

PRACTICAL PERCEPTION

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Polarizing Sunglasses - An Unusual Risk

When Polaroid® first brought its polarizing sunglasses to the market, most automotive displays consisted of physical dials and cockpit warning lights that were illuminated with actual bulbs. In that context, the advantage of using polarizing filters as driving aids was clear.

As described in the article on *Polarized light and Its Uses*, removing certain components of light, such as the reflections from the hood and from the chrome edging around the windshield (without seriously decreasing the overall light from the scene) produced a definite improvement in visibility for the driver. He or she could still see other cars, pedestrians, and other external objects with minimal darkening, while reducing much of the intrusive and undesirable glare. To get a similar decrease in glare from ordinary neutral lens would darken the entire scene much more drastically.

To summarize the manner in which polarization helps, remember that ordinary light can be considered as traveling in waves that oscillate in all planes perpendicular to the direction of travel. Reflection of such *unpolarized* light from surfaces like automobile hoods and window frames changes the light in predictable ways. Specifically, reflected light from horizontal surfaces (i.e., often the source of glare) becomes polarized by the process of reflection itself. The filters that form polarizing sunglasses are oriented to have a greater darkening effect on such reflected light than on the unpolarized light from the general scene. Ordinary sunglasses simply affect all light – direct or reflected – to the same degree. Thus, polarizing sunglasses actually can decrease common sources of glare, while preserving a better view overall.

However, cars and their dashboard displays have evolved significantly. In particular, most displays now incorporate LED and/or LCD displays. In many vehicles virtually all of the information needed by the driver is presented in such displays, thereby allowing the auto designers to provide a great deal of useful information, even changing that information to serve different purposes from situation to situation. (Most recently, as this is written, many manufacturers have begun to use the same displays, in combination with small external cameras, to provide views that significantly improve visibility to the back and sides.)

So, where would one look for the risks indicated by this Blog Entry's title?

In 2011, I purchased a new car, despite being disgruntled when I found that the new cockpit displays appeared to be much less visible than in my previous car. (Although part of this problem was the use of blue displays, I ultimately realized that more of the difficulty involved my own polarizing sunglasses!)

The LED and LCD displays in modern cars produce light that is polarized. Light from the control panel displays is thus affected by the same polarizing filter effect as that which provides the improved outside visibility. Unfortunately, I could find no warning in the driving manual of how polarization affects the visibility of the controls. This discovery eventually just shows itself, often dramatically.

My observations in several brands of new cars suggest that the orientation of the polarized light from the controls (relative to an upright head with standard polarizing sunglasses) is roughly halfway between optimally visible and maximally darkened. Thus, if one is wearing polarizing sunglasses, and tilts one's head toward one shoulder, the controls brighten and become more clearly visible. Tilting one's head toward the opposite shoulder, however, darkens the displays to near invisibility.

Center Beneath Illustration:

An LED display from a Hyundai 2011 Elantra Touring. The left-hand display has been optimized for brightness/contrast. The right-hand display simulates the changes that would occur, if the display were viewed through a suitably-tilted pair of polarizing sunglasses. *Note: The right-hand display must be simulated, because a modern digital camera will interfere with the manner of polarization, thereby eliminating the sunglasses effect.*

Although it seems likely that a clear external view is probably worth the intermittent changes in visibility of the control displays, if one is driving in brightly sunlit environments, there may be exceptions. Such exceptions include occasions in which the sudden and unexpected loss of display information could pose an unnecessary risk. Consider the variety of auxiliary controls, e.g., a radio, iPod, GPS map, blue-tooth phone, that are included in many modern vehicles. Many of these auxiliary controls/ displays are positioned on the dash, sharing the same technology as other driving controls. In particular, certain displays may be located slightly more centrally in the dash (perhaps to provide better accessibility for a passenger). If so, a driver might naturally tend to lean a little to reach such controls, creating the possibility for an unexpected change in visibility. This decrease in visibility could increase the time spent in nonessential manipulation, with a consequently longer lapse in attending to the primary driving task.

There are several variables that likely interact in determining the extent of distraction while manipulating more centrally positioned controls, including placement of displays, size of the driver, whether duplicate controls for the desired operations are available on the steering wheel, thereby modifying the required tilt-reach. Nevertheless, it is reasonable to expect that simply knowing visibility *can* be affected by the type of one's sunglasses, and knowing which direction of tilt will produce which effect, may be important for improving driving safety.

Note: In all the cars I've recently examined, my polarizing sunglasses have a constant effect. Tilting my head toward my right shoulder decreases the display's brightness; tilting my head toward my left shoulder allows the display to brighten.

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