



## 10.18

**Stereoscopic depth resolution of the Zeiss (Oberkochen) 10x50, and an arbitrary 10x50 roof prism binocular without axis-offset.**

coast guards who had to measure precise distances of approaching vessels.

Instruments with enhanced stereoscopic vision, including Porro prism binoculars, are generating an interesting optical illusion, which is generally known as *card board effect*. Based on daily life experience, human perception interprets an enhanced stereoscopic cue as the consequence of reduced distances. Through the binocular, objects at distance  $E$  are displaying a depth resolution as if they were at distances of  $E/K$ . At the same time, the perspective proportions of those objects remain unaffected by the magnification, and consequently they appear strangely deformed. In particular, the extent in depth is disproportionate and apparently squeezed by a factor of  $m$  – an effect, which is well known to photographers when employing long tele lenses. Yet, only the binocular (and hence stereoscopic) vision, which combines the distortions of the depth cue with the enhanced cue of depth resolution leads to the card board effect, which makes the scenery



## 10.19

**RISO-I 7x40 stereoscopic binocular with an objective baseline of 255mm (at eye-distance setting of 65mm (field of view: 133m/1000m). The eyepieces are located near the central upper part of the photo.**

appear like a collection of scattered objects that are flat, almost as if they were made of card board.

Another consequence of these mutually contradicting visual cues is the impression of objects being shrunk in size – after all, their distances seem reduced, and to fit into the field of view, they must have left their natural dimensions. The impression that a Porro prism binocular appears to magnify less than a roof-prism binocular of identical power, is sometimes attributed to that card board effect. Of course, magnification and hence resolution of details remain unaffected by stereoscopic vision, as is easily verified in comparative measurements.

In summary, the enhancement of stereoscopic vision through beam axis offsets comes along with both advantages and problems. The increased depth resolution is paid for with disproportionate landscape motives, and the wide objective spacing prevents a close focus distance that is required to observe insects or other small animals (section 6.3.2). Yet, the