# Comment from Gerald Miller

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As technology advances, we need to evaluate it carefully to understand both the risk and benefit of its application clearly. The automobile, like many of our modern-day tools, are complex systems with many complex sub-systems working together.
With every advancement in systems, the human interface changes with those systems. As sub-systems are added to a complex system, the need for additional human interfaces is also added. In automobiles, human interfaces occur with the operator (driver), passengers, service people, and others sharing the road.

Interfaces that directly interact with the operator need to be carefully considered as to the impact on operations. Operating a modern automobile requires both physical and mental skill sets. As the physical operation becomes more effortless, we tradeoff control and skill for system management. As an operator, we manage the systems through control inputs that happen automatically or by prompted human action by the system itself.

In addition to what is going on outside the automobile, we are required to maintain awareness inside also. The operator must visually move from outside to inside in a constant cadence to maintain control of the vehicle. Any disruption of this cadence is cause for alarm for its potential of an accident.

A grave concern with all drivers today is distraction. Drivers that focus on phone usage, both voice, and text, has resulted in high accident and death rate caused by this distraction. Distraction for even a second can have immediate impairment on driving ability as witnessed by anyone who has been behind a weaving driver using a cell phone.
Technology fails; it is not perfect. Electronics are subject to physical component failure with the additional possibility of failure from not receiving energy. Redundancy is built into critical systems to allow for a failure to occur without collapsing the system.

Proven technologies often migrate to other uses that show benefit by reducing cost or increasing function or both. Video technology for looking at the space behind a vehicle has been very successful in showing areas that are not visible from the typical driver's view. It has added cost to the vehicle but added functionality with greater proportionality. I would argue that this technology has saved lives.

The use of backup video technology as experienced by the driver is initiated automatically by the vehicle when the reverse gear is selected. The camera is activated before the movement of the vehicle. The driver is given a view of the area behind the vehicle with guidelines showing both path of travel and color-coded lines designating impact zones. All this visual queuing comes with a warning not to rely on the screen picture for total situational awareness. The driver is expected to look at the visible areas outside the vehicle without the use of the camera before any movement is made.

As we look to expand the role of video in the automobile to that of replacing the mirrors, we must consider the changes that will be made to the human interface to the system. The interface will change the focus of the driver to more of one inside the vehicle. The cadence of looking inside and outside will be changed, giving the driver an additional task of interpreting electronic images vs. standard images.

Viewing an image through a mirror will match the ambient light that exists outside the vehicle. A video image creates its light requiring an eye adjustment to transition to light conditions outside the vehicle. Video images flicker at both a scan and refresh rate. These rates combine to create a flicker. Our eye filters out the flicker to make video images appear as a smooth projection. However, filtering out this flicker can cause fatigue. Also, extended exposure to video images can have a hypnotic affect. At night moving from looking at a lighted display to the darkness outside can adversely affect night vision.
A failure of the video system would leave the drivers with few options for situational awareness. Without mirrors, the driver will be forced to look out the windows by rotating the neck and body, creating unnecessary body movement potentially impacting the operation of the vehicle.

I am against removing mirrors from automobiles because I believe that action would introduce new hazards into the vehicle at the same time, removing a critical safety device. Drivers have too much complexity to deal with now, adding additional complexity is not moving in the right direction. Failure of the video system provides no backup for situational awareness to the driver. I ask that this proposal to eliminate mirrors in favor of a video system be firmly rejected.