Supplemental Data

Experience Can Change Distinct Size-Weight Priors Engaged in Lifting Objects and Judging their Weights

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Supplemental Experimental Procedures

Weight Judgments across Multiple Days in Experiment 3

In Experiment 3, participants lifted the inverted size-weight objects 240 times a day over 30 successive weekdays, with the exception of days 15 and 30 when no lifts of the inverted objects were performed. We assessed the size-weight illusion on days 11-15 and days 26-30. In the main manuscript, we report that on day 11, the illusion was inverted. Here we present the size and direction of the illusion on all test days.

On all days except day 15, we tested the size-weight illusion using the same large and small green cubes used in Experiments 1 and 2. On day 15, we used the equally weighted large and small cubes employed in a previous study [1]. These cubes, also covered in balsa wood, were grey and slightly lighter (350 g) and larger (5.2 and 10.9 cm^3) than the green cubes. We included the grey cubes to test whether lifting the green inverted size-weight object would influence the size-weight illusion tested with blocks of a different colour.

The bars in Figure S1 show the mean percentage change scores, averaged across participants, for all 10 test days. The symbols to the right of each bar show the scores for individual participants. A different symbol is used for each participant so that each

participant's scores can be compared across days. Note that one participant (black squares in Figure S1) was unavailable after day 15. On all days, participants, on average, judged the larger cube to be heavier than the smaller cube and thus exhibited an inversion of the size-weight illusion. On average, the large cube was judged to be 53 % heavier than the small cube and this percentage was significantly different than 0 % ($F_{1,7} = 35.2$; $p = .001$). No effect of day was observed ($F_{9,63} = .87$; $p = .56$).

For descriptive purposes, we ran separate t-tests for each day and found that participants judged the large cube to be heavier than the small cube on all 10 days ($p \leq .036$). We also ran separate t-tests for each of the 8 participants who were tested on 10 occasions. For 7 of the 8 participants, the percentage change score was significantly different than 0 % ($p \leq .04$) and for the other participant (open triangles), the change score approached significance ($p = .07$). As shown in Figure S1, participants generally provided different magnitude estimates across days resulting in different percentage change scores. Thus, participants did not simply recall and repeat their previous estimates.

A comparison of the size-weight illusion tested with the grey cubes on day 15 with the illusion tested with the green cubes on days 11-14 combined failed to reveal a difference ($F_{1,8} = 1.37$; $p = .28$). Thus, the inversion of the size-weight illusion transferred to the grey cubes. This suggests that the inverted perceptual expectation that large objects will weight more than small objects applies to both the green and grey cubes lifted in the same environment as the green inverted size-weight objects. In other words, the inverted perceptual size-weight map appears to incorporate blocks of differing shape and colour.

These results show that after 11 days of lifting the inverted size-weight objects 240 times a day, the illusion was inverted and did not get stronger with additional days of lifting. Note that the magnitude of the inverted illusion was less than the standard illusion measured in our control participants (see Figure 2). One possible reason for the inverted illusion being weaker than the standard illusion is that the objects used to test the illusion (cubes) had a different shape than the inverted size-weight objects. In other words, had we included inverted size-weight cubes, the inverted illusion may have been slightly stronger. On the other hand, the magnitude of the standard illusion observed in our control group may be unusually large. Control participants in our previous study on the size weight illusion judged the small cube to be about 70 % heavier than the large cubes [1]. Ellis and Lederman [2] used a range of object sizes and weights to assess the illusion. Based on values they report, we estimated that, for objects equal in volume to our large and small equally weighted cubes, participants in their study would have judged our small cube to be 95 % heavier than the large cube. However, caution must be exercised when comparing illusion strength across studies because of differences in stimuli, task, and analysis method.

The inversion of the size-weight illusion in Experiment 3 was not due to the total number of lift trials. When the illusion was tested on day 11, participants in Experiment 3 had performed 2640 lifts of the inverted objects whereas participants in Experiment 2 performed 3720 lifts distributed over four days. To further assess the relative effects of days and trials per day, we ran 4 additional participants in an experiment in which they lifted the 12 inverted objects 2 times each for 11 days (for a total of 264 lifts) and tested the size-weight illusion at the end of day 11. On average, these participants judged the

small cube to be 13 % heavier than the large cube (see Expt 4 in Figure S1). Thus, both days and the number of lifts per day appear to contribute to the inversion of the illusion.

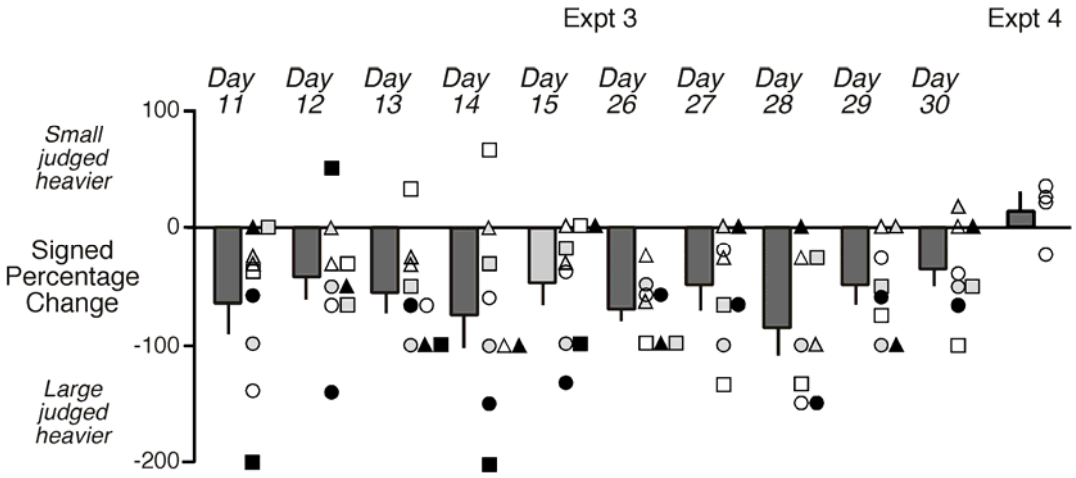

Figure S1. Strength and Direction of the Size-Weight Illusion

Strength and direction of the size-weight illusion tested 10 times in Experiment 3 and in Experiment 4. The height of each bar represents the mean signed percentage change score across participants and the height of each error bar represents 1 SE. The symbols represent scores provided by individual participants. For Experiment 3, different symbols are used for each of the 9 participants.

SUPPLEMENTAL REFERENCES

1. Flanagan, J.R., and Beltzner, M.A. (2000). Independence of perceptual and sensorimotor predictions in the size-weight illusion. Nat Neurosci *3*, 737-741.
2. Ellis, R.R., and Lederman, S.J. (1993). The role of haptic versus visual volume cues in the size-weight illusion. Percept Psychophys *53*, 315-324.