Impossible Motion "Antigravity Barrel Vault"

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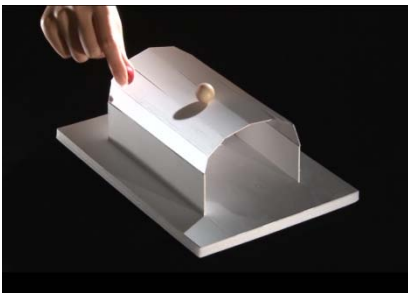
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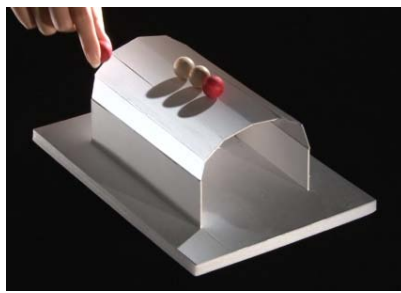
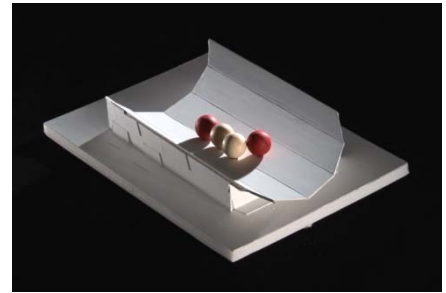Fig. 1. Barrel vault.   Fig. 2. Anti-gravity motion.   Fig. 3. Another view.

At first glance, the solid looks like a barrel vault, but when we put balls on it, they go uphill toward the top of the roof as if they were pulled by magnet, as shown in Figures 1 and 2. The fact is that the center of the roof is the lowest just like the bottom of a valley, as shown in Figure 3, and the balls roll downhill obeying the gravity toward the lowest bottom. However, even if we know the true shape of the solid, our eyes still see illusion of anti-gravity ball motion when we go back to the vantage viewpoint.

This impossible motion might look similar to my "magnet-like slopes", which won the first prize in the 6th Best Illusion of the Year Contest, 2010, but there is a big difference. In the "magnet-like slopes", the slopes were supported by columns, which look vertical and hence our eyes interpret that longer columns support higher parts. The present solid, on the other hand, has no columns, and consequently the height is perceived by some different mechanism; provably it is based on the tendency that human eyes prefer symmetric shapes to less symmetric ones.

This class of optical illusion, which I named *impossible motion*, was discovered in my engineering research for machine interpretation of line drawings. A single picture does not have direct information about the depth of the scene, and hence a human should "interpret" the picture in order to perceive the solid. The impossible motion can be created by cheating this interpretation process in such a way that we first specify the set of all possible interpretations as the set of solutions of a certain system of equations, and next choose one that is far from what human usually chooses in his perception.