# Loose change

Andrew K. Dunn

THE SIZE-CONTRAST illusion is a commonly demonstrated visual illusion. Here we report a fun informal experiment, based on a method provided by the late Professor Richard Gregory, that demonstrates that it is a powerful illusion of depth that can be replicated with even highly familiar objects (coins). We also offer some comfort to those who, in these times of financial uncertainty, have had a grant bid rejected.

The size-contrast illusion is often explained as a depth illusion (cf. misapplied size-constancy scaling – see Gregory, 1963). The basic illusion involves two identically sized circles flanked by either an annulus of smaller circles or an annulus of larger circles (see Figure 1). This arrangement results in a misperception of the true size of the centre (target) discs: the target disc surrounded by the annulus of small circles appears slightly larger than it actually is, whilst the target disc surrounded by the annulus of large circles appears to be slightly smaller. The illusion is remarkably persuasive and although the illusion works best when making a relative judgement between the pairs, the distortion is easily visible when matching target size for only one of the pairs. It also works, as I am about to show, with highly familiar objects demonstrating both the robustness of the effect and the inaccuracy of perception in the real world. As a consequence it is a neat demonstration piece at dinner parties. Here I will demonstrate a method for doing this that you may want to try yourself (subject to clearance by your ethics board).

The method is based on an impromptu discussion, generously provided by Professor Richard Gregory, at a meal following his talk at Nottingham Trent University (Spring 2004), During the course of the evening I suggested to him that I thought that his explanation of the size-contrast illusion as a depth illusion was unnecessary, proposing instead that that the effect could reasonably be explained by very low level visual filtering (e.g. Morgan, Hole & Glennerster, 1990) or

Figure 1: Basic configuration for the size-contrast illusion.
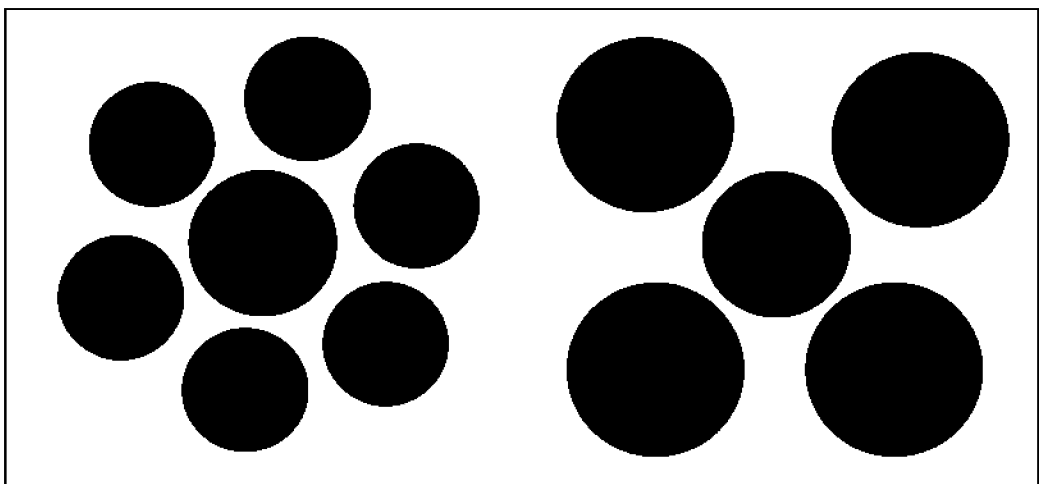
even as an illusion of attention (e.g. Shulman, 1992). Generously acknowledging my observation, Gregory then set about correcting it using a hand full of coins harvested from his own pockets, and from those around us*. His method was as follows.

To generate the illusion first place two 1 pence coins (Target A, Target B – see Figure 2a) approximately 8 cms apart. Next arrange six 5 pence pieces around Target A and four 10 pence pieces around the Target B. You will now observe that Target B appears to be smaller than Target A (Figure 2b). Next begin placing 5 pence pieces beneath Target B. Continue to do this, one coin at a time until the effect is nulled (Figure 2c – there are three 5 pence coins

beneath Target B). You can also try removing the coins from beneath Target B and placing them beneath Target A (Figure 2d). The apparent size difference in A vs. B is quite striking.

Informal data collected with verbal permission (N=5) indicated that in the initial set up, four observers thought Target B to be smaller than Target A (having first agreed that the both targets were of the same size: A=B). The remaining observer was unsure. However, all participants agreed that targets appeared to be the same size when three 5 pence pieces were inserted beneath Target B (the height of Target B having been raised by approximately 3 mm). When the 5 pence coins were removed all five observers agreed

Figure 2: Illustration of the contrast illusion set-up: (a) Target figures A and B; (b) Targets with annuli; (c) effect nulled (Target B raised); (d) size of Target A enhanced (Target A raised).
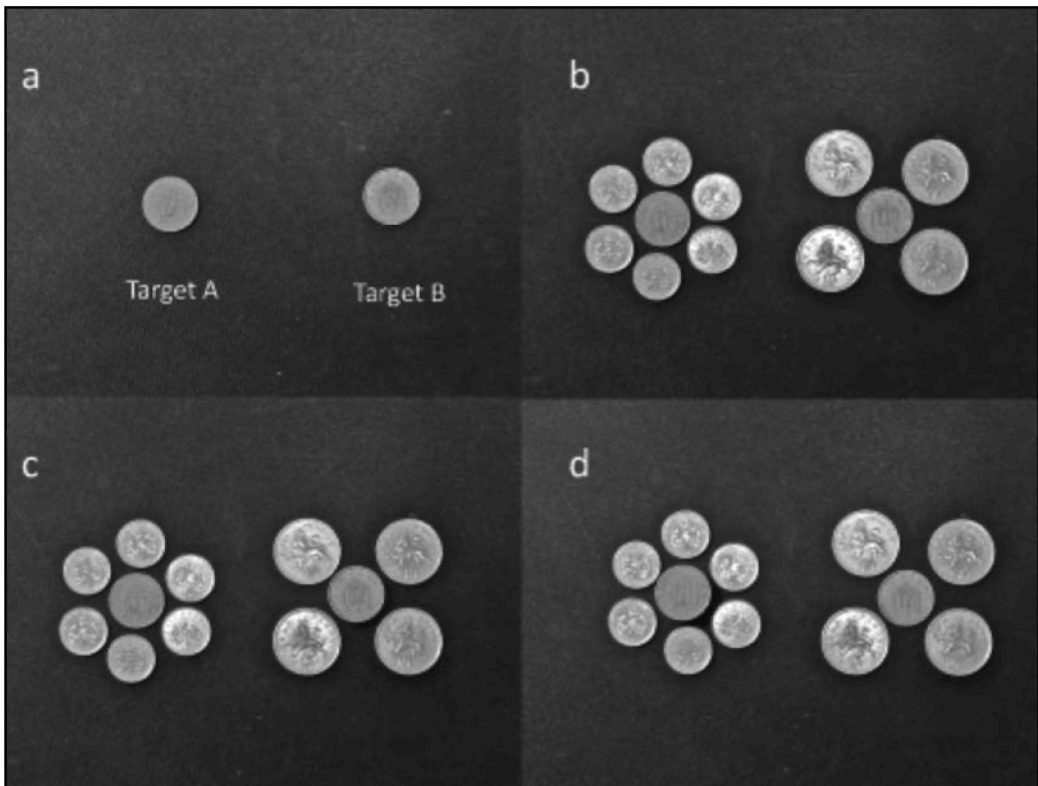
*In case you are wondering I kept everyone's change as a souvenir.

the coins appeared to be different sizes. Next, the three 5 pence pieces were placed beneath Target A. In this condition all of the observers agreed that Target A was markedly bigger than Target B.

I draw three conclusions from this. First, the illusion is powerful and easily produced. Moreover the effect is present even with highly familiar objects (coins) in fairly rough and ready demonstrations. In fact the magnitude of the effect is also influenced by the affective properties of the stimulus (if you use cookies the effect is bigger: Ulzen et al., 2008). Second, whilst there are undoubtedly a number of mechanisms at play, misapplied size-constancy scaling provides a reasonably good explanation for the illusion in the real world. Finally, demonstrating and understanding the nature of our perceptual systems can be fun and need not be expensive; a comforting thought next time your grant application fails – unless you are donating the money.

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