Report Automotive Visual and Display Technologies USA 2018

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1 Introduction

The Automotive Visual and Display Technologies meeting was conducted by IQPC, a Berlin based conference producer. It was located at Ann Arbor, Michigan and conducted on March 26 and 27, 2018. The additional workshop day on March 28 is not part of the report. About 40 professionals from the automotive industry attended the meeting. The schedule contained 11 presentations, 4 interactive sessions and a 30 minutes speed networking. I had the honor to moderate the meeting.

An overall, personal summary: the meeting was professionally organized and conducted. The selection of speakers represented the entire automotive displays industry. Aspects of markets, user and technologies where presented well balanced. Presentations, interactives sessions, networking opportunities, and a beers and bites session at the end of the first day combined an exciting event worth the attendance.

This text represents the options of the speakers as made during the meeting. They do not necessarily match with my personal or professional views. Where appropriate I add my personal remarks. Let me know your thoughts!

2 Display Market

- The automotive display market is pushed by the consumer market. This means speed, speed, speed. In some cases, this requires a re-definition of technologies
- Megatrends in the automotive industry are: autonomous driving, connectivity, software, user experience, ECU developments, and electrification (remark: I follow the CASE paradigm: connected, autonomous, shared, electric, I see these as the megatrends. Software, ECU, electronics are underlying, required technologies, they may serve as drivers or as suppliers. UX is a bridging concept, that is not a megatrend, but a core requirement)
- UX trends include a growing number of displays in the market, the number grows from 45mio annually to 72mio between 2016 and 2023. The size of displays grows, the gain in size was from of 6.8” to 7.2” between 2016 and 2023. Most of automotive displays is between 7” and 8” now, the biggest growth in market share have displays of more than 9”
- Most vehicles have at least a small display in the instrument cluster. The majority of these is under 5”. The biggest growth on market shares today comes from display of 7+”
- The market share of head up displays (HUD) will grow from 3% in 2016 to 13% in 2023. 50% of them will be combiners using a separate piece of glass or plastic, the other 50% will use the windscreen for projection
- Capacitive touch screens take over, they are the number one choice for many automotive applications (remark: until abut 2 years ago, Audi, BMW, and Mercedes stated that the will never have touch screens on their dashboards. Today they all have!)
- The LCD is the working horse of the automotive display market. They may have limited readability but low prices
- OLEDs are the main challenger of LEDs, they offer a superior quality, they may be bended and folded, high performance matches high prices
- Micro LEDs where presented in 2011, they are driven by the mobile devices industry and have a high life time. They have challenges in production, no mass production yet

- AMOLED Displays are introduced into consumer markets now. They will play a stronger role in luxury segments, since they have high prices but superb quality
- 3D displays will play a certain role since users do not fully accept the fully flat designs
- LED/TFT head up displays are the workhorse in the HUD arena. Prices get lower as mass production kicks off. They face serious thermal problems
- DLP/DMD HUDs are used in offices and cinemas, the first automotive application was realized in 2017. They are single source today, so foreseeing price developments is difficult
- Augmented reality HUDs play a strong role in many HMI concepts. Their flawless application requires the knowledge on the eyepoint. Since cameras controlling the driver due to safety (posture, position, facial recognition) a device for the eye detection is on the dashboard.
- Other HUD technologies are laser HUD, optical films, holography
- The main issue in the application of HUDs is not necessarily the price, but definitely size
- Rear view mirror displays will a future trend, first realizations are available on the market, side view mirrors will follow late 2018/early 2019. Both offer a high value at a low price (remark: I see the value of these technologies, use cases and applications need to be defined carefully. The mirrors are objects in the visual field that receive a lot of attention. If they contain too much or the wrong information, or if the information is presented the wrong way they may lead to serious driver distraction)

3 Technologies and Testing

- Measuring objective and perceived quality is core for a positive user experience
- The use of free form and bended displays creates new challenges for measuring display quality
- OLED displays are coming more and more, ensuring their quality is difficult since every pixel is an emitter, which leads to pixel level variation in luminance
- Future displays solution face mechanical challenges like curves displays with rainbow effects and lens effects, head impact issues, architectural issues like “where to operate what”, power consumption, critical in electric vehicles, and measurement challenges
- Cluster displays deliver flat images to the driver. Often a 3D images is preferred. This may be caused by user experience of to highlight certain information on a cluster
- The UX includes trusted analogue (stability, predictable behavior, familiarity, intuitivity) and dynamic digital (flexibility, configuration, dynamic, hi-tech advanced feel), stereoscopic multi-layer displays can combine the advantages of both worlds. 4 to 8mm of physical depth is sufficient for automotive cluster applications
- Windscreens need to comply with transmission regulation
- Modern windscreens contain the reflection film in the sandwich of the glass sandwich, which required a modification of the HUDs technology

- HUDs do not work with polarized sunglasses
- HUDs have thermal problems
- In HUD the challenges are the virtual image size, the resolution, and contrast accuracy. HUD require specific anti-glare solutions
- Augmented reality HUDs (AR HUD) still face big challenges, the windshield itself, its surface, design, wedge angles. Light finds a way, it always pops up where it is not supposed to be, projectors for AR HUDs are still huge, which brings serious thermal issues. Size is driven by field of view and virtual image distance
- AR HUDs are safety devices
- HUDs will be in cars for safety reasons. In augmented reality (AR) scenarios they will present critical information. Redundancy will be eliminated, meaning they become safety relevant
- A typical application of AR HUDs is the indication of critical objects in the visual field of the driver
- Combiner HUDs with a small separate piece of plastic or glass will be replaced by full screen HUDs
- Downturns of HUD displays are low contrast and the large size of projector, lenses, heat sinks
- Polarized beam folding, holographical elements, and laser holographic imaging may serve as solutions. In HUDs 80% of all pixels are off for most use cases, which leads to a loss in brightness. Laser HUD systems re-direct the light and create brightness. Distortions are easier to correct
- The size of AR HUDs will grow by 50% in a foreseeable time frame

4 HMI, User Experience, Usability

- Focus points of display applications in vehicles are simplicity, beauty, functionality (remark: I see safety as the core focus, the others are of course valid as well)
- The development of displays kicked off with mechanical devices in the 1910s/1920s, the first car radio was introduced by Blaupunkt in 1932 in Europe
- For almost 100 years the until today mechanical clusters, combining speedometer, rev meters and other driving relevant information are used. In the mid-80s the first digital/screen displays showed up on dashboards. At that time, they were highly priced options. The future will belong to the display solutions (remark: I see digital cluster displays in all vehicle classes prominent in a few years from now, mechanical instruments will be found in luxury segment cars to indicate value and individualism)
- Killer app for the introduction of displays on dashboards was navigation
- Future displays in vehicles will be bigger, curved, and there will be more than we have today

- All digital dashboards will be in series production very soon, the reduction of buttons will lead to clear designs
- Core for the success of autonomous driving (AD) is trust. Is AD secure? What about identification? Vandalism? Will the cars take me, where I want to go? Is AD a good use of my time and money? How can I stop the car when I need a bathroom? Can the car take care of itself? How save is everyone else?
- AD creates time to watch videos, immersion scenarios become possible using walls, windows, roofs as displays
- Good designers take care to solve the right problems beautifully, they inject emotional responses into products, everything can be a little better
- Products connect makers and humans. On the maker side are influences like manufacturing, marketing, sales, legal, service and more. On the user side are intelligence, humor, creation, smartness, imagination, intuition
- User categories are: End consumers, real customers, OEMs/1st tiers, analogous users, super users
- Technologies usually see three different levels innovation: incremental (70%), boundary (20%), radical (10%)
- Mainstreet needs, Wallstreet demands