# When articulation does not enhance lightness contrast

PLATANIA, Alessio, CASTELLANO, Sabrina, AGOSTINI, Tiziano, BALDASSI, Giulio and SORANZO, Alessandro <http://orcid.org/0000-0002-4445-1968>

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# WHEN ARTICULATION DOES NOT ENHANCE LIGHTNESS CONTRAST

**Giuseppe Alessio Platania, Sabrina Castellano, Tiziano Agostini, Giulio Baldassi, Alessandro Soranzo**

## Introduction

Simultaneous lightness contrast (SLC) is the condition whereby a grey placed against a dark background appears lighter than an equal grey placed against a bright background (figure 1a). Adelson (1993) found that the SLC magnitude increases when the backgrounds are articulated (figure 1b).



A        Fig. 1        B
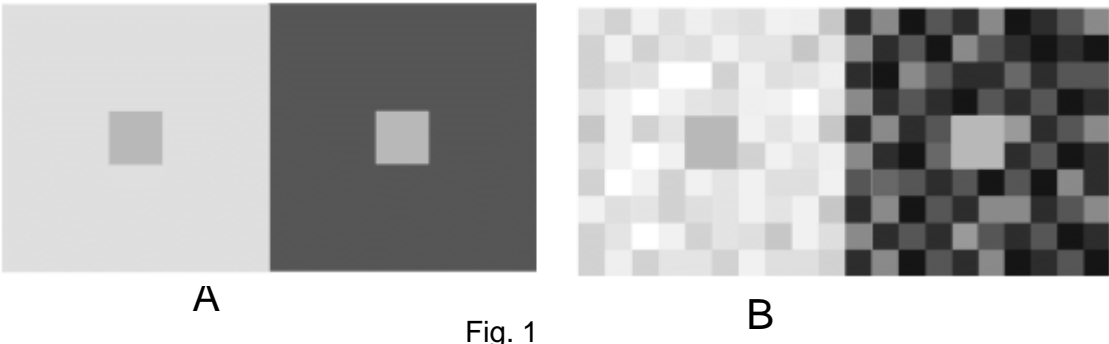
We noticed that in the articulated version of the SLC, all the darker patches are on one side and all the brighter on another. What happens if this regularity is violated?

## Aim

The aim of the research is to assess whether articulation increases the SLC magnitude because of the number of elements or because of the regularity of bright and dark patches all placed on the same side.

## Method

28 stimuli were used containing two disks of the same grey shade placed on a dark background and a white one (Figure 2).
The following variables were systematically manipulated:
1)    Number of additional elements (One, Two, Three)
2)    Position of the additional elements (left, right, both)
3)    Congruency (Congruent, Incongruent, Within) – [Figures 3-5 report the Munsell values of these conditions]
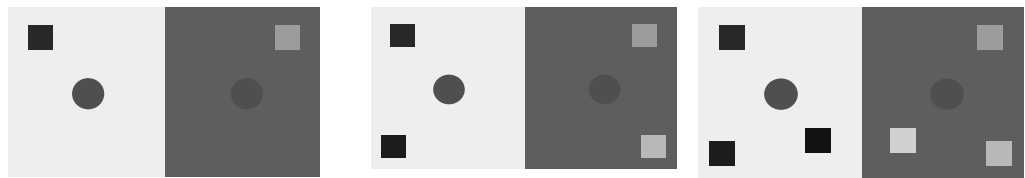


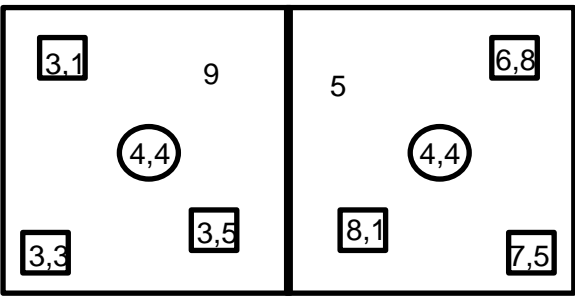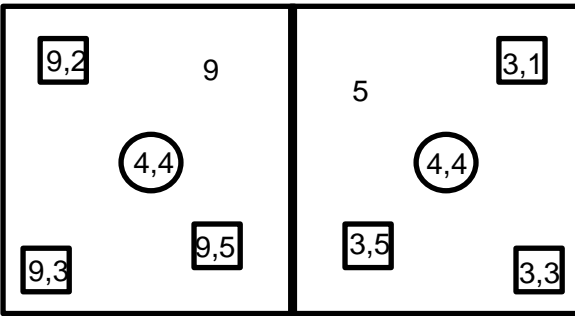Fig. 2: Examples of stimuli



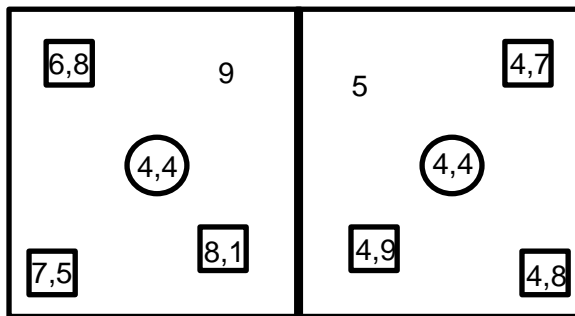Fig. 3  Cognruent



Fig. 4 Incongruent



Fig. 5 Within

## Procedure

21 Participants were requested to match the colour of both the grey discs (targets) on a Munsell chart.

To minimize the potential effects of the background, the patches of the Munsell chart were placed on a checkered background made by the same colours as the backgrounds of the experimental stimuli.



Fig. 6. Experimental setting
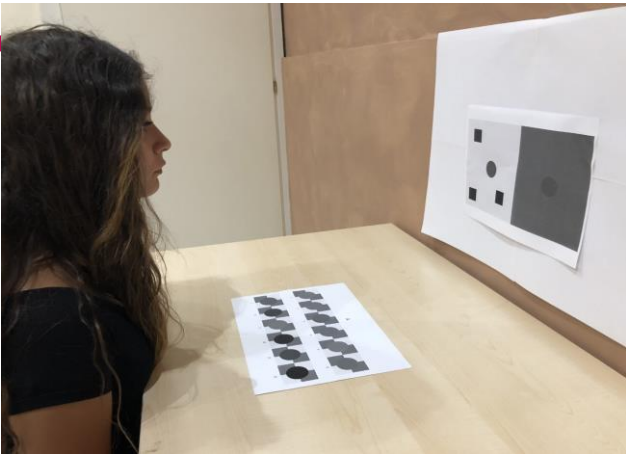
## Results

We used generalised linear mixed-effects models in R version (lme4 package, Bates, Mächler, Bolker, & Walker, 2015) to analyse the data. For brevity, we do not report the results of Position (which was ns). Results are reported in Table 1.

```
Type III Analysis of Variance Table with Satterthwaite's method
                   Sum Sq  Mean Sq NumDF DenDF F value   Pr(>F)
Congruency        0.210914 0.105457    2   564 10.0663 5.064e-05 ***
Number            0.028807 0.014404    2   564  1.3749   0.2537
Congruency:Number 0.076505 0.019126    4   564  1.8257   0.1224
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> |
```
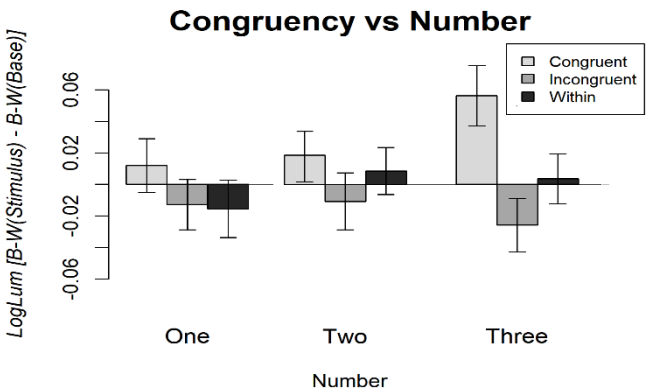
Table 1.



Fig. 7

As can be seen in figure 7, only Congruency had an effect on the SLC, not the Number of added elements. To directly compare the role of  Congruency with the Number of added elements, a Bayesian repeated measure Anova was conducted. Results are reported in Table 2.

Table 2 shows that the Bayes factor indicates evidence for an effect of Congruency but not of Number. Specifically, a $BF_{10}$ of 1453.74 for Congruency shows that the data are about 1454 times more likely to occur under the hypothesis that Congruency has an effect on the perceived difference between the two targets. On the contrary, the Bayes factor of 0.073 for the Number variable indicates that the data are about 14 (1/0.073=14) times more likely to occur under the hypothesis that Number of added elements does not enhance the perceived difference between the targets.

**Model Comparison**

| Models | P(M) | P(M\|data) | $BF_M$ | $BF_{10}$ | error % |
|---|---|---|---|---|---|
| Null model (incl. subject) | 0.250 | 6.391e-4 | 0.002 | 1.000 | |
| Congruency | 0.250 | 0.929 | 39.351 | 1453.764 | 5.876 |
| Number | 0.250 | 4.681e-5 | 1.404e-4 | 0.073 | 1.828 |
| Congruency + Number | 0.250 | 0.070 | 0.226 | 109.757 | 3.897 |

*Note.* All models include subject.

Table 2.

## Conclusions

The number of additional elements does not negatively influence the background-independent constancy. What causes a different perception of our stimuli is the luminance of the elements.