Perceptual antinomies due to the watercolor illusion: How does the brain solve them? The problem of visual wholeness

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The purpose of this work is to study how the brain solves perceptual antinomies, induced by the watercolor illusion in the color and in the figure-ground segregation domain, when they are present in different parts of the same object. The watercolor illusion shows two main effects: a long-range coloration and a figural effect across large enclosed areas (Pinna, 1987; Pinna, Brelstaff & Spillmann, 2001; Pinna & Grossberg, 2005). This illusion strongly enhances the unilateral belongingness of the boundaries (Rubin, 1915) determining grouping and figure-ground segregation more strongly than the well-known Gestalt principles. Due to the watercolor illusion both the figure and the background assume new properties becoming respectively a bulging object and a hole both with a 3-D volumetric appearance (object-hole effect). When the coloration and the object-hole effects induced by the watercolor illusion are opposite (antinomic) within different portions of the same shape some questions emerge: Do the antinomies split the shape in two parts (a half shape appears as an object and the other half as a hole) or are they solved through a new emergent perceptual result beyond the single effects? Is there a predominance of one component over the other that is less visible or totally invisible? What is perceptible and what is invisible? Is there a wholeness process under conditions where perceptual antinomies coexist? By imparting motion to a watercolored object that gradually should become a hole while overlapping another object placed behind, is the wholeness of the watercolor object weakened or reorganized in a new way? The same questions can be asked in relation to the coloration effect of the watercolor illusion. The results of psychophysical experiments suggested that the antinomies tend to be solved through a new emergent way (e.g. by creating transparency) or not to be perceived at all. Some principles of perceptual wholeness are suggested (e.g. the part for the whole and the object/color inertia). The results are explained in the light of the FACADE neural model of biological vision (Grossberg, 1994).

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