How does the color influence grouping, numerousness, reading and calculation? The role of chromatic wholeness and parcelling-out

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Pinna & Reeves (2006) have recently introduced the notion of "figurality", defined as the phenomenal appearance of what is perceived as a figure within the three dimensional space and under a perceived illumination. It concerns the shape, the color, the 3D appearance of an object with light and shaded regions, as well as the direction and the color of the light emerging from the object. Some "principles of figurality", similar to the Gestalt ones, were suggested (see also Pinna, 2008; Pinna & Tanca, 2008). The figurality is a subset of a more holistic property: the perceptual wholeness. This property includes also the grouping problem studied first by Wertheimer (1923), who put the following question: "How do individual elements create larger wholes separated from others?" The wholeness can be studied by measuring the strength of the grouping and of the cohesiveness of the elements within a whole but also through related effects like the apparent numerousness and unitarity. This work investigates the following questions: What is the role of color in determining the wholeness of an object? How does the color interact by inhibiting or exciting other main factors inducing wholeness, like the shape, the figure-ground segregation and the grouping principles?
To answer these questions we studied psychophysically conditions where equiluminant colors are used to favor or break (parcelling-out) the wholeness of objects like geometrical composite figures, words and numbers. The tasks were: to evaluate their cohesiveness and numerousness; to read texts and calculate additions. The results showed that the color determines the wholeness and figurality of the stimuli by strongly influencing (enhancing or reducing) the performances of the subjects during these tasks. The results are interpreted in the light of a chromatic parcelling-out process of separation, division and breaking of a whole object into unconnected and ungrouped elements. Some general principles of whole formation are suggested.

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