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SID Display Week, June 4, 2015

ADVANCES TO IN-CAR HMI SYSTEMS

STEFAN MARTI, PH.D., VP FUTURE EXPERIENCE
RASHMI RAO, DIRECTOR COC SYSTEMS
IP PARK, PH.D., CTO HARMAN

JUNE 3, 2015 (V1.6)

HARMAN X AKG harman/kardon Infinity JBL Mark Levinson Lexicon REVEL

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PROBLEM

There will be more and more computers in cars: built-in, brought-in, worn, etc.

These computers want to interact with us (and we with them).

If not designed and engineered appropriately, the user interfaces between us and these computers will become more complex—and more distracting.

This is not acceptable.


This is not acceptable.
Ben Cooper / LaunchPhotography.com

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INFORMATION OVERLOAD

The current ways how we interact with computers is distracting from our main task in the car.

That is because today's HMI methods depend mostly on our eyes and ears.

These senses tend to become overloaded.

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SOLUTION 1: MORE THAN JUST EYES AND EARS

First, we need to "load balance" our senses.

Our fingers are usually telling computers what to do—but they can also sense, e.g., what the car wants to tell us.

And not just our fingers: we can also sense with our palms, wrists, even forearms.

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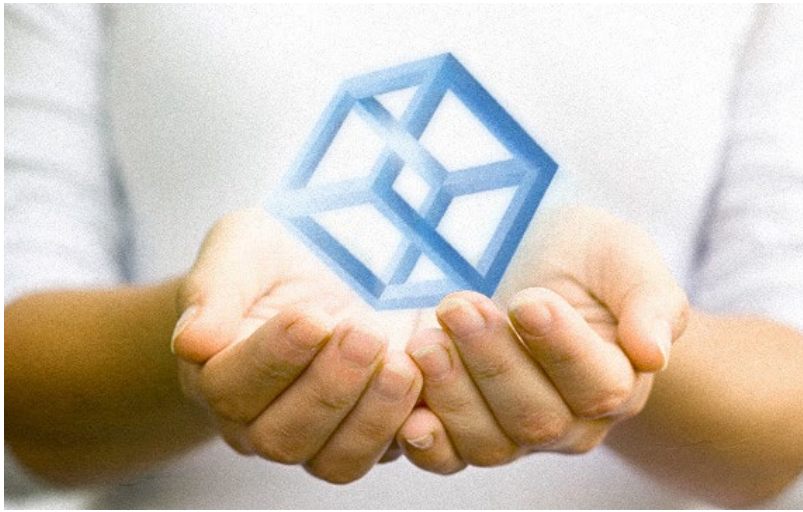
SOLUTION 2: SPATIAL INTERFACES

Second, we need to use people's spatial perception better.

Right now, many output methods are flat: displays, sounds.

When interfaces become spatial, they become easier for us humans to comprehend.



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SOLUTION 3: SENSING NON-VERBAL LANGUAGE

Third, we need to pay attention to people's subtle non-verbal cues. Very few interfaces do so currently.

Our face, e.g., can convey information which should be important for our systems: it may show what we really want, or think, or feel.

1 Pseudo Holographic Display Systems

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PSEUDO HOLOGRAPHIC DISPLAY SYSTEMS

CORE IDEA

Pseudo-holographic display systems take advantage of volumetric space between driver and steering wheel.

Alerts and important information, such as a speeding notification, can become more prominent by getting closer to the driver.

Machine intelligence decides which information is most relevant, and dynamically determines priority and position in space.

TECHNOLOGY

- Autostereoscopic display
- View dependent rendering
- Adaptive UI with context awareness

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STEREOSCOPIC 3D INSTRUMENT CLUSTER

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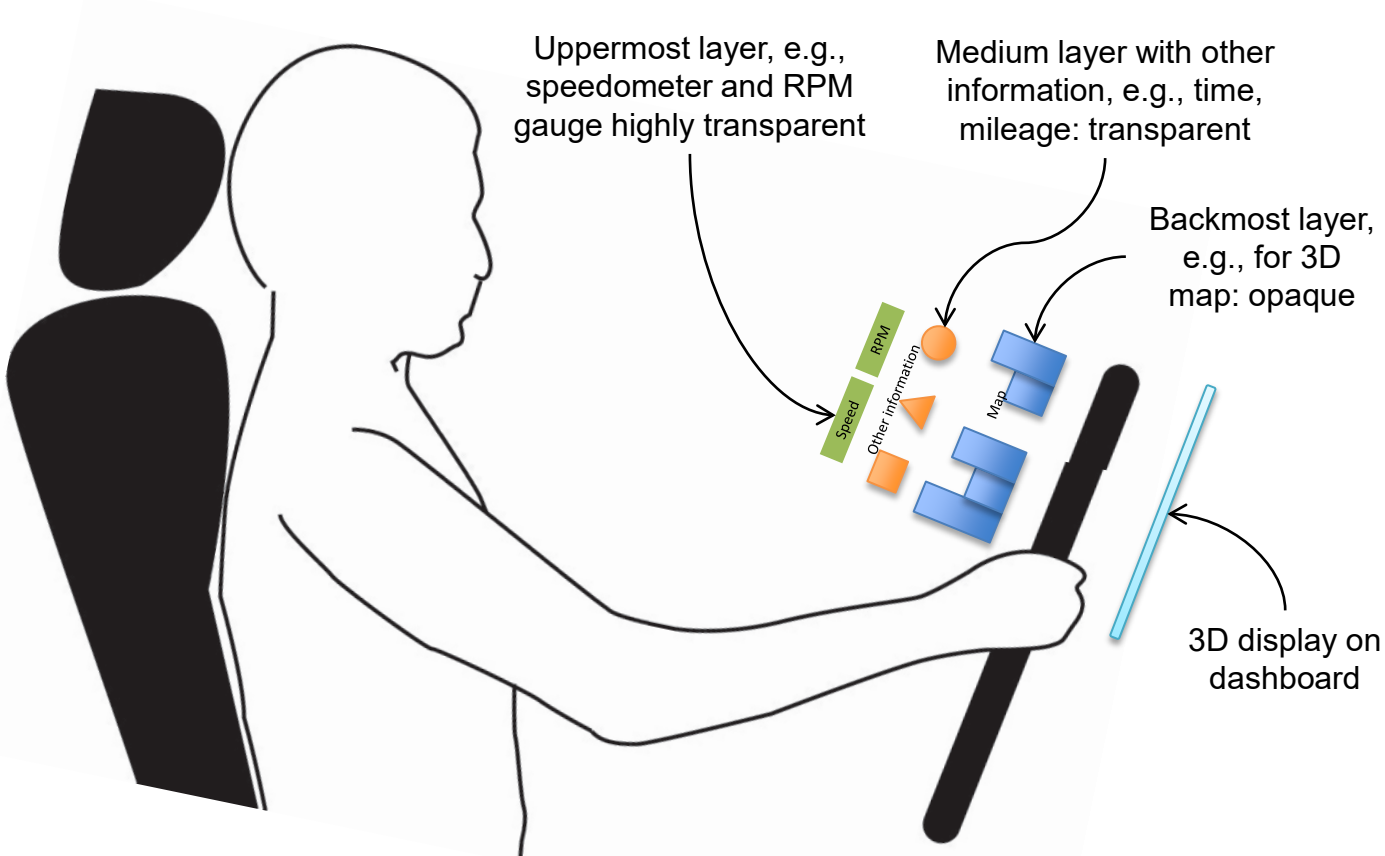
CONFIG 1: 3D DISPLAY BEHIND WHEEL



3D field in front of steering wheel, with display behind steering wheel (seen through opening in steering wheel)

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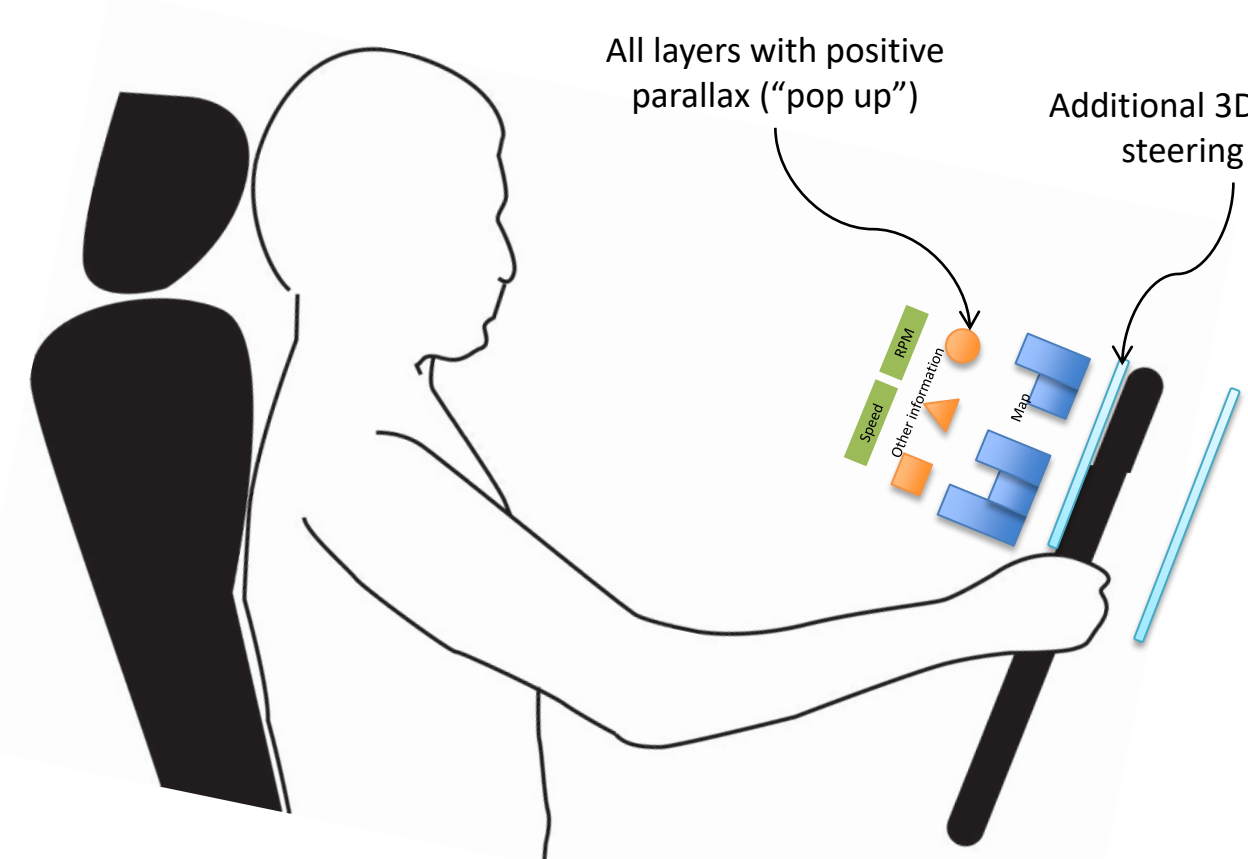
CONFIG 2: 3D DISPLAY ON STEERING WHEEL



Secondary display on steering wheel, 3D field behind steering wheel (“pop back”)

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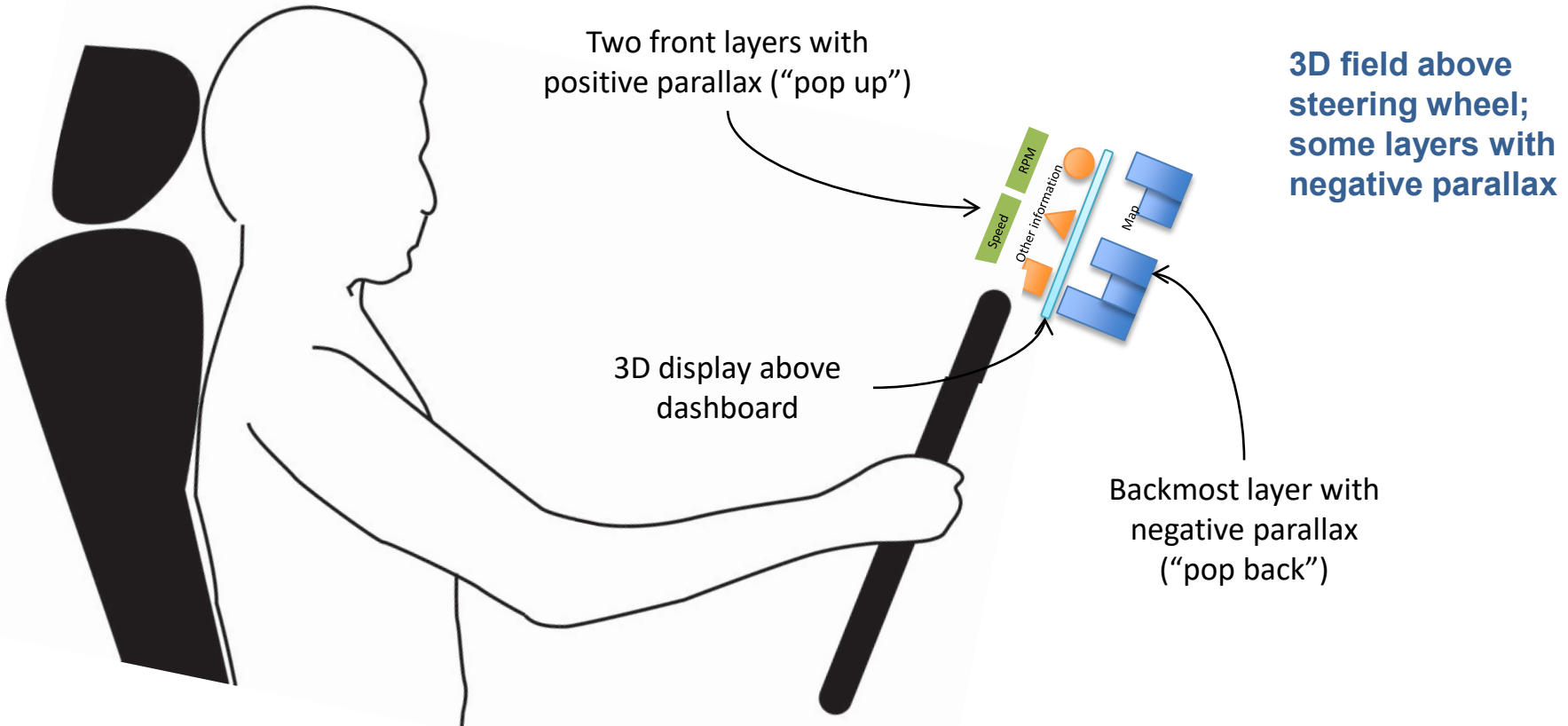
CONFIG 3: 3D DISPLAY ON DASH



3D field above steering wheel; some layers with negative parallax

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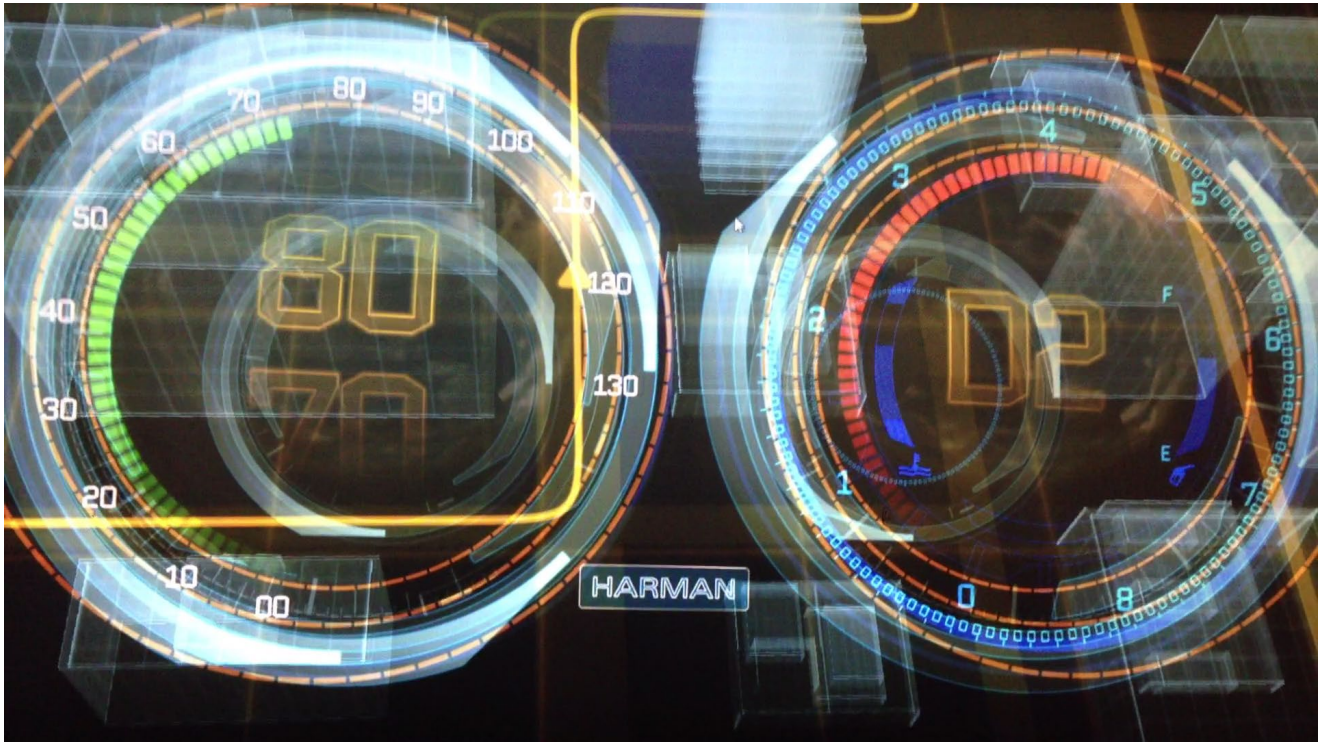
TRANSPARENT INSTRUMENT CLUSTER DEMO



2 Gestural Control of In-Vehicle Sounds

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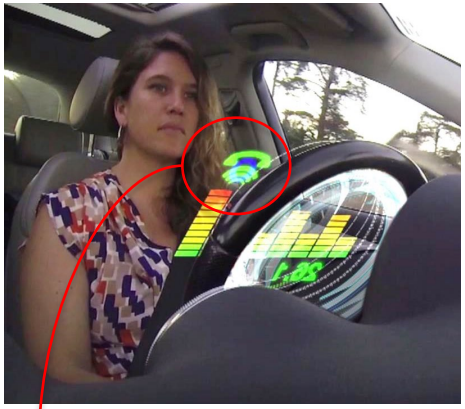
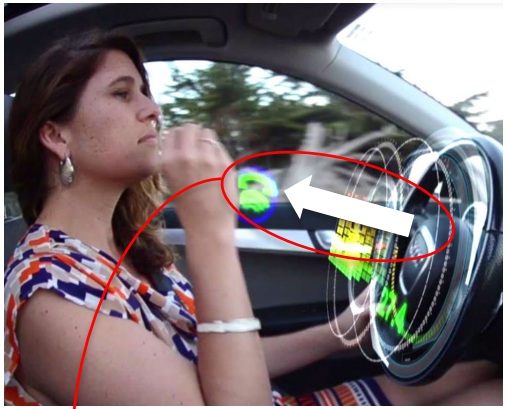
GESTURAL CONTROL OF IN-VEHICLE SOUNDS



Icon of ringing phone, and 3D location of audio point source



Driver pulling sound (ringing phone) towards her ear

CORE IDEA

Driver can use intuitive gestures, such as grasp and pull, to control volume and perceived location of audio events.

Can also be used to activate audio events, such as answering a phone call.

Such as system makes sense when paired with a 3D instrument cluster, or with individual sound zones (ISZ).

TECHNOLOGY

- Gesture sensing
- Surround or 3D sound system

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BARE-HAND MANIPULATING SOUND

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GESTURE INTERACTIVE
3D SOUND

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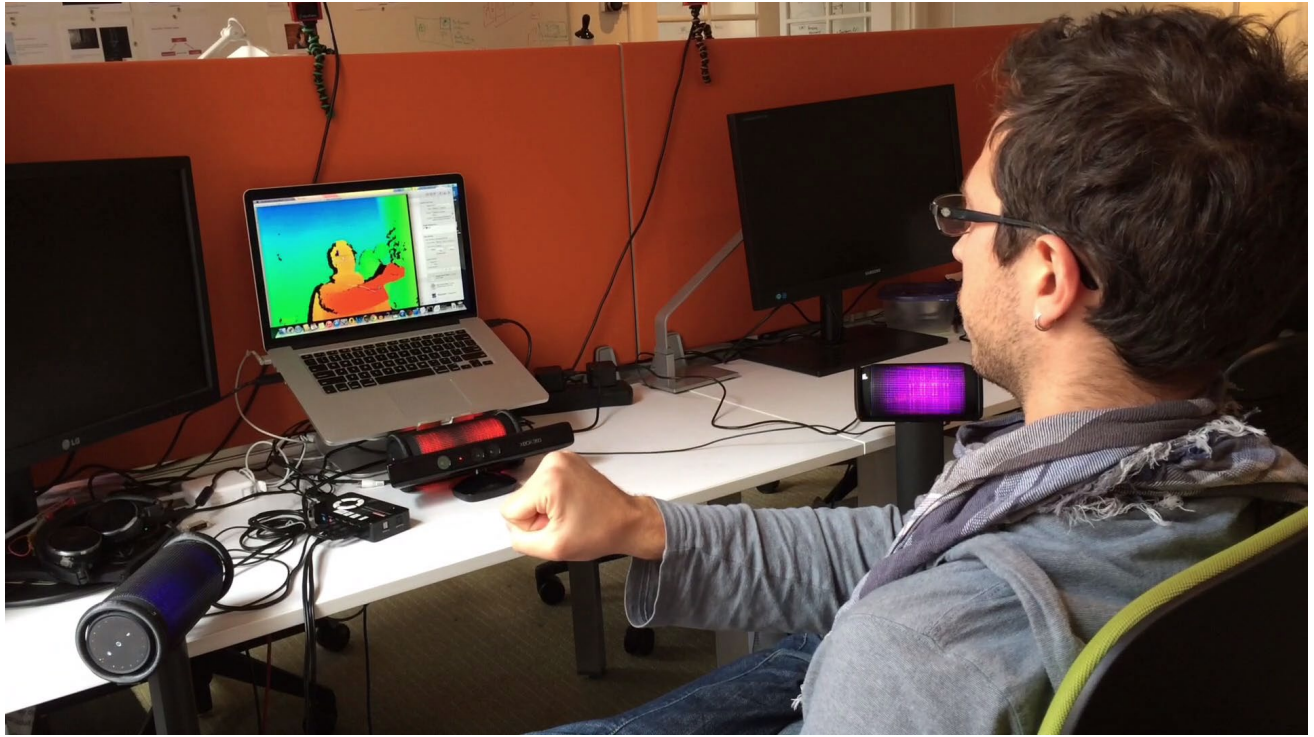
PROOF-OF-CONCEPT PROTOTYPE



3 See-Through-Dash Display Systems

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SEE-THROUGH-DASH DISPLAY SYSTEMS

CORE IDEA

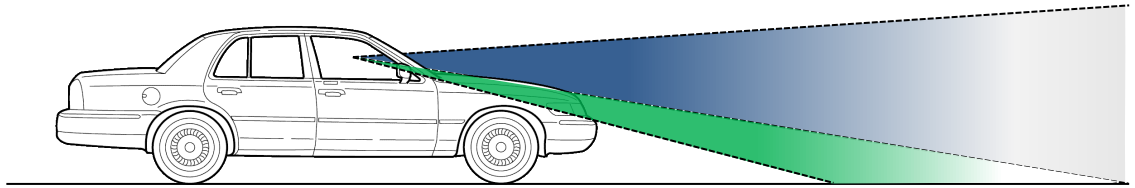
Being able to see through the dash gives the driver an augmented field of view of the road in front of the vehicle.

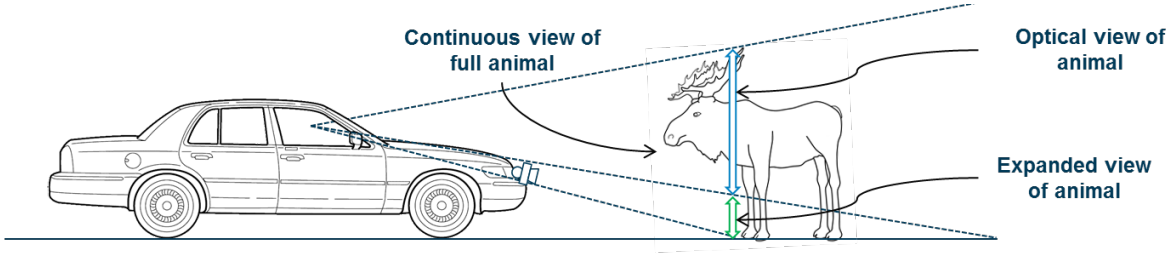
This increases the spatial awareness for the driver.

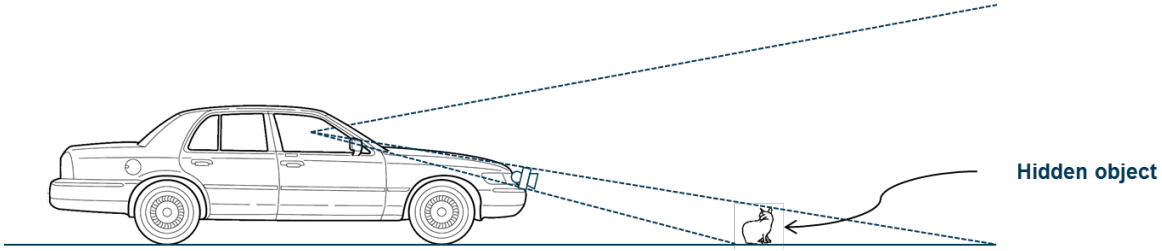
System aims to convey a similar effect to a virtual hole through the engine or a partial glass-cockpit.

TECHNOLOGY

- Pseudo holographic 3D display
- Stereo imagers, physically or virtually actuated
- Driver face tracking for view dependent rendering




Continuous view of full animal
Optical view of animal
Expanded view of animal


Hidden object

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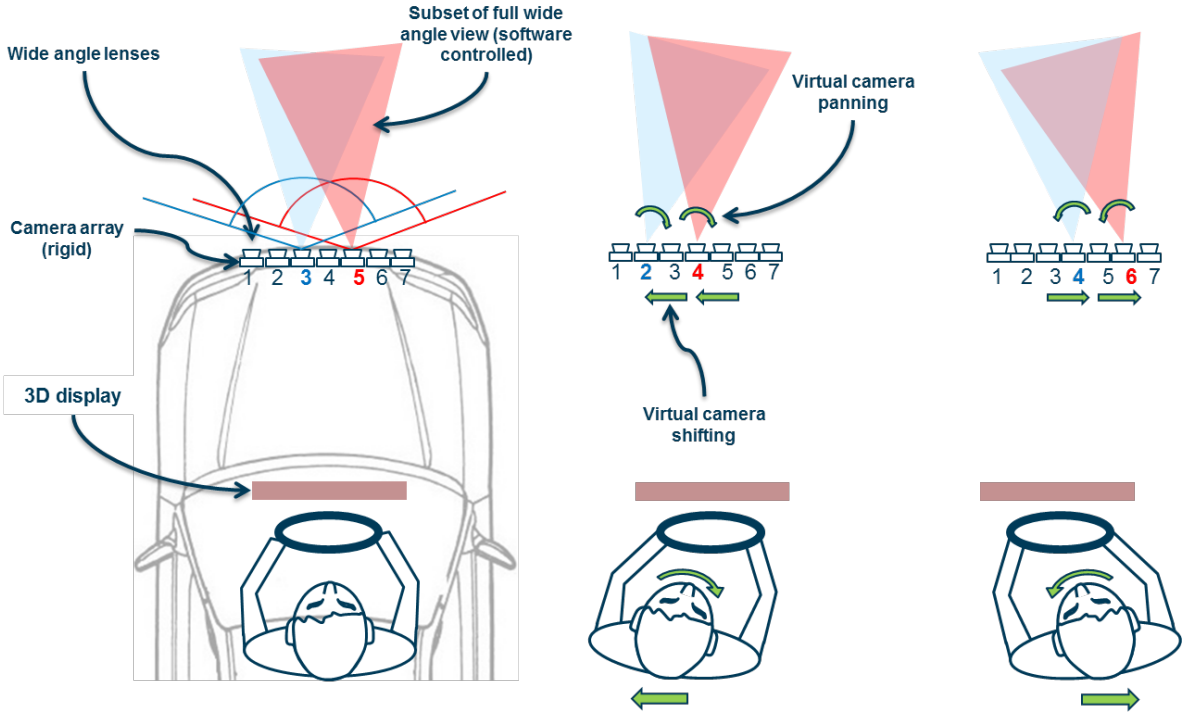
ARRAY OF CAMERAS



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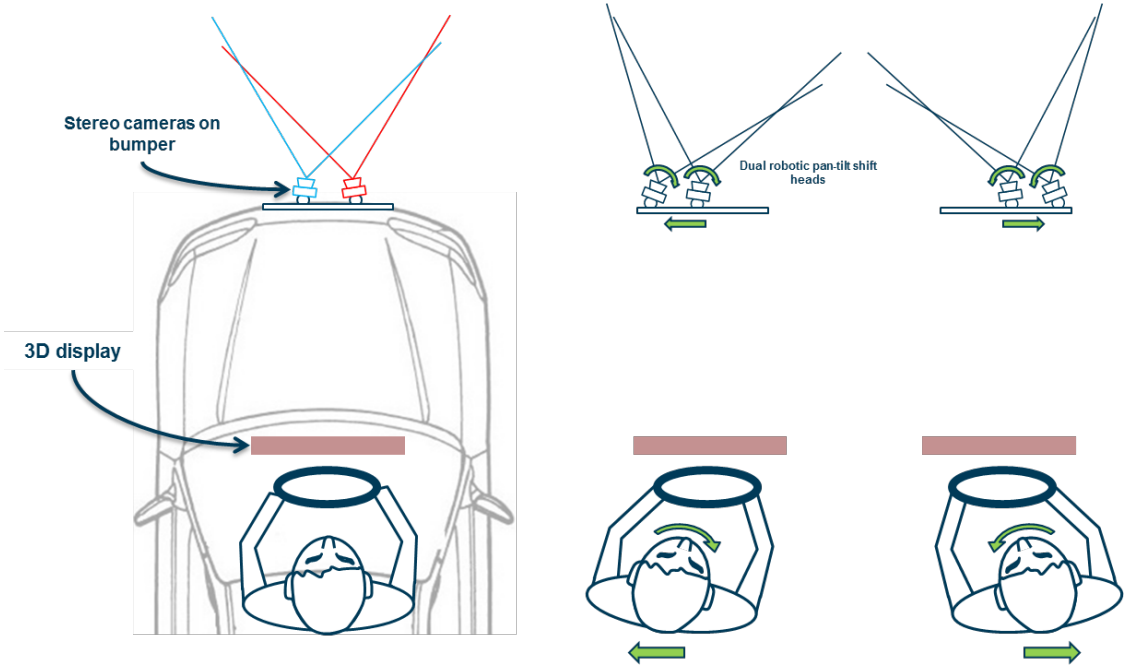
PAN-TILT CAMERAS



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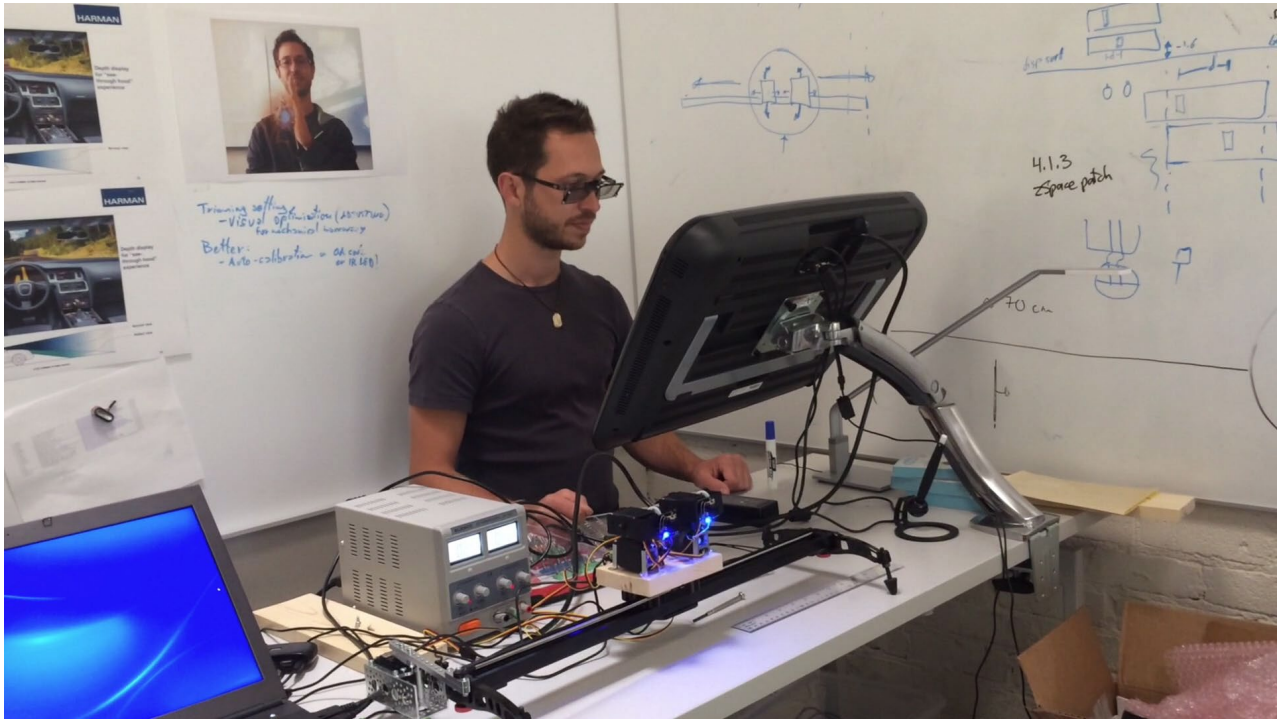
PROOF-OF-CONCEPT PROTOTYPE



4 In Mid-Air Tactile Feedback Systems

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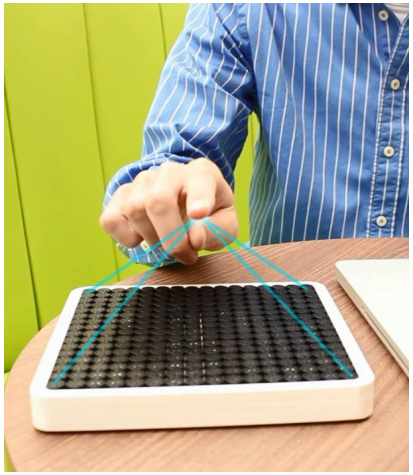
IN MID-AIR TACTILE FEEDBACK SYSTEMS



CORE IDEA

System which gives the driver tactile feedback in mid-air.

This feedback is in sync with visual and auditory 3D UI, supporting it. For example, a visual icon or UI element of a 3D display becomes tangible, in mid-air.

This closes the interaction loop of spatial displays and spatial sound with haptic experience, creating “illusory haptic objects”.

TECHNOLOGY

- Ultrasonic parametric transducer array
- Finger tracking sensor

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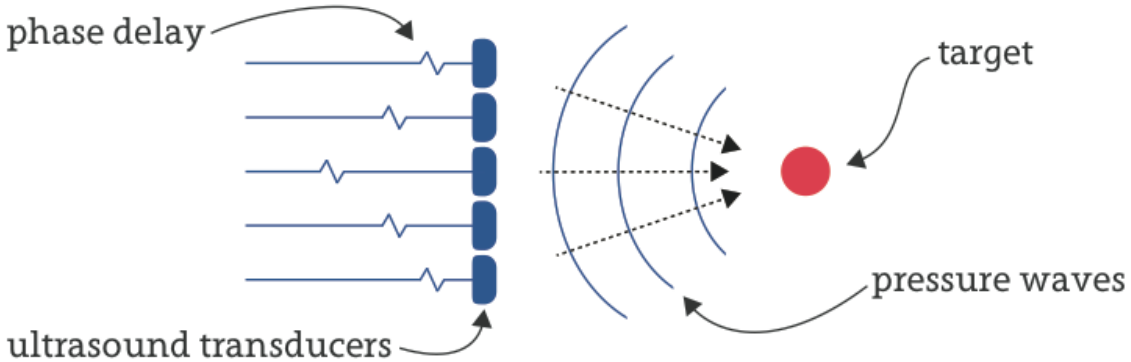
HOW IT WORKS



- Hand/fingers are tracked by sensor
- Transducer phased array sends waves of ultrasound to a localized focal point
- A pressure difference is created at the focal point, and exerts a force on user's fingers
- This tactile feedback is only felt at the exact focal point (neither above or below, etc.)
- Multiple focal points are possible (sequentially), creating impression of 3D objects on user's hand


LOCATION
TAINAN CITY
SETTING
SPEED NOW
40KM
6.0 MI
19°
19°
Video
Phone
Maps
Music
Settings
PUSH
AUTO
ON/
OFF
AUTO
77


JBL
PHNX.
LEFT

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ADVANCING IN-CAR HMI SYSTEMS

1. **Use people's spatial perception capabilities: create spatial interfaces**

2. **Use more than just eyes and ears: "load balance" our human senses**

3. **Sense people's non-verbal cues to understand what they really want: from explicit to implicit interaction**

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THANK YOU!