ShyTech Displays

Enabling a new era of puristic vehicle design and enhanced user experience

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Abstract
Displays – particularly touchscreens – offer the benefit of providing a dynamic interface for the constantly growing amount of information and control functions that come with the digitalization of the car. However, the driver’s and passenger’s needs will typically change with the traffic situation, the individual type of journey, time of day, and state of mind. In a specific situation a lot of current information may be required, in other situations only the essentials are what a driver needs to do his or her job best without any distraction. Displays offer a new solution for this as well: High resolution ShyTech displays make it possible to scale both the information and control function scope to what the driver prefers at a given time, enabling information on demand. There is no “one size fits all” when it comes to information, control and infotainment. It all depends on the situation. ShyTech displays enable a new quality of human-machine interaction. Plus, this innovative technology offers a new solution to the comparatively bland look of conventional displays when the power is off and no contents are shown.

1. The age of displays
One of the most reliable trends in the vehicle interior over the last decades has been the constant growth of display area(s) and their steady increase in resolution and image quality. More than ever before, displays are becoming the dominant element of the human-machine interface in the vehicle and they clearly play the main part in designing a cockpit. The recently introduced fully digital pillar-to-pillar cockpit displays spanning over the entire width of the dashboard herald the beginning of a new age. Currently, the seamless integration of large displays under one cover glass is focusing on new display shapes and aspect ratios which will serve to support different approaches to driver and/or passenger information and control operation [1]. However, the bottom line usually is: Whatever the approach to the individual automotive human-machine interface is, displays are an essential part of it. This trend is equally driven by the growing number of functions in the vehicle (all of which need an interface), by digitalization in general and by domain networking
in the car. Other mega trends, such as electrification and automated driving, also bring new information and control demands which are at least partly met by displays with touch functionality.

Obviously, this exciting change also brings new considerations with it. On the one hand, displays in the off state tend to be much less attractive to the eye than a display showing contents. A lot of the character and appeal of a modern digital cockpit is thus lost during the ignition off state, to the extent that some people still appreciate old-fashioned looking instruments as they have a physical presence and solid 3D appearance.

On the other hand, the wealth of information and control options provided by a pillar-to-pillar solution, when fully active, gives rise to the discussion whether this can be an information overload for the driver. This is a perfectly justified consideration and a reason for a holistic human-machine interface expert such as Continental to develop ergonomic answers to this discussion. The company’s “instrumentation” expertise spans almost 120 years (since 1902) and it has always been a core target of development to balance the driver’s wish for information, a healthy driver workload and the top priority of keeping his or her eyes on the road. Every age of instrumentation has come up with its answers to this challenge. The age of displays is no different in this. So-called ShyTech displays utilize a new off state look featuring a puristic human-machine interface to reconcile the varying levels of information and control demand of the driver with the visibility and potential dominance of displays.

2. Introducing ShyTech displays

Although current and future cockpits are digital, immersive and provide an increasingly exciting user experience, they can benefit from being ‘shy’ at times: Hiding control surfaces made of buttons, lights and switches behind device fronts is an ongoing trend in many areas, and has already been applied to some extend in the automotive industry. The idea behind the so-called “ShyTech” is to make complex technology and user guidance invisible when not needed, enabling interaction only on user demand, Fig. 1. For example, instead of presenting ‘empty’ black display surfaces or numerous physical buttons, a ShyTech solution blends well into a puristic approach to cockpit design that creates a calm atmosphere by presenting a decorative surface.

In principle, a ShyTech display can actually be a pillar-to-pillar solution, utilizing the full width of the dashboard, or it can also be introduced to create completely new interactive areas for drivers and passengers where displays traditionally were not in use before. The information scope and the full range of control options – through touch and other interaction – is always there but the relevant content becomes visible on demand only.
Fig. 1 provides an example of the decorative surface a ShyTech display can offer. The appearance of wood as an exemplary curved display surface has several benefits. Attractive wood has a very noble look. Also, this premium surface is free of any ‘white shirt’ effect: There is no glare from the display surface even in the case of a flashlight going off. At the same time, recreating a credible wood pattern is a technical challenge. This can also be achieved with artificially produced decorative surfaces, e.g. in wood or leather optics, which give a visually and haptically realistic surface impression and conserve natural resources.

Fig. 2 shows other design options which have been developed so far to demonstrate the technology’s potential for interior design. Metal effects such as decorative strips or trims can also be included in the display surface, but they will show the same level of reflection as the real thing.

Fig. 1: ShyTech dashboard with active displays under the curved wood-effect surface

Fig. 2: Examples of other foil designs that were developed and validated so far
When the display is not active, the entire surface looks like wood. Particularly in the vehicle, this allows the integration of all desired functions without visual overload, but by creating a calm and clean interior design. ShyTech in automotive applications therefore enables stunning designs and reduces potential sources for driver distraction at the same time. **Fig. 3** shows a demonstrator with the display fully dimmed. **Fig. 4** shows the same ShyTech display with active contents. Instrumentation, navigation, or infotainment become invisible and only appear when needed.

**Fig. 3:** ShyTech demonstrator with natural looking wooden appearance

**Fig. 4:** The same demonstrator with active display and contents
3. Look, touch and feel

When the displays are not active, the whole dashboard area appears to be an elegant wooden surface, Fig. 5. This look is created by a special semi-transparent foil which is applied to the display cover glass.

Fig. 5: Curved ShyTech dashboard with displays off

The high-resolution relief print on the foil has the appearance and haptic feel of real wood with only a minimum of color shift of the display’s content underneath. Sophisticated pillar-to-pillar display solutions can be designed in a fully integrated trim panel style, thus allowing the next era of vehicle interior design elegance and enhanced user experience for drivers and passengers. In the dashboard demonstrator, the individual information and control zones directed towards the driver and passenger are provided by using three 12.3” Low Temperature Poly Silicon (LTPS) TFT displays with InCell touch and 1920x720 pixels resolution. The high brightness of the matrix backlight solution ensures the crisp image quality for high-resolution content with superior contrast. In addition, the power consumption and thermal load are moderate because LTPS displays are power-efficient by design. Plus, local dimming options and dimming algorithms reduce power consumption depending on the shown content. Particular care has been taken to avoid the so-called postcard effect: There is no visible “postcard”-dimensioned area where the display dimensions underneath the foil can be discerned through color or brightness variations. The transition between foil surface and display contents is clear and sharp, Fig. 6.
The seamless integration of graphical interface elements is done via the 24x10 active-matrix LED illumination with local dimming (driven by a Continental algorithm), to create a high dynamic range with a light intensity of more than 800 cd/m².

Fig. 6: Driver “instrumentation” (left), navigation (center) and passenger infotainment (right) areas follow the proven ergonomics of human-machine interfaces in the car

To activate a ShyTech display there are multimodal technical options which can be chosen to blend in with a specific interaction concept and model. For instance, a small part of the display could be permanently showing a landing icon to guide the driver’s or passenger’s hand to the display. However, the display could simply remain invisible until it is touched by a fingertip. As an alternative, a capacitive sensor can detect an approaching hand at a convenient distance to activate the display in time, e.g., for a touch control operation. Of course, voice control is another option. In that case, individual displays could respond to voice commands and interaction via natural language understanding (NLU) technology. Switching the display off can be initiated by touching a specific display area (virtual control button), by voice control or via gesture.

4. Conclusion
One future alternative car cockpit is digital, immersive, and shy. There will be many and/or large displays in the car that are seamlessly orchestrated by a central computing unit such as a High Performance Computer (HPC). Large display areas are offering a new quality of user experience. This is relevant today, as cars become a part of the Internet of Everything, but it
will be even more relevant with the growing automated driving capabilities because the driver will gain the liberty to engage in activities not related to the driving task. To meet these new demands, the display in the traditional driver instrumentation zone will become part of the immersive quality. As a bottom line, one can state that innovative UX solutions are becoming the new ‘horsepower’ and key differentiators for any carmaker.

Beyond traditional displays, there can be hidden (or shy) displays behind a translucent material with a natural look and texture of, for example, wood or leather. The display will only become visible in case there is relevant information to present. Touching such a shy display adds to the tactile experience in the car. The scalable amount of information and control functions helps the driver (and passenger) to match the human-machine interface to her or his momentary requirements, traffic situation and state of mind. With the ShyTech technology in combination with its automotive display solutions, Continental is demonstrating an innovative answer to this rising trend.
