What you SEE when you look at a relativistic object

The question of what one "sees" and "perceives" when witnessing an extended macroscopic object moving by at a relativistic speed is very tricky. "Seeing" involves the process of photons arriving at the retina of the eye, or the cells of a CCD camera, and being recorded as an "image" of the scene. However, "images are generated by photons arriving at an observer simultaneously, not by those simultaneously emitted by an object. As light has both a constant and finite speed, what one really sees is an extended object made up of a patchwork of itself at different times."[1] This results in a distorted image, as shown in the referenced paper. Interpreting such images is very difficult, so much so that it is not useful to even discuss what one actually "sees".

Due to our Galilean upbringing, we implicitly believe that information can be conveyed between any two points instantaneously. This is what makes possible the idea of a "snapshot in time" picture of the relative positions of objects at a given instant in time. Such pictures imply that there was no delay in acquiring information about the disposition of all the objects in the snapshot, but this is not correct. The finite speed of light means that we can't "know" (i.e. precisely image) the exact locations of all objects, and all parts of the object, to create a "snapshot" picture.

Unfortunately the textbook perpetuates this incorrect concept of a "snapshot in time" picture. Look at Fig. 1.11 on the top of page 31. This purports to show the exact disposition of the length-contracted snake relative to the two knives at "t = 0". In fact, this picture is a part of the "paradox" described in the text. Rather than try to visualize such an incorrect picture in your mind, one must focus instead on the two distinct events – the falling of the left knife and the falling of the right knife. Resolving how those events are described in each of the two IRFs gives a consistent set of results that resolves the "paradox".

Just for fun, the paper referenced below examines the appearance of a relativistic bicycle by a person with binocular vision.

Reference:

1 E. A. Cryer-Jenkins and P. D. Stevenson, "Gamow's cyclist: a new look at relativistic measurements for a binocular observer," Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences **476** (2238), 20190703 (2020).