

3D-Print in Design: Hybrid Prototyping

blickfang| Stuttgart, March 11th 2023

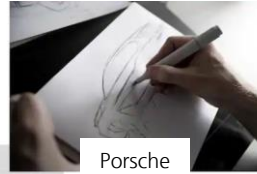
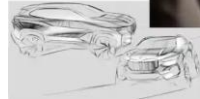
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Director Virtual Dimension Center (VDC)
Project Manager V/AR Application Center





Motivation

- long design processes
- many media changes, from digital to physical to virtual



Porsche



Audi



Audi



Porsche



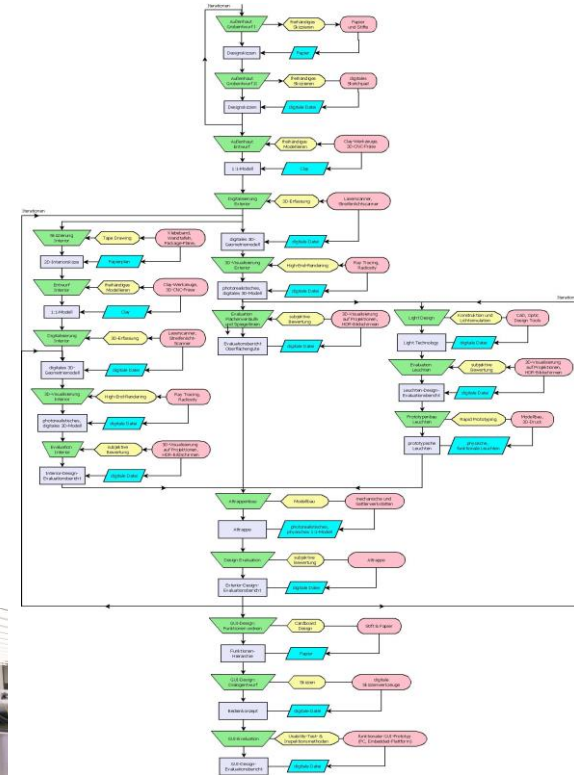
Audi



Porsche



Audi



Motivation

What about virtual design tools? The world is full of them!

No, the designers need something tangible...



Hersteller Lösung URL	Plattformen	Arbeitsweise	Export
Google Blocks https://arvr.google.com/blocks  Blocks	Oculus HTC Vive	3D-Modellierer	3D-Geometrie: .obj , .fbx , .glTF , .usdz , trianguliertes .obj
Google Tiltbrush https://www.tiltbrush.com  Tilt Brush	SteamVR Humble Store HTC Vive Oculus PlayStation	2D-Zeichner	3D-Geometrie: .fbx Snapshots (Foto, Video), 360°-Video
Gravity Sketch https://www.gravitysketch.com  gravity sketch	SteamVR Oculus Quest Oculus Rift HTC Vive Valve Index Varjo HP Reverb Windows Mixed Reality	3D-Modellierer	3D-Geometrie: .obj , .iges , .fbx , plus Rhino-Plugin
MasterpieceVR Masterpiece Studio https://www.masterpiecevr.com  MASTERPIECE	SteamVR Valve Index HTC Vive Oculus Rift Windows Mixed Reality	3D-Modellierer	3D-Geometrie: .obj , .fbx , .stl , .glTF
Oculus Medium https://www.oculus.com/medium/  medium	Oculus	3D-Modellierer	3D-Geometrie: .obj , .fbx Texturen: .tga , .png Polygonreduktion und Texturreduktion möglich



Combining physical and virtual

So what about combining a 3D printed sketch with a digital visualisation, thus bringing together physical haptics and computer graphics?



Volkswagen



augmented.org



3DS 3DXcite

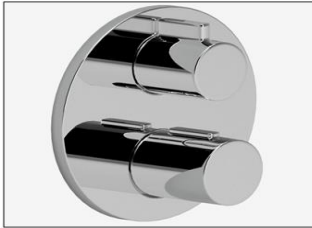
Combining physical and virtual



Volkswagen

Relevant use cases of our idea

reflections, gloss,
light effects



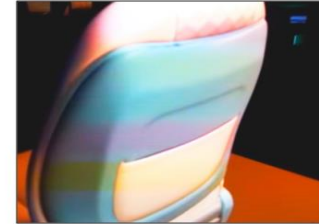
color and material
configurations



unrealized
mountings



emphasising characteristic
lines and contours



view through glass
onto inner structures



presentation of
dynamic content



interaction
with model



usability studies in a
geometric context



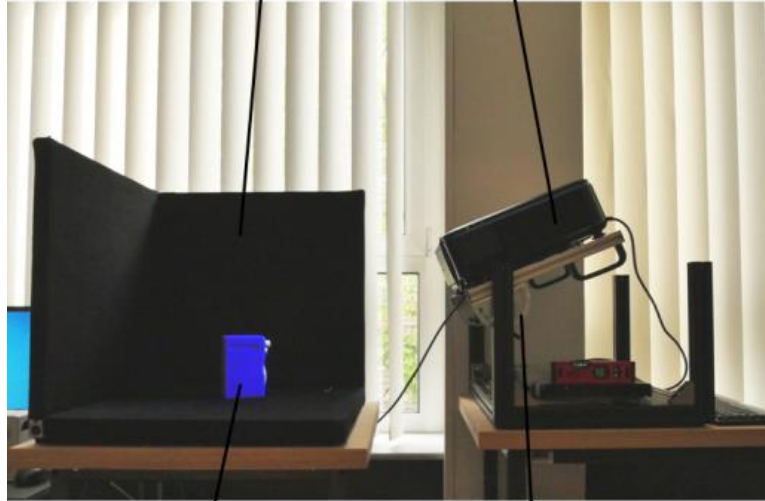
However some open questions

1. model preparation
2. light control (due to different directions of faces in relation to projector)
3. multi perspective rendering (virtual object behind surface when viewer is at different position as projector)
4. projection: one-channel vs. multi-channel
5. projection medium: what color is best?
6. stereovision: is it useful and when?
7. interaction: how to interact with the 3D print?

Setup

Präsentationsfläche mit
Bühnenmoltontuch

Projektor



3D-Druck

verstellbares
Projektionsgestell

Blick auf Prototypen



Setup

Präsentationsfläche mit
Bühnenmoltontuch

Projektor

Blick auf Prototypen & Überprüfung



3D-Druck

verstellbares
Projektionsgestell



Light Control

solution:
light compensation



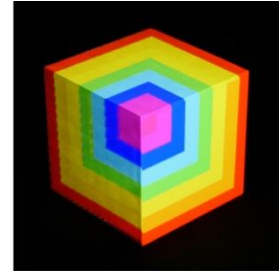
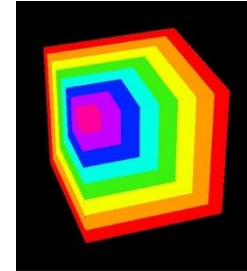
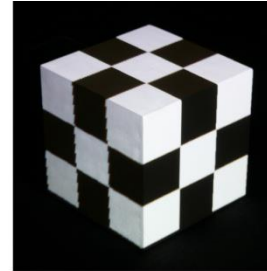
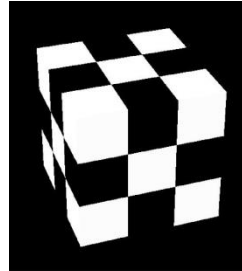
virtuelle Kamera

rendering
on screen

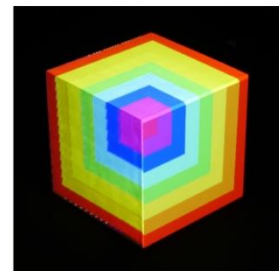
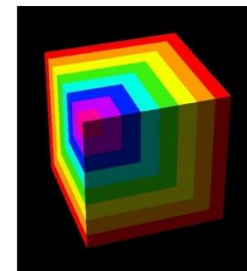
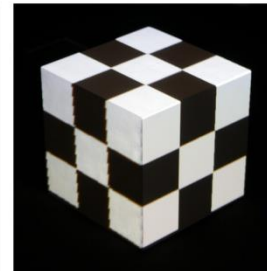
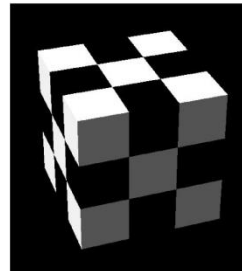
photography
of real object

rendering
on screen

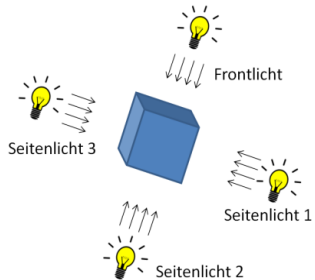
photography
of real object



no compensation

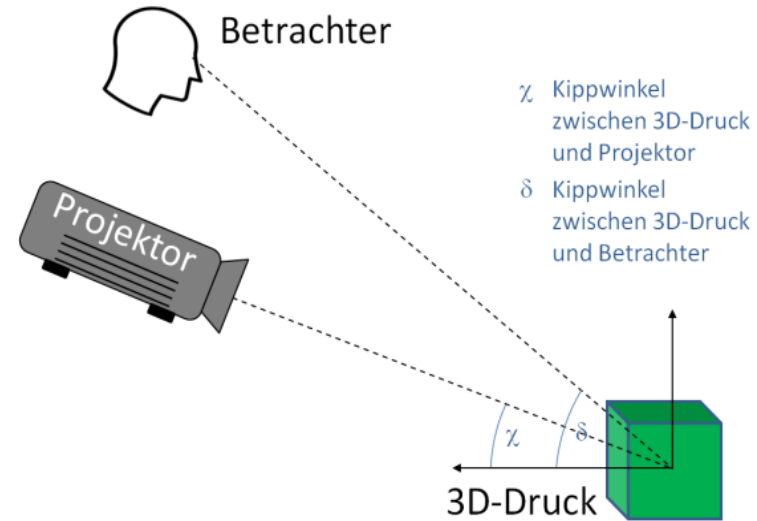
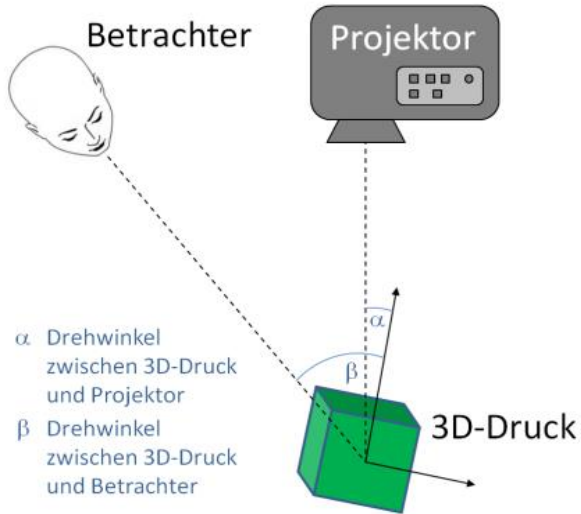


with compensation



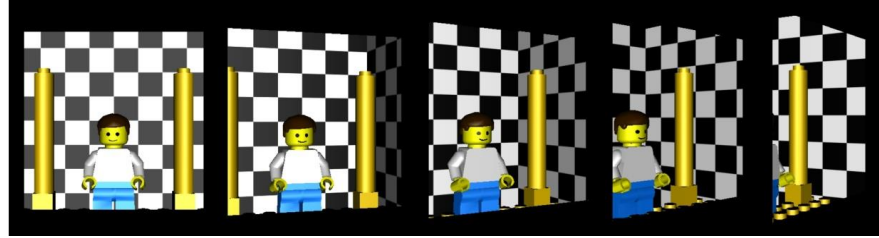
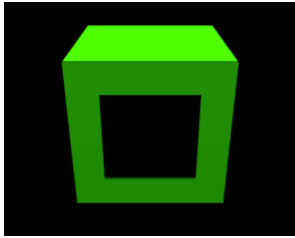
Multi perspectives

solution: decomposition of scenes



Multi perspectives

solution: decomposition of scenes



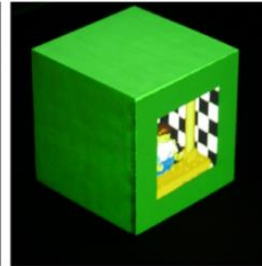
0°



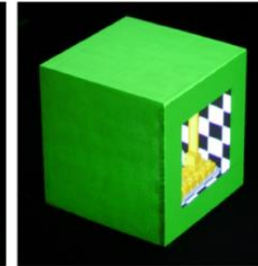
15°



30°



45°

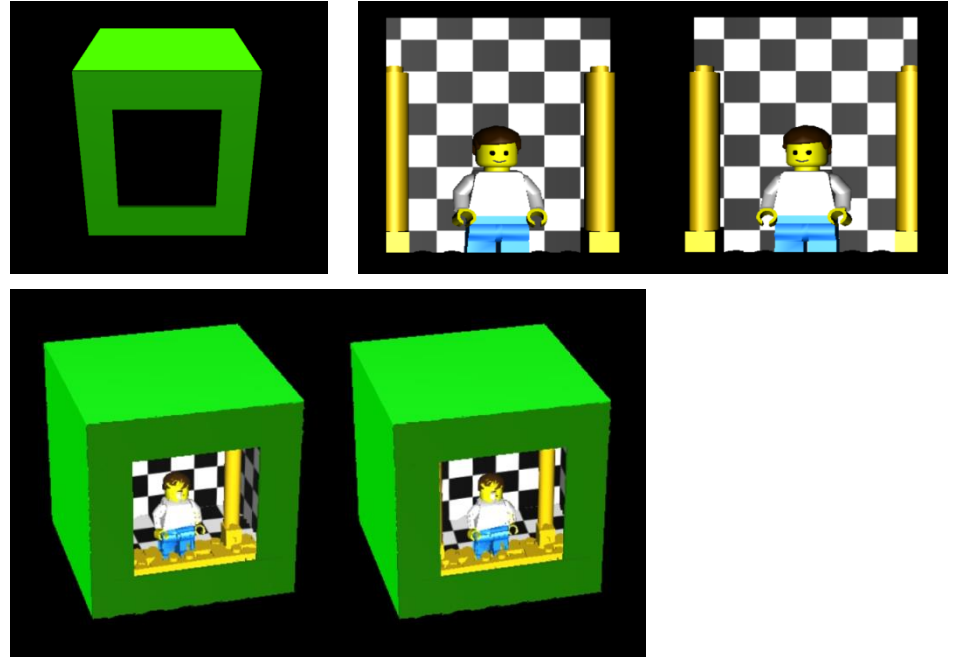


60°

Stereoscopics

Solution:

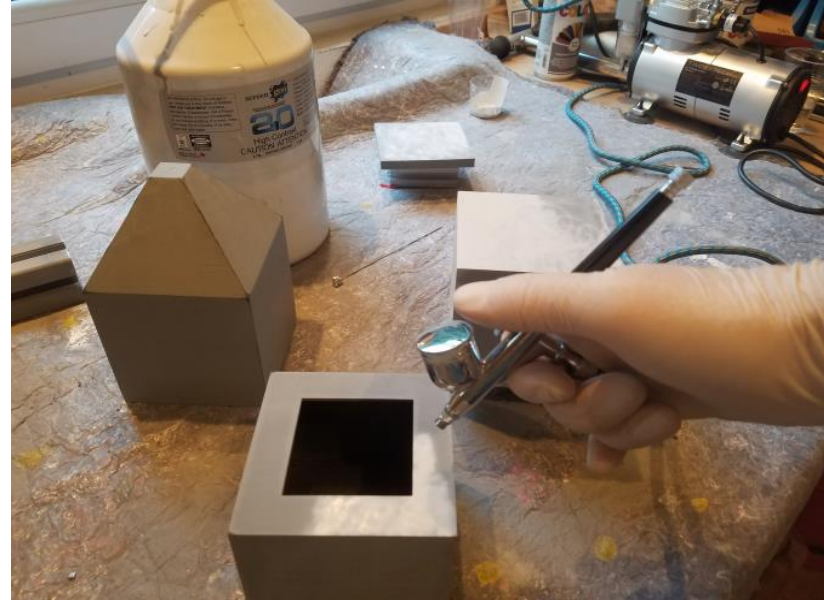
only useful for object behind
or in front of 3D print surface;
can be rendered only for the
separated scenes behind of in
front of surface



Projection medium

Solution:

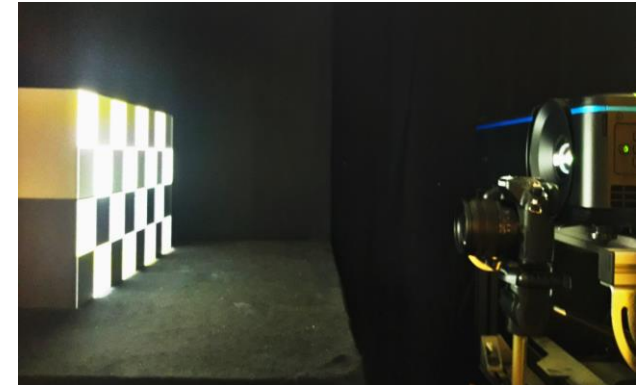
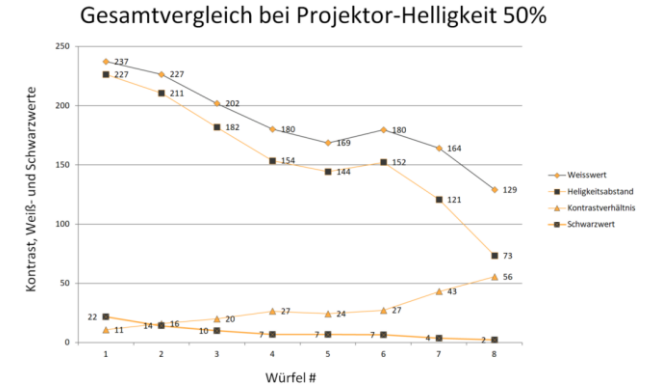
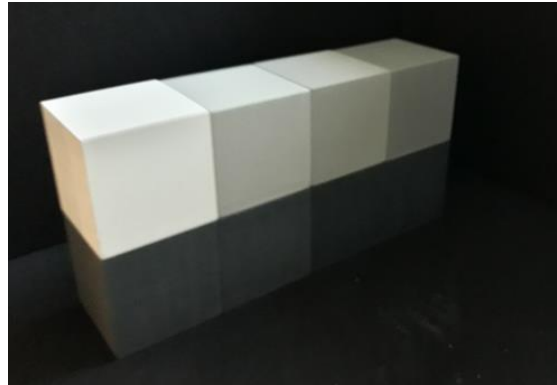
Coating tests with
professional screen
coatings, darkeners
and fluid medium



Projection medium

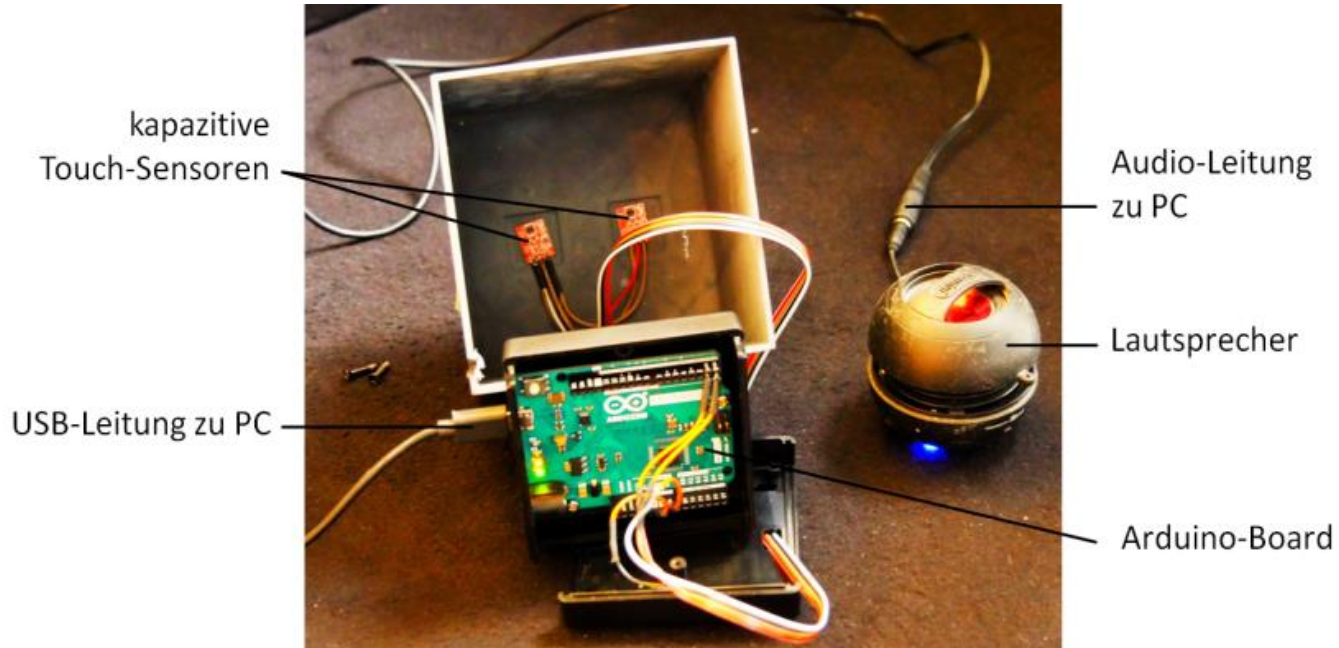
Solution:

Coating tests with
professional screen
coatings, darkeners
and fluid medium



Interaction

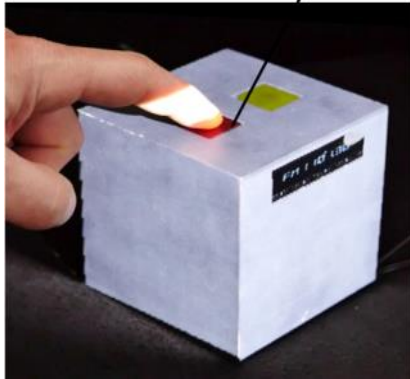
Solution:
capacitive touch
sensors



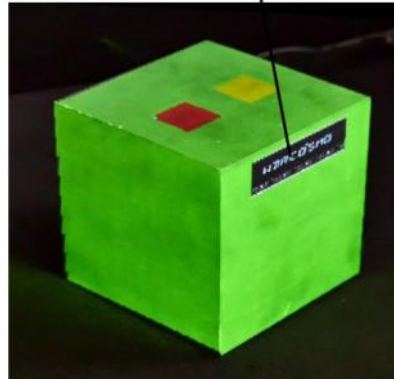
Interaction

Solution:
capacitive touch
sensors

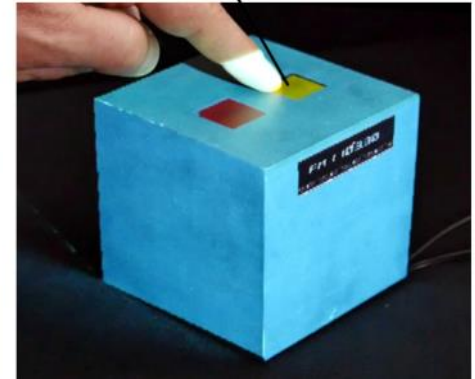
Farbwechsel über Button 1



Film als Textur für
dynamische Anzeigen auf
dem "virtuellen" Display

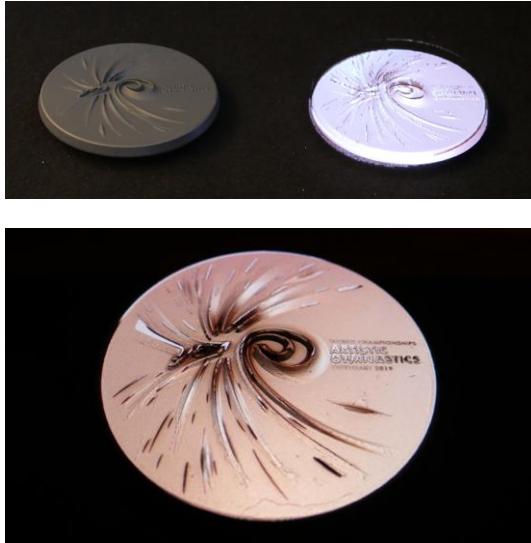


Rückkopplung der Benutzereingabe
akustisch (Lautsprecher in Box) und
visuell (Schalter wird sichtbar nach
unten gedrückt)



Evaluation

Athletics championship medal



Mercedes Avatar



BSH Washing Machine



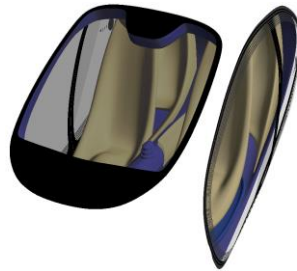
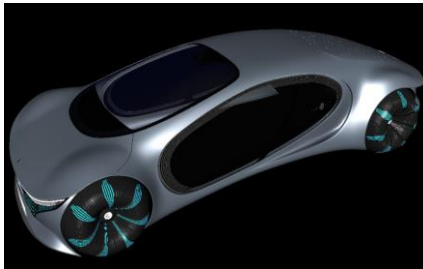
JGC Radio

Evaluation

Mercedes Avatar



3D Scene Decomposition:



BSH Washing Machine



3D Scene Decomposition:



Hybrid Design

projection-based augmented reality
in styling applications

Final Remarks

- process worked out
- many options for improvement, esp. projector
- scene decomposition and fusion was a manual laborous process: tools needed



Thank you for your attention!