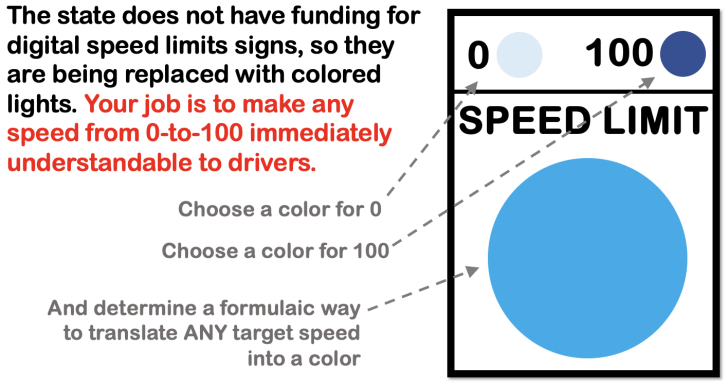
Seeing Speed: A Classroom Challenge in Color Mapping and Meaning

Have you had students wildly underestimate the practice of mapping data to color? After years of teaching, I've found that hindsight bias often nudges students to assume that color decisions don't need formal instruction, and their intuition is good enough (it's not!). This 1-hour, hands-on activity naturally motivates and nudges students to confront challenges in vis, including:

- (Non-) perceptually uniform color spaces
- Color semantics and individual differences
- (In)accessible design
- User testing and evaluation



Design Challenge and Activity Structure

Scenario: The state of Colorado has proposed using variable speed limits to reduce highway traffic congestion. But there's a catch: they don't have the budget for numeric speed signs. Instead, they're testing single-color LED signs to communicate speed, and you've been hired to design the mapping. *Your job is to translate any speed-limit from 0 to 100 to a unique color that is immediately understandable by drivers.*

Structure: This activity is run early in a course, before any lectures on color. It's a chance for groups of students to test their assumptions through design, prototyping, and peer feedback.

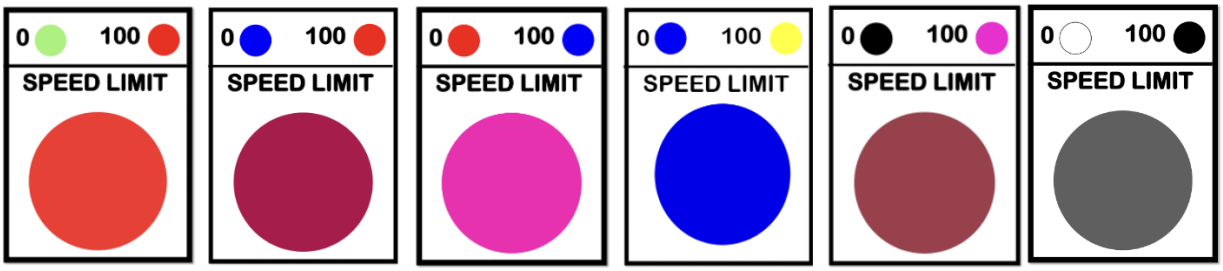
1. *Design (~15 min):* Determine how to map speed values to colors
2. *Prototype (~10 min):* Create 7 speed limit signs for random speeds between 0 and 100.
3. *Evaluation (~10 min):* User test with 3 students, guessing speed limits based on signs
4. *Share and Discuss (~15 min):* Share results, compare designs, and discuss tradeoffs.

Analog or Digital? Resources are provided to complete the assignment digitally, but it could also be completed using markers, pens, etc. While sketching often nudges students towards more creativity in their design decisions, digital design might surface color space tradeoffs more naturally.

🧠What Students Learn (and Often Misjudge)

Accessibility is easy to overlook: Red and green are common choices for traffic lights and visualizations, so students often default to a red-to-green color map. But this creates issues for users with red-green color blindness.

💡 *Learning opportunity:* Students see how easy it is to exclude users without realizing it. This sets up a rich discussion on accessible design - and why traffic lights avoid this problem (redundant encoding via position and color!).



A sample of proposed student designs. They naturally surface issues of accessibility, color semantics, and color spaces, helping both motivate and inform student learning.

Perceptual uniformity matters more than it seems: Students familiar with RGB often assume that linear interpolation across RGB space produces intuitive gradients. It doesn't, and we can observe the fault lines together in their short user evaluation.

💡 *Learning opportunity:* This provides an opportunity to talk about the advantages and disadvantages of different color spaces (HSL, RGB, CIELab), and why perceptual uniformity is important for effective encoding.

Color semantics vary - sometimes dramatically: Each semester, some student groups choose red to represent an upper-limit (100 mph) and green (or blue) to represent a safer, lower-limit (0 mph). Other groups make the opposite association! - red to represent "stop" (0 mph) and green (or blue) to represent "go" (100 mph).

💡 *Learning opportunity:* Students come to appreciate the ambiguity and subjectivity of color semantics, and how cultural or contextual meanings can conflict with even a perceptually-uniform color mapping.

Students learn the value of quick user testing: Student groups are often shocked to find that their intuitions (especially in color associations!) aren't shared by other student groups. This mirrors a common misconception in design, where creators falsely extrapolate their own experiences to large groups of people.

💡 *Learning opportunity:* Even for something as simple as designing a single light, students discover that just 10-minutes of feedback from classmates can have a dramatic, positive impact on the effectiveness of their design.

While this activity is deceptively simple (and short!), it's pedagogically rich. It challenges student assumptions, lays a foundation for future instructional material, and reveals - through hand-on experience - why color choices deserve more than common-sense intuition.

Resources: Student instructions, scaffolding, and user testing spreadsheet are publicly provided at the following location link: https://infovisions.github.io/resources/ed/color-speed