to a factor two.

2. Some 20-25% of the photogrammetry trainees, having passed succesfully tests for their natural stereoscopic vision, do not have the measuring capability to make a good photogrammetrist.
3. On the average a trainee needs some four years of training and experience to become a reliable photogrammetrist.
4. There is little known, and a lot to be clarified about the visual system's features in stereoscopic measuring.

Acknowledgement

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REFERENCES

(1) Schwarz, P.G., A test for personal stereoscopic measuring precision. Photogrammetric Engineering and Remote Sensing, Vol. 48, No. 3, March 1982.