To train the eye, keep it simple

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Researchers find that human eyes learn best in an uncluttered setting

If athletes, soldiers and drivers must perform every day in visually messy environments, common sense suggests that any visual training they receive should include distractions and disorder.
New research from the University of Southern California and UC Irvine suggests common sense is wrong in this case.

The human vision system learns best in "clear display" conditions without visual noise, said co-authors Zhong-Lin Lu and Barbara Anne Dosher. Their findings appear in a pair of articles in the current issue of PNAS.

The research has long-range implications for rehabilitation therapy, treatment of individuals with "lazy eye" or related disorders and training of soldiers, police officers and other personnel who must make split-second decisions in chaotic situations.

"Now you can simplify training a lot," said Lu, a professor of psychology in the USC College of Letters, Arts and Sciences. "Soldiers, for example, have to operate with goggles and all kinds of (visual) devices. Pilots have other kinds of goggles, video displays. They operate in different environments with different kinds of noise and different kinds of interference."

"What these results show is, in fact, you only need to train them in a clear display environment."

In their studies, Lu and Dosher asked subjects to identify the orientation of simple geometric patterns flashed on a screen. The subjects' performance improved dramatically after several sessions, in line with other studies that have shown the human eye to be highly trainable.

The difference came in the way subjects adapted to different environments. Those subjects who were trained with clear displays also showed improvement with noisy displays. The reverse was not true: Subjects trained with noisy displays performed no better with clear displays.

"That was a huge surprise to us," Lu said. "High noise training comes for free."

The researchers believe that noisy displays impose an artificial limit on a subject's potential improvement. The roughness of the image trains the eye's "filtering" ability but also masks the internal flaws of the visual system.

In clear display training, by contrast, the eye can focus entirely on reducing the intrinsic noise of human visual processes (the researchers refer to this process as "stimulus enhancement"). In addition, Lu said, clear display training may strengthen image recognition by improving perceptual templates.

The results also suggest that the two types of perceptual learning studied – noise filtering and stimulus enhancement – take place in different areas of the visual system. By training each eye separately, Lu, USC graduate student Wilson Chu, Dosher and USC undergraduate Sophia Lee found that noise filtering transferred completely from the trained eye to the untrained eye. Stimulus enhancement transferred only partially.

This implies that noise filtering is a "binocular" mechanism that serves both eyes at once, the researchers propose. Stimulus enhancement, on the other hand, is "monocular": The eye that is trained receives most of the benefit.

The researchers concluded that for optimal training, each eye should be trained separately in clear displays.

"Then you're done," Lu said.

Source: University of Southern California