

The Leaning Tower illusion: a new illusion of perspective

We would like to describe a new illusion of perspective that to our knowledge has not been reported before. Figure 1 shows two images of the Leaning Tower of Pisa placed next to one another. One obtains a strong impression that the tower on the right leans more, as if photographed from a different angle. Yet the two images are identical, as close inspection will reveal.

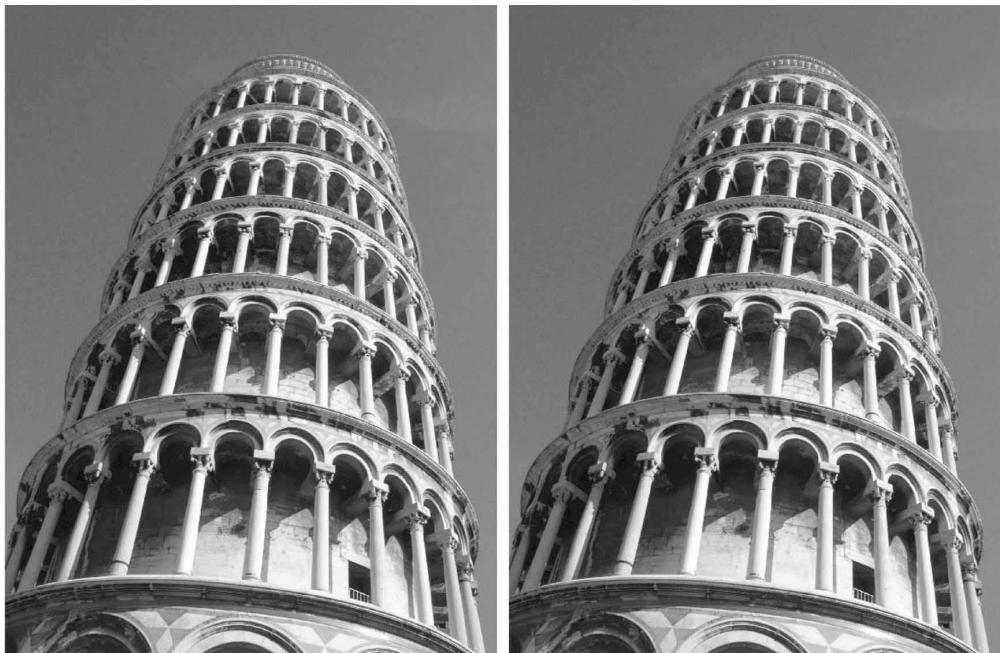


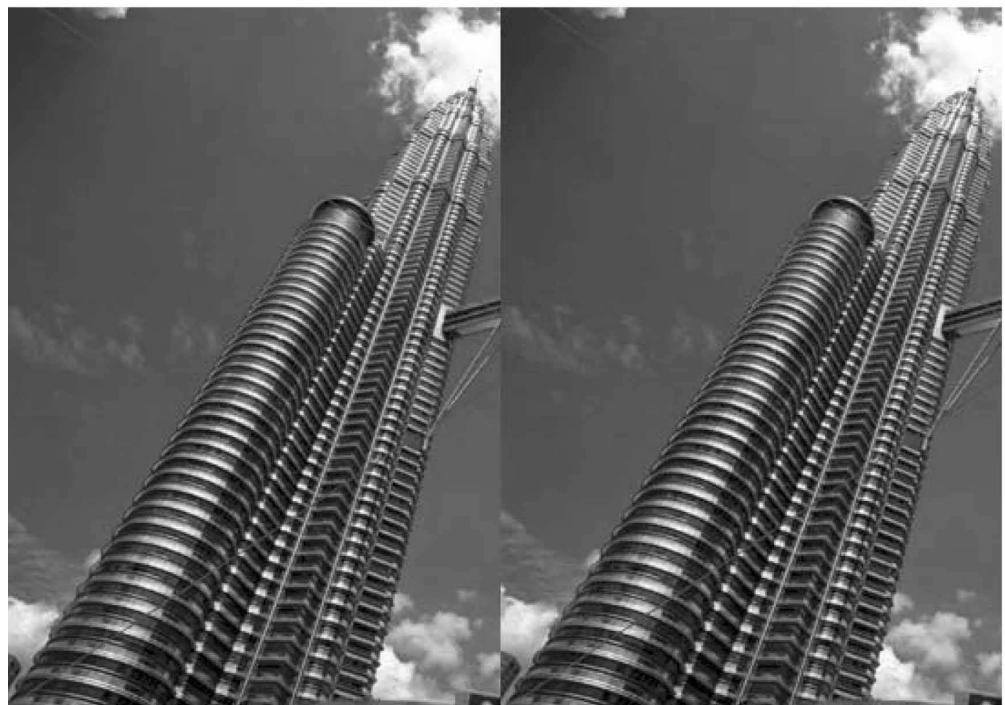
Figure 1. Identical images of the Leaning Tower of Pisa. Original photograph taken by Adriana Olmos, reproduced here from the McGill Calibrated Colour Images Database: <http://tabby.vision.mcgill.ca>. A colour version of this and subsequent figures can be viewed on the *Perception* website, <http://www.perceptionweb.com/misc/p5722a/>.

The explanation for this illusion would seem to be straightforward. Consider the photograph in figure 2a of the Petronas twin towers in Kuala Lumpur. Both towers are physically vertical, but in the two-dimensional projection their corresponding outlines are not parallel but converge as the towers recede into the distance. Our knowledge of perspective however compensates for this and leads us to perceive the inclinations of the two towers veridically. It follows that if the corresponding outlines of a pair of physically identical, receding objects are parallel in the two-dimensional projection, the objects cannot be physically parallel but, instead, must be diverging as they recede from view. This is clearly what we perceive in figure 2b, where the right-hand tower has been replaced with a copy of the one on the left. Now the corresponding outlines are parallel, and the two towers appear to diverge, as in figure 1.

The illusion is not restricted to towers photographed from below, but works well with other scenes, such as the tram lines in figure 3. What the illusion reveals is not a failure of perspective per se, but the tendency of the visual system to treat two side-by-side images as if part of the same scene. However hard we try, we seem unable to see the two photographs of the Leaning Tower in figure 1 as separate, albeit identical, images of the same object. Instead, our visual system regards the images as the 'Twin Towers of Pisa', whose two-dimensional projection leads to the 'correct' interpretation that one tower is leaning more than the other.



(a)



(b)

Figure 2. (a) Photograph of the Petronas Towers in Kuala Lumpur by Thomas Haltner. (b) Two copies of the left-hand tower. Reproduced with permission from TH.



Figure 3. Photograph of tram lines by Brian Micklethwait. Reproduced with permission from BM.

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