Study finds color naming conventions related to how our eyes work

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(Medical Xpress) -- One of the big questions in philosophy is whether or not we all perceive the world around us in the same ways. For example, does everyone perceive the color red the same way as everyone else? Because individual perception is impossible to measure, there is no way to prove if everyone does or not. To get around such problems, researchers turn to phenomena that can be observed that might offer some insight into such difficult to define topics. In that vein, one small team made up of Vittorio Loretoa, Animesh Mukherjeeb, and Francesca Triab has been studying the ways words are developed among different peoples to describe different colors. They describe their study, using computer simulations to create a framework called a Category Game, using virtual agents, in their paper published in the *Proceedings of the National Academy of Sciences.*

The team started out with the basic premise that the names of colors tend to appear in a certain order based on their importance to a specific culture. If a culture has words for black and white, for example, it will almost certainly also have a word for red; though the opposite won't necessarily be true. Such tendencies have been found to exist through research by various groups over the years, but until now, no one has built a formal hierarchy describing color naming across all cultures. To do so, the team devised a computer simulation game using virtual agents that had no prior knowledge of color names. In each simulated scenario, one agent served as the speaker and another as the listener. The speaker is shown objects, pairs of which are the same color, and is then asked to name that object by its color. The listener hears only the name of the

color the listener has spoken and from that must guess which objects are being described. The game is played until both agents finally agree on which colors refer to which objects.

In running their simulation, the team found that by measuring the amount of time the agents took to agree on all the colors and objects, they could build a hierarchy describing which colors appeared to be the most important, second most, etc. Specifically, they found that color naming went red, magenta-red, violet, green-yellow, blue, orange and finally cyan. Always in that same order, which they say just happens to match what studies in the real world have found. They also note that the hierarchy also serves to demonstrate that the colors that are easiest for us to see (most sensitive to our eyes) just happen to be the same ones we tend to see as being the most important.

This study doesn't prove that we all see the color red they same way, of course, or any of the others for that matter, but it does show that we do all as a general rule, place roughly the same value or importance on different colors, which does suggest we interpret the end result in much the same way as everyone else regardless of how we actually perceive those colors in our minds.

More information: On the origin of the hierarchy of color names, *PNAS*, Published online before print April 16, 2012, doi: 10.1073/pnas.1113347109

Abstract
One of the fundamental problems in cognitive science is how humans categorize the visible color spectrum. The empirical evidence of the existence of universal or recurrent patterns in color naming across cultures is paralleled by the observation that color names begin to be used by individual cultures in a relatively fixed order. The origin of this hierarchy is largely unexplained. Here we resort to multiagent

simulations, where a population of individuals, subject to a simple perceptual constraint shared by all humans, namely the human Just Noticeable Difference, categorizes and names colors through a purely cultural negotiation in the form of language games. We found that the time needed for a population to reach consensus on a color name depends on the region of the visible color spectrum. If color spectrum regions are ranked according to this criterion, a hierarchy with [red, (magenta)-red], [violet], [green/yellow], [blue], [orange], and [cyan], appearing in this order, is recovered, featuring an excellent quantitative agreement with the empirical observations of the WCS. Our results demonstrate a clear possible route to the emergence of hierarchical color categories, confirming that the theoretical modeling in this area has now attained the required maturity to make significant contributions to the ongoing debates concerning language universals.