

Walking Robot: illusory dynamic slant from luminance modulation

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Explanations:

1. Phenomena:

Movie 1 (basic):

A robot looks like walking and made of aluminum plates. By carefully looking at it, you will see that the orientations (i.e., slants in depth) of the aluminum planes change continuously, and probably that the legs appear to be lustrous after a while. By looking at the navel of the robot, you will see the phenomena more clearly. Please set your movie player software to play the movie repeatedly so that the robot keeps walking continuously.

Movie 2 (with arm-swings):

The arms also look like swinging. By looking at shoulders, you'll see the swings more clearly.

Movie 3 (partial presentation):

Even if we present only legs, they will keep walking. But if only one leg is presented, the impression of the walking (changing slant) gets weaker.

2. Stimuli and illusion:

Each leg (and also each arm in Movie 2) is simply a gray rectangle of which luminance changes dynamically. Despite the fact that there is no typical depth information such as binocular disparity or motion parallax, we get an impression of dynamic surface slant in depth just from luminance change.

### 3. Implications for human visual mechanisms:

The illusory perception of dynamic surface slant in these movies suggests that our visual system utilizes luminance change as a cue for the perception of changing slant of the surface. That is, the human visual system knows that light generally comes from above and thus surfaces are brighter when orienting upward than when orienting vertical or downward because when orienting upward, they receive more light from above. It is well known that we can see "shape-from-shading" (Ramachandran, 1988), which produces the perception of spatial variation of surface orientation from spatial variation of luminance. The phenomenon we found here could be called "dynamic shape-from-shading" because it is the perception of "temporal" variation of surface orientation from "temporal" variation of luminance.

As for the impression of luster, this impression also arises from luminance change, as reported previously (Anstis, 2000; Sakano and Ando, 2010, 2012).

### References:

1. Anstis, S. M. (2000). "Monocular lustre from flicker". *Vision Research* 40(19): 2551-6.
2. Ramachandran, V. S. (1988). "Perception of shape from shading". *Nature*, 331(6152): 163-6.
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