


3 Don't It Make My Brown I's Blue?

If you tell a friend with number → color synesthesia that your phone number is 713-555-8240, she may remember . (As one synesthete said about David's phone number, "It's not bad, but I wouldn't wear it.") Number → color synesthesia goes something like this: when a synesthete sees a **6** printed in black ink, she knows it is black and sees it as black, but she also has the experience of greenness. That experience of green is automatic and involuntary. For some, the experience is internal (green in the mind's eye); for others, the color may have a location (say, superimposed on the letter). Typically, it is a little disconcerting for a synesthete to view a letter in the "wrong" color—for example, looking at a red **6** when it seems to that individual that only **3** can be red.

Similar to colored numbers are colored letters: these forms of synesthesia typically occur together and collectively are referred to as grapheme → color synesthesia. The color associations for each grapheme differ for each synesthete and typically have very precise hues.

We earlier mentioned David Starr Jordan's 1917 report of grapheme → color synesthesia entitled "The Colors of Letters."¹ Jordan, a Stanford psychologist, presciently wrote, "It has been misunderstood by writers, who have imagined that the peculiar individuals having this trait actually see the color on the letter, which is not the fact. It is a mental association, not a false vision." This description holds true today, even though a minority of grapheme → color synesthetes do experience their color as having a particular location. Even in that case, synesthetic colors are readily distinguishable from real colors in the outside world. We return to the different ways of experiencing colors below.

Dr. Jordan, himself a synesthete, understood that synesthesia arose spontaneously, without teaching or outside suggestion. When he asked his eight-year-old son Eric, "What is the color of A?" Eric responded without hesitation that A was red. Jordan jotted down all of his son's color associations in 1912 and never again brought up the issue until 1917. Between ages eight and thirteen, 42% of Eric's grapheme colors had changed somewhat. In chapter 1 we cited this case as an example of how synesthetic associations can change during childhood. Nevertheless, when Dr. Jordan asked Eric again for his colors (see figure 3.1), he found enough correspondence in the boy's color choices to satisfy himself that his son's color correspondences had not simply been made up on the spot.

As surmised by Jordan, the reality of synesthesia can be shown by the fact that synesthetes show greater consistency than nonsynesthetes during repeat testing of their color choices.² However, although Eric Jordan's consistency was judged to be high, the problem remained that there was no

	Eric Jordan, 1913	Eric Jordan, 1917	David Starr Jordan
A	red	red bright	brown red
B	bluish	gray	green
C	white	white	yellowish white
D	bluish	gray	blue
E	pale green	yellow	red
F	red brown	brown	pale scarlet
G	pale brown	yellow	pale yellow
H	green	yellow	brown red
I	black	black	leaden black
J	dark blue	greenish	leaden
K	brown	brown	lead violet
L	pale green	green	green
M	red	brown	lead blue
N	pale greenish	light brown	brown red
O	light blue	black	white
P	yellow	yellow	lead color
Q	pale red	red brown	bluish white
R	dark green	dark red	bright green
S	silvery gold	silver	bright yellow
T	white	silver	green
U	yellow	yellow brown	yellowish
V	silver	white	violet blue
W	red brown	brown	lead blue
X	silver	silver	scarlet
Y	silver	white	blue
Z	reddish	dark brown	scarlet

Figure 3.1

Letter-to-color associations for David Starr Jordan's son Eric in 1912 and again in 1917. In the final column, Dr. Jordan lists his own synesthetic colors. Note that the colors are fairly consistent across time for a given synesthete and are idiosyncratic between synesthetes.

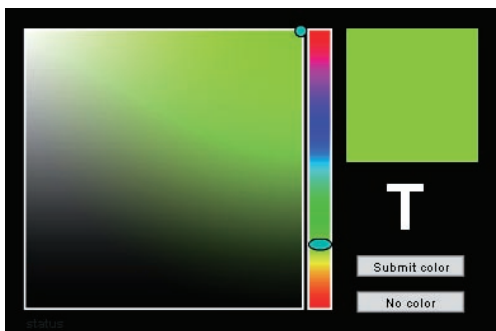


Figure 3.2

A screenshot from the online software at <http://synesthete.org>. A letter or number appears on the right (a T in this case), and participants use the color selectors on the left to find the best match to their synesthetic color.

good way of quantifying his responses. Was “white” in one test the same as “silver” in later testing, or should it be counted as different? And if so, how much different?

The introduction of computerized color matching has allowed a precise way to address these issues. In one method, internal consistency of color choices is tested not across years but within a single session. In a test developed by David’s lab, participants sit in front of a computer screen and are presented with a random letter or digit (see figure 3.2, and take the tests yourself at www.synesthete.org). Navigating the mouse over a color palette lets them choose one of 16,000 different colors that most closely match their synesthetic experience for a given character. After selecting a color, they are presented with the next letter or digit. A participant is presented with a total of 108 trials (the full set of graphemes A–Z and 0–9) three times in randomized order. The data are then analyzed for consistency: did the participant chose a similar color the first time she saw the letter T as well as when she saw it some time later? The distance in color space can be computed for an exact score of consistency (see figure 3.3). Through this testing method, synesthetes can be readily distinguished from control subjects who are asked to use free association and memory in choosing their colors.³ Tests like these have been another tool in confirming synesthesia as a real perceptual phenomenon.

A number of mysteries remain about grapheme → color synesthesia. For instance, why do some synesthetes experience color for both letters and numbers, whereas others experience it for letters only or numbers only?

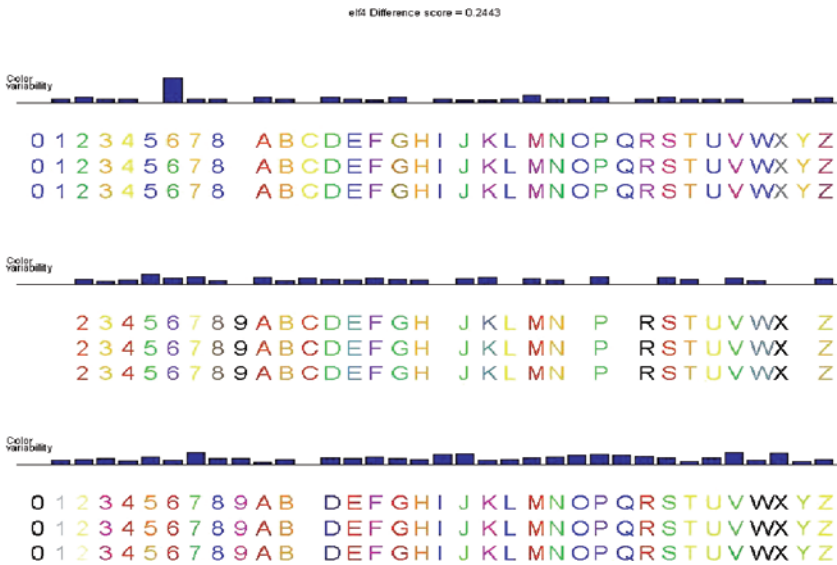


Figure 3.3

Example numerals and alphabets from three grapheme → color synesthetes. Each participant chooses colors three times for every letter and digit, presented in random order. The color difference between successive choices is computed to produce a consistency score.

Why are some graphemes colorless for given synesthetes? (For example, the second synesthete in figure 3.3 has no color associations for 0, 1, I, O, Q, and Y, whereas the third synesthete has no colors for C.) Indeed, synesthetes say that some colors are strong and vivid whereas others appear “pale” or “washed out” as if the dial on a color television had been turned way down.

These differences, while not totally understood, introduce a useful metaphor that we explore in chapter 9, namely, that the landscape of associations in the brain is mountainous, with some peaks poking above the cloud cover of consciousness while others lie below. This metaphoric image raises the possibility that the surprising cross-connections of synesthesia are present in all brains—just at a lower elevation (and thus below consciousness). We explore this idea in depth in chapter 9.

One way to make progress in understanding synesthesia is to ask whether the shape of this mountainous landscape can change during adulthood. The answer appears to be yes, as we know from looking at synesthesia for

letters from foreign alphabets. That is, what happens when a synesthete looks at foreign letters written in non-Roman scripts such as Hebrew, Arabic, Cyrillic, or Chinese? Typically, the newly learned shapes are not accompanied by a color experience. As Cassidy C writes, “they look like little black shapes on a white background. They have no color effect whatsoever.” But most synesthetes report that once they have *learned* a language (even as an adult), the new graphemes take on colors. Often there is some correlation between the sound of a letter and its associated color in both alphabets. Together with the observation that synesthesia sometimes changes during adolescence, this implies that the peaks of the landscape can continue to shift through adulthood, which means that the brain retains the ability to change.

Combinations and Context

Figure 3.3 displays graphemes in their individual colors—but when letters become grouped into a word, the colors can change dramatically due to context. For many individuals, a word's first letter dominates the rest of the sequence, whereas others discern a blending in which all the letters influence one another. Some report that vowels tend to fade into the background under the dominating influence of neighboring consonants; in other cases, vowels inherit the shade of nearby colors. Some letters have more influence than others when appearing at the beginning of a word. For example, Cassidy C reports that the beginning letter I “can give an entire word a luminescent quality, and the consonants often lose some of their power in its presence.” He also reports that the repetition of a letter in a word—as in the three Ss of synesthesia—influences the word's overall hue. In this case, the green Ss dominate and shift the rest of the letters towards green (see figure 3.4).

Typically the color of a word has less to do with pronunciation than spelling—so, for example, EROS and ARROWS would be quite different colors despite sounding similar. On the other hand, both the spelling *and* pronunciation matter for some synesthetes. Consider homographs, words with identical spellings but different pronunciations, as in “my smile is my best *attribute*” or “I *attribute* my success to my smile.” For Krissa K, word shadings change according to where the stress is in a homograph (see table 3.1).

SYNAESTHESIA
SYNAESTHESIA

Figure 3.4

The repetition of a letter, as in the Ss in this word, can influence the color of other letters in the word. The word on top is drawn in the colors of the individual letters of Cassidy C, while the word on the bottom is how he perceives the word when he views it as a whole. Note that he has used the British spelling in this example, while we use the American spelling throughout this book.

Sensitivity to pronunciation seems to hold for only about 25% of grapheme → color synesthetes polled⁴ and implicates an auditory component to their synesthesia. In other words, some grapheme → color synesthetes have an interaction with *auditory* parts of the brain, whereas for most their synesthesia is based only on the *written* letters, a difference we return to in chapter 9.

In many cases word *meaning* also influences color. For example, it is common for the word APPLE to be reddish, BANANA yellow, and ORANGE orange. Sometimes synesthetes find that colors change subsequent to their learning a new word definition. When Cassidy C encountered the new word “phthalocyanine,” his synesthetic color experience was determined by the colors of the word’s individual letters (figure 3.5, *top*). However, upon learning that phthalocyanine is the name of a vivid blue–green pigment, he now experiences the word as shown in the bottom half of figure 3.5.

Color associations usually provide a good method for remembering spelling, but they can occasionally lead to confusion in the case of similarly colored names (see figure 3.6). In Cassidy C’s case, Mike and Dave have similar colors, as do Dan and Rob, leading to social uncertainty at cocktail parties.

As we see by the descriptions above, the rules of letter-to-color associations are varied: some synesthetes find that their colors are influenced by the first letter, others by vowels or consonants, some by pronunciation, and still others by meaning or context. This variety of experience is not yet fully understood, but in chapter 9 we will explore how natural variability in individual brains may underlie this variability of expression.

Table 3.1
Examples of homographs and their synesthetic colors

Attribute	My smile is my best attribute . I attribute my success to my perseverance.	bright yellow darker, muckier looking, a kind of yellow-gray
buffet	Steamed clams are at the left edge of the buffet table. It takes a catastrophe every now and then to buffet the nation out of its laziness and complacency.	reddish brown darker, shinier brown
compound	I earn compound interest on my savings. I'm worried that the weather will compound my troubles.	light gray stays the same
desert	To desert the military is a crime. The Gobi is a large desert in Asia.	muddy brown golden brown, like toast
present	All need to be present for a unanimous vote. He will present his ideas to the Board of Directors tomorrow.	White stays the same
record	She played a vinyl record on her turntable. Did he record the concert with his camcorder?	dark blue slightly lighter shade of blue
resume	Resume breathing or you will surely faint! My resume highlights my extensive work experience.	dark blue lighter blue
voyage	I'm getting ready to take a voyage . Bon voyage!	blue-gray stays the same
wind	How did we wind up in Kansas? The wind blew us here.	light gray dark gray

Note. For a minority of synesthetes, different pronunciations of a single spelling can modify the associated synesthetic color, implicating an auditory component to their synesthesia. The right column shows the colors reported by Krissa K.

PHTHALOCYANINE
PHTHALOCYANINE

Figure 3.5

Cassidy C's synesthetic experience of a word before (*top*) and after (*bottom*) learning that "phthalocyanine" refers to a vivid blue-green pigment.

MIKE DAN
DAVE ROB

Figure 3.6

Similarly colored names in the case of Mike and Dave, and Dan and Rob, can be confused (Cassidy C).

Weekdays and Months

Colors for weekdays and month names, such as Thursday and February, tend to be determined by concept rather than spelling. In fact, it is more common to experience days of the week as colored than it is to simply experience colored graphemes. A weekday → color synesthete may tell you that Wednesday just feels magenta—but not because the letters *W-e-d-n-e-s-d-a-y* are magenta. A synesthete thinking about Tuesday may have an orange experience, perhaps, whereas Friday feels like a nice deep red (see figure 3.7).

What happens if someone has both letter → color and month → color synesthesia? Is a month's color determined by the spelling or the concept? The answer is both, depending on what you pay attention to. For example, Gizelle T, a native of Puerto Rico, learned English and Spanish simultaneously as a child. For her, color is often associated with the concept of the day rather than the spelling (e.g., January and its Spanish equivalent, *Enero*, are both the same color if she thinks about the winter month. But she was surprised to realize that when she attends to the spelling, her colors are sometimes different—for instance, when *F-r-i-d-a-y* is spelled, it is red, whereas *V-i-e-r-n-e-s* is blue.

Sunday	January
Monday	February
Tuesday	March
Wednesday	April
Thursday	May
Friday	June
Saturday	July
	August
	September
	October
	November
	December

Figure 3.7

One synesthete's weekday and month colors. For this subject the month of November was close to white; it is therefore displayed against a black background for easy reading.

Where Is the Color? Localizers and Nonlocalizers

We now return to an issue touched on earlier. Grapheme → color synesthetes experience a color when they see a letter—but *where* do they see the color? Does it have imagined spatial coordinates, hover in real space like a hallucination, or exist as a placeless inner experience of color? This is an area ripe for confusion, so we suggest some clarifying terminology.

In general, there appear to be different ways of experiencing colored letters. In many cases, the color is experienced as an internal sensation, or “feeling of color,” the way you might visualize indigo if asked to strongly