39. Visual

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From illustrations and photographs to principles of document ***design***, visual elements are an essential part of technical communication. But what does it mean for something to be "visual," and how have theories of the visual shaped technical communication scholarship and practice?

The earliest uses of the term *visual* recorded in the *Oxford English Dictionary* include "visual beams" and "visual rays," which reflect the ancient (and incorrect) belief that we see by shooting a beam of light from our eyes—or by the eyes receiving beams emanating from objects. For example, in Nathanael Carpenter's 1625 *Geography Delineated Forth in Two Books*, "The visuall Ray wherein the sight is carried, is alwaies a right line" (Oxford University Press, n.d.). The contemporary meaning of "pertaining to sight or vision" became prevalent after the 18th century, as in "a clear and settled idea of visual beauty," from Edmund Burke's 1757 *A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful* (Oxford University Press, n.d.). It was not until well into the 19th century that we saw increasing use of the word *visual* to refer to non-physical imageries conjured up by a viewer, as in Thomas Carlyle's 1845 *Letters and Speeches*: "Let the reader try to make a visual scene of it as he can" (Oxford University Press, n.d.).

This etymology, in some ways, predicts the two major theoretical frameworks used by our field in its study of visuals. If vision is caused by physical beams that seize an object or seize the eye, then what one sees is a material reality. Studies of visuals thus become an attempt to understand how the eye—and the optical nerve and visual cortex behind it—automatically reacts to that reality. The framework employed by these studies is variably called perceptual or cognitive. On the other hand, if, instead or in addition, *visual* means the formation of an imagined, self-constructed view, then studies of visuals become an attempt to understand how individuals—replete with different experiences, ***knowledge***, and assumptions—make sense of what *they* see. The framework employed by these studies is variably called critical, social, or cultural. These two frameworks have competing—but also complementary—focuses and applications in technical communication.

The cornerstone of the perceptual/cognitive framework is the Gestalt theory. Originated from the 20th century Gestalt psychology, Gestalt is the study of visual perceptual organization—with the German word "Gestalt" translating loosely to "shape" or "pattern." The theory includes a set of principles that govern our perception. The principle of *proximity*, for example, states that visual elements close to each other tend to be perceived as belonging to one group and conveying related ***information***; by contrast, elements that are set apart are perceived as

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conveying unrelated information. Other commonly applied Gestalt principles include *closure*, *similarity*, *continuation*, *enclosure*, and *figure-ground*, which are summarized in Figure 39.1.

Drawing upon or overlapping with the Gestalt theory are various other perceptual/cognitive lenses: for example, Edward Tufte's (1990) concepts of layering, separation, and small multiples; Charles Kostelnick and David Roberts' (1998) ideas of emphasis and clarity; Evelyn Goldsmith's terms of syntactic and semantic unity, location, emphasis, and text parallels (Dragga, 1992); and Stephen Kosslyn's (2006) principles of salience and discriminability.[1]

Local differences aside, the overriding goal of these perceptual/cognitive lenses is to expedite the workings of the human eye and brain, to design visuals in such ways that a viewer can derive information from them most swiftly and accurately. This goal has obvious relevance and value to technical communication, a field concerned with communicating complex information where it is expedient (and reassuring) if viewers follow a consistent process in visual processing. The process starts with viewers sensing visual stimuli (lines, colors, etc.) on the retina, which are processed by working memory where visual queries and pattern searches allow viewers to recognize the stimuli as, say, a human face.

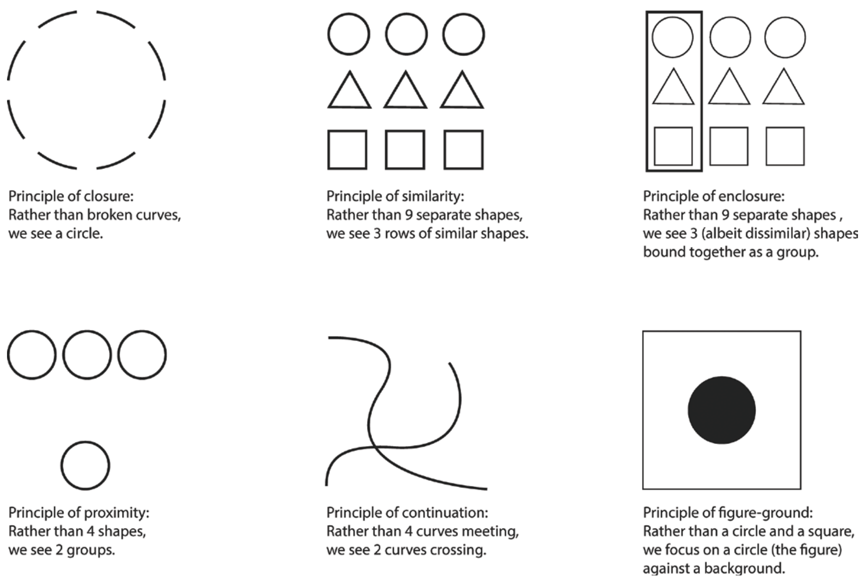

Figure 39.1. Commonly applied Gestalt principles.

1. It is important to note that most theoretical lenses are not 100 percent perceptual/cognitive or 100 percent social semiotic. Kostelnick and Roberts, for example, also emphasize visual tone and ethos, while Goldsmith speaks of pragmatic, all of which implicate factors beyond biological processing of sensory data. Even Edward Tufte is not straightforwardly positivistic (see Kimball, 2006).

With this predictable process, targeted (and thereby effective) interventions become possible. Because viewers may not optimally sense visual stimuli (due to color vision deficiency, visual impairment, or environmental conditions), technical communicators are instructed to practice universal design principles: for example, using adjustable fonts, accessible color schemes, or redundant visual cues (Chaparro & Chaparro, 2017; Chisnell et al., 2006; Wong, 2011). Even when viewers can physically sense stimuli, problems may arise at the stage of working memory, which has a low capacity and can only "hold" a few items at a time (Kosslyn, 2006; Miller, 1956; Ware, 2012). Thus, excessive visual details or failures to configure those details vis-à-vis Gestalt will confuse—even harm—viewers, deterring their comprehension of popular ***science*** visuals, for example (Yu, 2017), or failing to alert them of safety warnings (Paradis, 1991).

Despite its valuable applications in technical communication, the perceptual/cognitive framework runs the risk of espousing a positivist visual outlook, which assumes that visuals embody an objective reality and should help (universally conceived) viewers decode that reality through a transparent conduit. Ben Barton and Marthalee Barton (1985) were among the first in our field to critique this visual outlook and to emphasize visuals as contextualized, ***rhetorical*** productions subject to ideological and cultural consensus.

Since then, various critical, social, and cultural lenses have been applied to studying technical and scientific visuals: the anti-positivist, anti-hegemonic, feminist, environmental, ethical, or the more broad-ranging humanistic, which acknowledge a range of human-centered factors from emotions to lived experiences (e.g., Barton & Barton, 1993; Brasseur, 2003; Kimball, 2006; Mellor, 2009; Robles, 2018; Ross, 2008; Welhausen, 2017; Yu, 2017).

These individual lenses can be comprehended through the larger framework of social semiotics. Originated from the work of Swiss linguist Ferdinand de Saussure, semiotics is, put simply, the study of signs. A sign contains two parts: the signifier, which is originally a sound pattern (e.g., the pronunciation /pɛn/), and the signified, which is the concept denoted by the sound pattern (a writing device). "Signifier" was later broadened so that signs become "anything which 'stands for' something else" and can "take the form of words, images, sounds, gestures and objects" (Chandler, 2007, p. 2).

Social semiotics believes that in a given sign, the signifier (e.g., an image of a pen), rather than the signified (the actual pen), assumes primacy (Chandler, 2007). This is because signifiers set the stage and create the parameters for us to conceptualize, imagine, and deliberate the signified. In other words, reality is actively constructed rather than passively reflected in signs, the construction driven by sign-makers' interest tied to social-cultural histories and contexts (Kress & van Leeuwen, 2006).

These beliefs profoundly complicate the way we look at visuals. For example, the abundant rectangles in contemporary life—in the shapes of buildings and devices—are not random. Rather, with their parallel lines and controlled angles, they support and perform a rational, disciplined, and impersonal modern society (Kress & van Leeuwen, 2006). Similarly, stunning photographs of prepared dishes in *Elle* magazine—"golden partridges studded with cherries" or "a faintly pink chicken chaud-froid"—are less about cooking and foodstuffs and more about petit-bourgeois' preoccupation with gentility and ornamentation (Barthes, 1991, p. 78).

Once invested in social semiotics, we realize perceptual/cognitive principles are precisely some of the means by which visuals conceal their social/cultural values. For example, the iconic map of the London Underground depicts routes in straight lines connecting stations of homogenous distances—when, in reality, routes are meandering and stations are congested (Barton & Barton, 1993). In the name of clarity and consistency, the map, Barton and Barton (1993) argued, belies nationalist and capitalist attempts to depict urban London as orderly (when it isn't) and to persuade tourists that travel is easy (when it isn't).

The perceptual/cognitive and the social semiotic frameworks more visibly clash when scholars attempt to reveal visuals for the ideological signs that they are and to articulate individual, social-cultural, and humanistic values in established technical ***genres***. Sam Dragga and Dan Voss (2001), notably, suggested using pictorial human icons and other means to combat the absence of human emotions and lives in Cartesian graphs and technical illustrations. The suggestion invited considerable criticism from technical communicators who called the idea "off-base," "almost laughable," and "totally wrong-headed" ("Correspondence," 2000, pp. 9-10). Similar attitudes can be found in the writings of renowned information designer Edward Tufte (1990, 2001), who coined the term *chartjunk* to denigrate non-data-ink or redundant data-ink—anything from dark grid lines to pictorial elements—that does not directly contribute to perceptual/cognitive processing. Symbols of patrons and religious orders in 17th century diagrams, rather than seen as fabrics of social-cultural identities, are deemed "strident, contradicting nature's rich pattern" (Tufte, 1990, p. 21).

But nature's pattern is never truly detached from human interference. The moment a pattern is visualized—is deemed worthy of visualization—it always already is wrought with subtle or unsubtle signs of beliefs and interests. Consider the making of scientific visuals, the quintessential endeavor to portray nature. Prior to the 19th century, natural philosophers aspired to achieve "truth to nature"—by peeling away nature's spurious elements and revealing its divine and hidden truth (Galison, 1998). Thus, in Andreas Vesalius' *De Humani Corporis Fabrica*, muscle men line up for a dance of death (Hildebrand, 2004). As each layer of their bodily tissues is stripped away, Vesalius reveals the structure and purpose of the human body as the Creator intended—whilst the last muscle man collapses to his fate. Circa 1830, such artistic attempts to reveal nature's truth gave way to mechanical objectivity (Galison, 1998). In making visuals, scientists aspired to rely not on humans but machines—first, the camera lucida; later, increasingly sophisticated apparatuses from electron microscopes to DNA sequencers—with the hope of producing objective evidence. But machines are *made* and *set* by humans: Even without obvious re-touching, factors such as position, zooming, exposure time, and shutter speed can manipulate images into publishable evidence (Knorr-Cetina & Amann, 1990; Meyer, 2007). In opening the black-boxed, machine-made inscriptions (Latour, 1986, 1998), we can expect to find one visual no more strident than another and all a result of interpretation.

It is in acknowledging—and celebrating—"interpreted images" (Galison, 1998) that we can start to synthesize the perceptual/cognitive and the social semiotic, to consider viewers' information needs as well as emotional state, cultural beliefs, political ideologies, economic interests, and more. In her study of popular science visuals, for example, Yu (2017) combined perceptual/cognitive discussions of shapes, colors, and layouts with social semiotic considerations of female bodies, genetic determinism, and citizen science. Such integrated approaches are more likely to result in visuals that are persuasive, compelling, and useful—as opposed to merely easy to use (Mirel, 2002).

An integrated approach also enriches our understanding of visual ***ethics***. Many agree that misleading readers in perceptual/cognitive processing—by drawing what one didn't observe or omitting what one did observe, for example—is unethical (Dombrowski, 2003). But what about removing human bodies from accident reports (Dragga & Voss, 2003)? "Staging" experimental contexts for scientific photographs (Buehl, 2014)? Underrepresenting women and minorities in popular science images (Yu, 2017)? Selecting perfect as opposed to representative visual evidence for publication (Frow, 2012)? Or asking readers to take responsibilities in scrutinizing visuals (Dragga, 1996)? We cannot broach—or even conceive—these questions without seeing visuals as social/cultural artifacts.

As new (and old) visual types and technologies find their relevance in technical communication, we will benefit by approaching them from the interrelated domains of the perceptual/cognitive and the social/cultural. For example, comics, with their abundant pictorial images (including staple technical communication genres such as illustrations), make rich sites for multi-pronged studies (Yu, 2015; Bahl et al., 2020). Interactive visuals—from web-based 3D molecular modeling tutorials (Yu, 2017) to geovisualization ***risk communication*** tools (Stephens & Delorme, 2019)—represent another important (and underdeveloped) area for integrated studies to prioritize users' diverse needs and contexts. Ultimately, visual technical communication, whether between experts or between experts and non-experts, relies on the interplay between the perceptual/cognitive and the social/cultural to make and share knowledge, reflecting the dual empirical and humanistic values that undergird our field.

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