

## Chromatic dimensions. Earthy, watery, airy, and fiery

Humans tend to associate colors and shapes, sounds and shapes, or taste and music. In natural language we make wide use of expressions such as ‘bitter’ or ‘rough’ sounds, and ‘acid’ or ‘vivid’ colors, or speak in terms of a ‘falling’ minor and a ‘rising’ major in music; the triangle is generally associated with yellow and the square with red, zigzag shapes are associated with sharp sounds, and curvilinear shapes with soft ones. More than this, complex paintings are associated with specific music, faster music in the major mode produces color choices that are more saturated, lighter, and yellower, whereas slower, minor music produces the opposite pattern; even abstract concepts such as impartiality seem to be blue-green. Because the association is shown even with such highly complex stimuli, rather than being treated as a curiosity it should be considered an essential feature of perception.

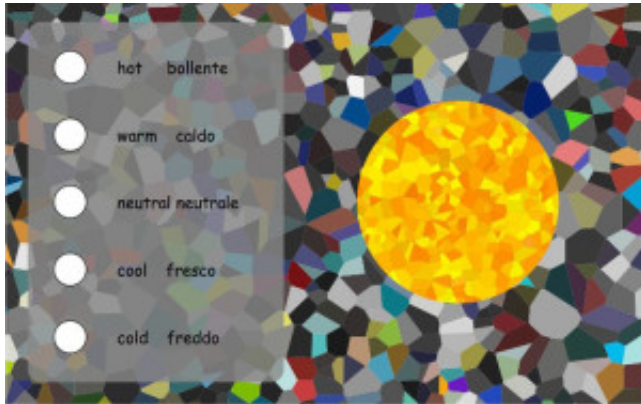


Fig. 1. Example of a stimulus presented.

Color is a perceptual attribute playing an important role in associations with smell, touch, shape, and sound. In our study we analyzed the extent to which different couples of contraries related to different perceptual fields show associations with, and hence are mappable on, chromatic dimensions. Of seven contraries (cold-hot, dull-radiant, dead-vivid, soft-hard, transparent-chalky, dry-wet, and acid-treacy) and their intermediate attributes (cool-warm, matt-shiny, numb-lively, mellow-firm, semi-transparent-opaque, semi-dry-moist, and sour-sweet), we found that some contraries relate to chromatic dimensions, and others to achromatic ones. The observer was presented with a color patch at one side of the screen (Fig. 1.) and five possible responses of one category were presented as text on the other side, in both English and Italian. They were then asked to choose the term that went best with the on-screen color. These responses included a pair of extreme contraries (e.g., cold-hot, dry-wet), a pair of intermediate attributes (cool-warm, semi-dry-moist), and a neutral term.

The cold-hot couple of contraries proved to be the most salient cross-modal dimension, coinciding

with the dry-wet dimension, with dry corresponding to hot and wet to cold (Fig. 2.).

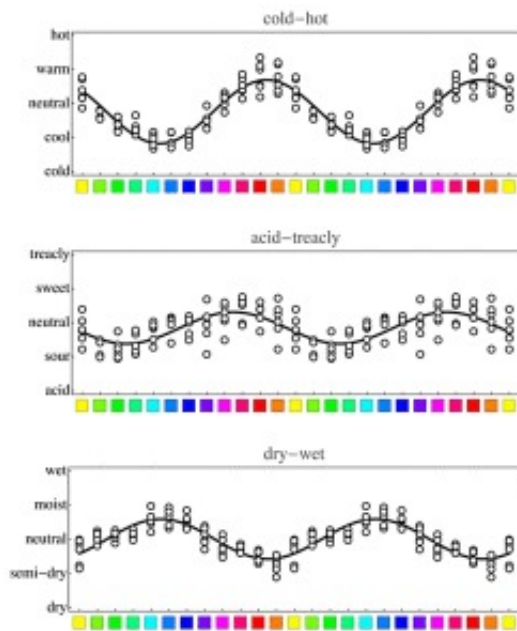


Fig. 2. The hue variation for the cold-hot, acid-treacly and dry-wet categories.

Based on our results, dry and hot are associated with the same colors, as are wet and cold. Acid and treacly show a clear association with specific colors too, but prove to be transversal to the cold-hot dimension. Hence these pairs mutually span the chromatic domain as opponent dimensions. Vice versa, the dull-radiant, transparent-chalky, and dead-vivid pairs appear to depend little upon chromaticity. We can also tell that no matter how the color changes, there is no specific association with softness or hardness.

A text dictionary of color constructed in this way can be used for several purposes: generating automatic descriptions, deducing color from instances in which only textual evidence remains, or picking colors in order to elicit a response of a specific kind. Systematic analyses of this type might also lead to the construction of a color atlas based on connotative dimensions, such as warm/cold or advancing/receding colors in the visual space. Interestingly, these findings can be related to the Aristotelian system of the Four Elements (Fire, Air, Water, and Earth) defined in terms of two qualitative contraries, thus giving rise to a cyclic system that seems to work as an ecological trait of human perception.

## Publication

[Chromatic Dimensions Earthy, Watery, Airy, and Fiery.](#)

Albertazzi L, Koenderink JJ, van Doorn A.

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