**Supplemental Materials**

**Experiment 1 Stimuli**

Objects in Experiments 1a-1c were orange, red, purple, blue and green. Colors were approximately perceptually equiluminant, as determined by a separate experiment where three observers were asked to minimize perceived flicker as a red and another colored square alternated at 15 Hz. Participants performed 6 adjustments of the luminance of the colored square (starting at low or high values; 6 adjustments for each of the 4 other colors per participant) while the luminance of the red square remained fixed. Equiluminant values of each color were designated as the grand average of each subject’s mean value. Equiluminant colors were used to ensure that all participants only paid attention to the colors and shapes, rather than luminance, of the objects on screen.

**Experiment 1 Results**

One concern is that the present feature conditions differ in target and distractor consistency. Specifically, *color* trials present each available irrelevant shape throughout the experiment, and *shape* trials present each available irrelevant color as well, whereas *redundant* trials always present the same set of targets and distractors (or at least roughly identical in Experiments 1b and 1c, since color and shape are randomly and independently assigned to each distractor for each trial). Because one third of the trials consist of the same target and distractor set, the higher accuracy in *redundant* trials could simply be an artifact of familiarity. This account would predict that participants improve at a quicker rate in *redundant* trials than *color* and *shape* trials across the course of the experiment. To address this, we examined the accuracy for each feature condition (redundant vs. second best) for each third of the experiment. This was done separately for each feature condition, rather than splitting up the trials into thirds as they appeared (randomly) through the experiment, which otherwise would yield slightly uneven amount of trials per feature condition per third of the experiment. An ANOVA showed that the redundancy benefit did not change across time, supported by a lack of interaction (Experiment 1a: *F*(2,20) = 1.61, *p* = 0.23, ηp2 = 0.14; Experiment 1b: *F*(2,22) = 1.15, *p* > 0.250, ηp2 = 0.095; Experiment 1c: *F*(2,24) = 1.47, *p* = 0.25, ηp2 = 0.11). Thus, participants performed consistently across the feature conditions, and were better on *redundant* trials from the very beginning of each experiment.

Lastly, in addition to accuracies, we also examined response time (from correct trials only). We did not expect any differences given that we did not emphasize response time to participants and instead asked them “to respond whenever ready.” We were surprised to find differences (based on participants’ median response times) between the feature conditions in each experiment, Experiment 1a: *F*(1.22,12.16) = 4.58, *p* = 0.048, ηp2 = 0.31; Experiment 1b: *F*(1.21,13.33) = 15.32, *p* = 0.001, ηp2 = 0.58; Experiment 1c: *F*(2,24) = 17.11, *p* < 0.001, ηp2 = 0.59. Specifically, participants in Experiments 1a and 1c responded faster to *redundant* trials (Experiment 1a: *M* = 660ms, *SD* = 108ms; Experiment 1c: *M* = 670ms, *SD* = 177ms) than to both *color* trials (Experiment 1a: *M* = 773ms, *SD* = 209ms; Experiment 1c: *M* = 737ms, *SD* = 179ms), Experiment 1a: *t*(10) = 2.53, *p* = 0.030, *d* = 0.76; Experiment 1c: *t*(12) = 4.79, *p* < 0.001, *d* = 1.33, and *shape* trials (Experiment 1a: *M* = 739ms, *SD* = 109ms; Experiment 1c: *M* = 766ms, *SD* = 203ms), Experiment 1a: *t*(10) = 4.63, *p* = 0.01, *d* = 1.40; Experiment 1c: *t*(12) = 5.00, *p* < 0.001, *d* = 1.39, while responding equally slowly on *color* and *shape* trials, Experiment 1a: *t*(10) = 0.74, *p* > 0.250, *d* =0.22; Experiment 1c: *t*(12) = -1.76, *p* = 0.10, *d* = -0.49. Experiment 1b participants also responded faster to *redundant* trials (*M* = 701ms, *SD* = 156ms) than to both *color* trials (*M* = 731ms, *SD* = 170ms), *t*(11) = 2.43, *p* = 0.033, *d* = 0.70, and *shape* trials (*M* = 849ms, *SD* = 205ms), *t*(11) = 4.42, *p* = 0.001, *d* = 1.28, but faster to *color* trials than *shape* trials, *t*(11) = -3.52, *p* = 0.005, *d* = -1.02. Although we did not emphasize response time, *redundant* trials were the fastest for 2 of the 3 experiments.

**Experiment 2 Results**

Accuracy for each feature condition (redundant vs. second best) for each third of the experiment was again examined separately for each feature condition. An ANOVA showed that the redundancy benefit did not change across time, supported by a lack of interaction (Experiment 2a: *F*(2,26) = 0.90, *p* = 0.42, ηp2 = 0.065; Experiment 2b: *F*(2,30) = 0.74, *p* = 0.48, ηp2 = 0.047). Thus, participants performed consistently across the feature conditions, and were better on *redundant* trials from the very beginning of each experiment.

Lastly, we examined response time from correct trials. Again, we did not expect any differences given that we did not emphasize response time to participants and instead asked them “to respond whenever ready.” We were again surprised to find differences (based on participants’ median response times) between the feature conditions in each experiment, Experiment 2a: *F*(1.33,17.34) = 15.55, *p* < 0.001, ηp2 = 0.54; Experiment 2b: *F*(1.16,17.36) = 14.86, *p* = 0.001, ηp2 = 0.50. Specifically, participants in both experiments responded faster to *redundant* trials (Experiment 2a: *M* = 757ms, *SD* = 107ms; Experiment 2b: *M* = 783ms, *SD* = 210ms) than to both *color* trials (Experiment 2a: *M* = 833ms, *SD* = 163ms; Experiment 2b: *M* = 836ms, *SD* = 256ms), Experiment 2a: *t*(13) = 4.00, *p* = 0.002, *d* = 1.07; Experiment 2b: *t*(15) = 3.53, *p* = 0.003, *d* = 0.88, and *shape* trials (Experiment 2a: *M* = 856ms, *SD* = 179ms; Experiment 2b: *M* = 964ms, *SD* = 352ms), Experiment 2a: *t*(13) = 4.23, *p* = 0.001, *d* =1.13; Experiment 2b: *t*(15) = 4.13, *p* = 0.001, *d* = 1.03. Participants also responded significantly faster (marginally, for Experiment 2a) to *color* than to *shape* trials, Experiment 2a: *t*(13) = -2.03, *p* = 0.063, *d* = -0.54; Experiment 2b: *t*(15) = -3.49, *p* = 0.003, *d* = -0.87. Again, although we did not emphasize response time, *redundant* trials were the fastest both of the experiments.