A SHORT DESCRIPTION OF THE USE OF STEREO-DOCUMENTATION IN ARCHAEOLOGY

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The human stereovision

Most people with normal sight perceive the world around them in a 3-dimensional way. This means that they are able to see things and objects around them in a certain depth, and that the sizes of these objects and the distances between them can be approximately estimated. These 3-dimensional visions arise when the regarded objects at the same time can be seen with both the left and the right eye. The pictures who will arise on the retinas of the eyes are two completely different images. This depends on that one of the eyes will see its picture of the centralperspective a little bit horizontally turned compared to the picture in the other eye. These two quite different pictures will be analysed of the brain and rearranged to only one vision with a 3-dimensional effect of the depth.

The distance between the two different pictures is, in this way, equal to the distance between the human eyes, 5—7 centimeters.

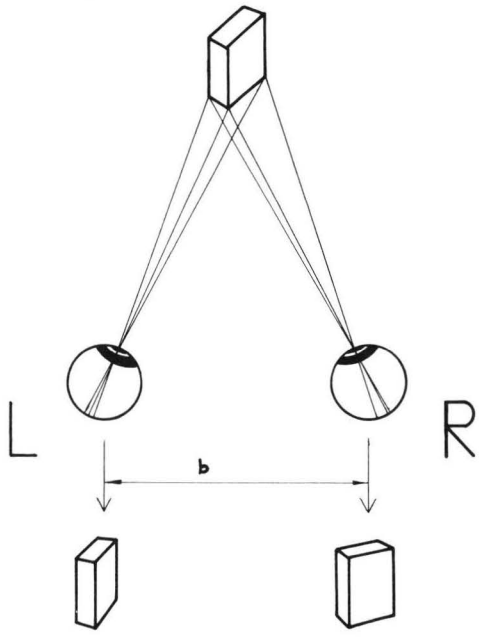

Fig. 1. Optical model for human stereovision.

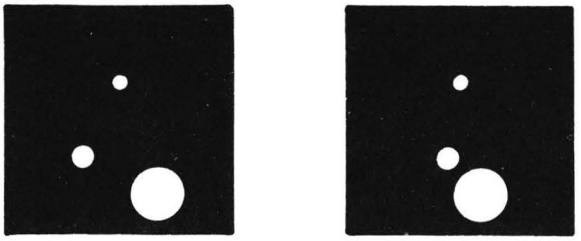

Fig. 2. A stereogram of dots.

These distance is called the basedistance, b. The human eye-brain-combination can separate different objects of larger format up to 200—300 meters away. Beyond that distance will the differences in the vision of the left eye compared with the right eye, be so small and minimised that the brain only can take in these pictures as if they were two identical ones. And with two identical pictures can no vision of depth arise. Accordingly to that is our sight on larger distances only 2-dimensional.

If a person with the base b = 5,5 centimeters, on the distance of 55 meters have a certain vision of depth called S, is it possible that another person with the base b = 7 centimeters can take in the same vision of depth S at a distance of 70 meters. This statement must be regarded only in a totally theoretical way since there are a lot of other factors in the eye-brain-combination who interact in the 3-dimensional vision of seeing.

To get a sharp picture at different distances the eye must be able to accomodate. The corresponding focusing in a camera will take place when you push or turn the lens closer or further away from the filmplane. The filmplane is similar to the retina in the eye, but as the distance between the lens and the retina is fixed at about 17 millimeters, is it only possibly for the eye to accomodate by changing the thickness and bellyness of the lens itself. The more close a subject is to the eye the more is the necessity for the lens to accomodate. This accomodation (changing of focus) is mostly taking place on the frontsurface of the lens, which then will get a little bit thicker in the middle.

At the same time as the eyes accomodates for close seeing, they will converge in an automatic and normal squinting movement. When seeing at an infinite distance, the squinting is 0 degrees, (the axes of the eyes are parallel). But as soon as you cast your eyes on a more close subject, the eyeaxes will turn inwards so that they form an angle with the object in question. This angle is about 1 degree for objects about 3 meters away. At a normal reading distance at 25 centimeters the angle is about 14 degrees. As said before the accomodation and the converge squinting work together automatically at close viewing. This phenomena becomes very apparent if you hold a finger about 10 centimeters from the eyes and try to concentrate your sight on it. When you release your concentration in the close-viewing of the finger, this will slide apart, and you suddenly will be seeing 2 fingers who are blurry and out of focus. The left eye gives the right sightvision of the finger and the right eye gives the left sightvision. If you for instance alternately twinkle with your eyes you can conceive that the image of the two blurry fingers are two completely different pictures. With repeated accomodation to see the finger sharply, it is with some slight trouble possible to apprehend further away situated visions, such as trees, houses, cars etc. as a double, out of focus and reversed view. This double-sighted view where the left eye see the right picture and vice versa are in spite of that, true to the optical laws. That the reversed, diffuse, unprecise, unsharp and turned upsidedown doublevision as the eyes presents, can be revealed as

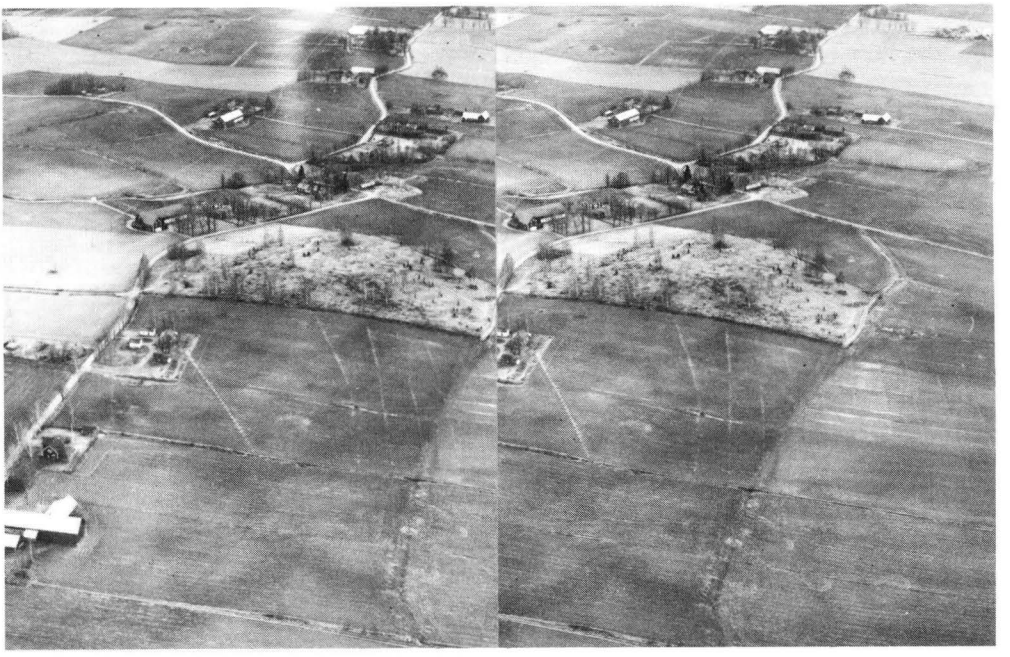

Fig. 3. Hjortsberga, County of Örebro. 6554 225/1464 440 BAZ 82.11.21. Reproduced by permission of the Swedish Defence Staff.

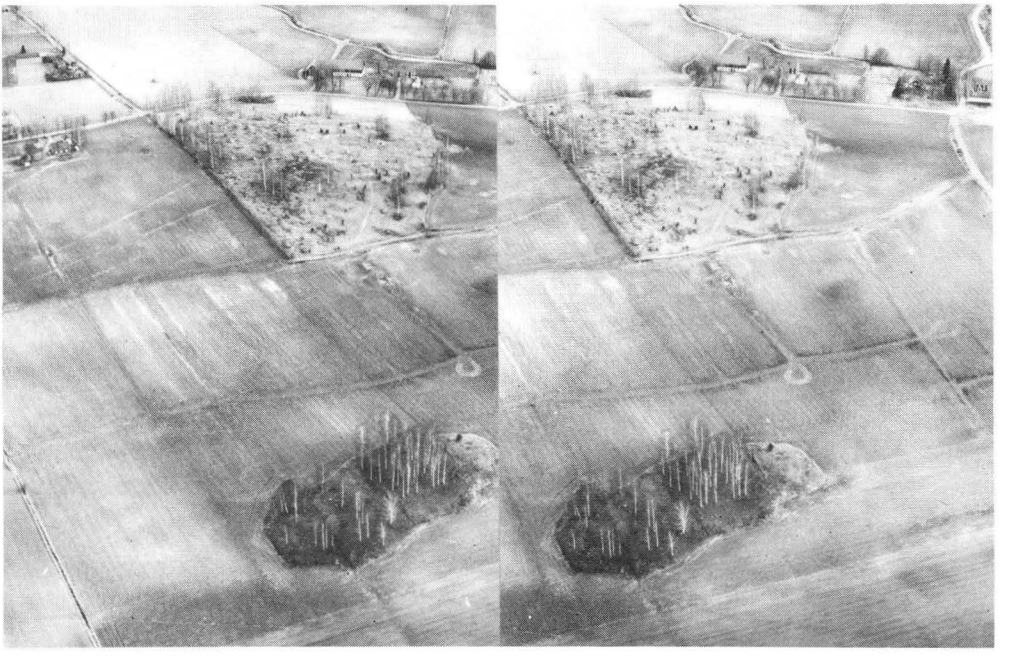

Fig. 4. Hjortsberga, County of Örebro. 6554 225/1464 440. BAZ 82.11.21. Reproduced by permission of the Swedish Defence Staff.

only one sharp, upstanding and real picture depends on the »washing, removing and reprogramming» which takes place in the brain.

Stereowatching

For the regarding of stereopictures you usually have an optical device, a stereoscope. Without a stereoscope it is nevertheless, with a little bit of practice in some simple methods, possible to look at stereopictures.

Method I

Focus your eyes on the most distant object in the room. Keep this book at arms' length distance from the eyes and raise it slowly so that fig. 2 will be in the range of sight. Now concentrate on the picture in fig. 2 without changing the position of the eyes. After some practice you will suddenly see three pictures, where the one in the middle is in 3-dimensional viewing and is flanked by the two flat left- and rightpictures.

Method II

Keep your eyes concentrated on fig. 2 and focus your eyes at infinite viewing pretending that you can see just through this book. Suddenly, after some practice, the two halfpictures are starting to move towards each other. Work with your eyes until the two halfpictures will become one complete 3-dimensional picture.

Method III

Look at the stereogram at fig. 2 from a very close distance, about 10 centimeters. The halfpictures will appear as just one very unsharp and blurry picture. Now move the pic-

Fig. 5. Hjortsberga, County of Örebro. 6554 225/1464 440. BAZ 82.11.21. Reproduced by permission of the Swedish Defence Staff.

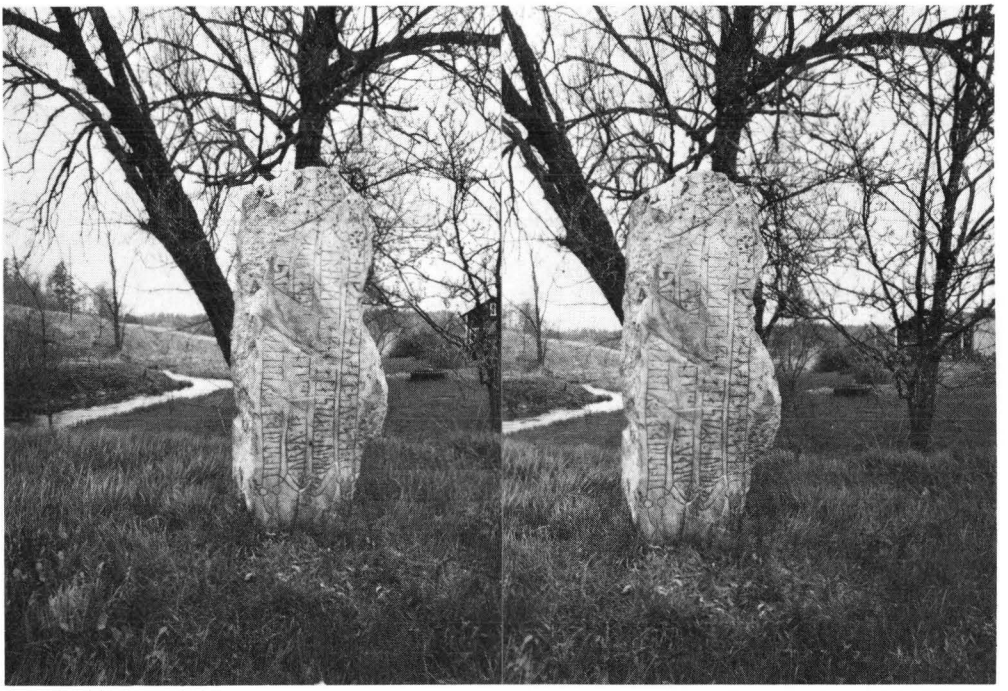

Fig. 6. Aspa löt, County of Södermanland. 6534 615/1574 530. BAZ 83.05.12.

Fig. 7. Near Aspa Löt, County of Södermanland. 6534 215/1571 980. BAZ 83.05.12.

ture hastily away from you to the ordinary readingdistance, about 25 centimeters, and the picture in the middle will appear in stereo.

Stereophotographing

The princip for taking stereopictures is simple. Every ordinary camera will be capable for this use. All you have to do is to look carefully in the viewer and squeeze the trigger. Then move the camera a little bit sideways, for instance 5—15 centimeters. Be sure you have the same view in the viewer and then take another picture. The only difficult thing in this operation is that you, after the first picture is taken, must transport the camera these few centimeters in a strictly horizontal direction. A tripod with libell is almost a must. With this method it is only possible to take pictures of not moving objects. For instance houses, archaeological artefacts, culture remains, archaeological excavations etc.

To photograph moving targets you will have to expose the two halfpictures (the left and the right) at exactly the same moment. To be able to do that you must have two exactly similar and syncronised cameras. When using two connected singlecameras instead of a real stereocamera you will have the possibility to change the basedistance b, between the two cameras. The length of basedistance b is the most important part when taking stereopictures. The basedistance can vary from parts of a millimeter to several tenth of meters, in special occasions even several kilometers. But the most common basedistance is 5—7 centimeters.

Dominions of apply for stereophotography

A stereopicture gives more information than a common monopicture. Documentation pictures from archaeological excavations as well as other excavations can be more easily interpreted. The cost for taking stereopictures at excavations will not be increased, compared with normal pictures taken today. The only extra moment for the documentary archaeologist is the little sideway — step between the two cameraclicks. The stereomethod is extremely useful in searching for archaeological finds and sites from the air. Especially if the groundareas are difficult to reach or find from ground prospection. The method can give more information of rural culture patterns, prehistoric village agglomerations, earlier routes of communications, gravefield, burial mounds etc. Another application of this method is documentation of artefacts, both in the field and in collecting catalogues. The method is useful not only in larger scales but also in smaller applications, for instance macro- and microphotographs of coins, jewellery, pollen etc. A few examples of stereopictures are shown in fig. 3—7.