Virtual Reality Applications to Transportation Design Education

Juan Antonio Islas Munoz
Head of Transportation Design, University of Cincinnati
JUAN ANTONIO ISLAS MUNOZ
Head of Transportation Design, University of Cincinnati

EDUCATION: Industrial designer from UASLP, Master of Design from DAAP

EXPERIENCE: 10 years of academic and industry experience
DRAWING TO CAD, TO PHYSICAL PROTOTYPING
WHAT IF ALL THIS TIME AND EFFORT WAS PUT INTO MAKING A DEEPER PROJECT?
INTRODUCTION

TRANSPORTATION DESIGN AT THE UNIVERSITY OF CINCINNATI

THE AUTOMOTIVE DESIGN PROCESS IN INDUSTRY AND ACADEMIA

VIRTUAL REALITY APPLICATIONS IN TRANSPORTATION DESIGN EDUCATION

USING VRED PROFESSIONAL FOR VIRTUAL REALITY VISUALIZATION

BENEFITS, LIMITATIONS, AND POTENTIAL
Transportation Design at the University of Cincinnati
TRANSPORTATION DESIGN AT THE UNIVERSITY OF CINCINNATI

Begins in 2000 as part of the Industrial Design program
INDUSTRIAL DESIGN – FIRST TWO YEARS OF SKILL BUILDING
INDUSTRIAL DESIGN – FIRST TWO YEARS OF SKILL BUILDING
INDUSTRIAL DESIGN – THREE YEARS OF SPECIALIZATION

Year 1
- Fall: DSGN 1000 Foundation Drawing 1
- Spring: INDL 1001 Design Visualization 1
- Summer: 3 Credit Hours

Year 2
- Fall: INDL 1001 Design Visualization 1
- Spring: INDL 2000 Design Visualization 2
- Summer: 3 Credit Hours

Year 3
- Fall: INDL 2001 Design Visualization 3
- Spring: INDL 3022 Transportation Design Studio 1
- Summer: 3 Credit Hours

Year 4
- Fall: INDL 3053 Transportation Design Studio 2
- Spring: INDL 4054 Transportation Design Studio 3
- Summer: 3 Credit Hours

Year 5
- Fall: INDL 4055 Transportation Design Studio 4
- Spring: INDL 4056 Transportation Design Studio 5
- Summer: 3 Credit Hours

Transportation Design
Product Design
EXPERIENTIAL LEARNING – INTERNSHIP WORK

AERODYNAMICALLY CONSIDERED

A large vehicle must take advantage of opportunities for efficiency. An aerodynamic shape prevents turbulence.

Joe Boniface, Internship 2016
EXPERIENTIAL LEARNING – INTERNSHIP WORK

Raleigh Haire, Internship 2016
FLOOR APERTURES
The floor of the car is raised from the base of the vehicle to allow for space for the seats to sit. The seats are inspired by a Japanese fan and they articulate open to allow for the seats to emerge from the floor and present themselves.
ON THE SHOULDERS OF GIANTS, WHILE IT LASTED

2013 – One of two transportation design professors became director
2013 – One of two transportation design professors became director

2016 – The remaining professor chooses another career path.
ON THE SHOULDERS OF GIANTS

2013 – One of two transportation design professors became director

2016 – The remaining professor chooses another career path.

A non-automotive designer is selected to run the program.
THE CHALLENGE

Recover the credibility of the program in the eyes of industry.
WE LOOKED OUT TO OUR PARTNERS
THE CHALLENGE

Identify the trends that will define the industry in the future.
Virtual reality was one of the coming trends, and it allowed us to be a step ahead and focus on what the industry will need in the coming years, rather than chase after what they need today.
The vehicle design process in industry and academia
THE DESIGN PROCESS IN INDUSTRY

Design brief generation

• Identifying and understanding needs

• Early specification from series of strategic meetings between design, marketing and engineering.

• **Considerations**: vehicle type, powertrain, materials, customer audience, production considerations, final vehicle price, and functional objectives.
Generation of product architecture (package)

- Product architecture that includes the layout of the vehicle’s components and occupants.

- **Considerations**: driver’s height and posture, rear occupants, power train type and location, occupants’ lateral location, cargo space, wheel location, track, body interior trim section.
THE DESIGN PROCESS IN INDUSTRY

Generation of product architecture (package)

By Jorge Rodriguez
IDEATION AND SELECTION – AESTHETIC CONCEPTING

FOR

THE ADVENTURING PROFESSIONAL

DRIVEN
Attire for quality and authenticity. A new generation creating for themselves.

HONEST
Corporate culture gives way to lifestyle-focused security. Professionals drive for high-level craft and exploration.

ADAPTABLE
Nature inserted itself into everyday life. Climbing mountains and solving problems can now happen in tandem.

UTILIZING

STRUCTURED BRUTALITY

By Joe Boniface
IDEATION AND SELECTION – 2D EXPLORATION

By Joe Boniface
IDEATION AND SELECTION – 2D EXPLORATION

By Joe Boniface
IDEATION AND SELECTION – 2D EXPLORATION

By Joe Boniface
IDEATION AND SELECTION – 2D EXPLORATION

By Joe Boniface
IDEATION AND SELECTION – 2D EXPLORATION

ALTERNATIVE STRENGTH

Clamping structures give a sense of power and strength in absence of a traditional grille.

FINAL DESIGN

By Joe Boniface
IDEATION AND SELECTION – 2D EXPLORATION

By Joe Boniface
REFINEMENT – SCALE MODEL

While working with a fellow design intern, a 1/5 scale representation of the vehicle was developed based on renderings. Over the course of two weeks we refined and detailed the forms to best utilize the given package and aesthetic theme.
REFINEMENT – FULL SIZE MODEL
VIRTUAL REALITY – REVIEW BEFORE PROTOTYPING
PROTOTYPING

Industry

FRONT END
- design brief generation
- product architecture

IDEATION AND SELECTION
- aesthetic concepting
- 2D sketch exploration

REFINEMENT
- CAD modeling
- Physical scale modeling
- Physical full scale modeling
- VR visualization

PROTOTYPE
PROTOTYPING

Industry

FRONT END
- design brief generation
- product architecture

IDEATION AND SELECTION
- aesthetic concepting
- 2D sketch exploration

REFINEMENT
- CAD modeling
- Physical scale modeling
- Physical full scale modeling
- VR visualization

PROTOTYPE

Academia – with brief

FRONT END
- design brief generation
- product architecture

IDEATION AND SELECTION
- aesthetic concepting
- 2D sketch exploration

REFINEMENT
- CAD modeling
- Physical scale modeling
- Physical full scale modeling
- VR visualization

PROTOTYPE

15 weeks
PROTOTYPING

Industry

FRONT END
- design brief generation
- product architecture

IDEATION AND SELECTION
- aesthetic concepting
- 2D sketch exploration

REFINEMENT
- CAD modeling
- Physical scale modeling
- Physical full scale modeling
- VR visualization

PROTOTYPE

Academia – no brief

FRONT END
- design brief generation
- product architecture

IDEATION AND SELECTION
- aesthetic concepting
- 2D sketch exploration

REFINEMENT
- CAD modeling
- Physical scale modeling
- Physical full scale modeling
- VR visualization

PROTOTYPE

15 weeks
MODELS | QUALITY = TIME + MONEY

By Joe Boniface
Virtual Reality Applications in Transportation Design Education
OUR VR TOOLS: HTC VIVE AND A BIG OPEN SPACE

https://www.vive.com/media/filer_public/b1/5f/b15f1847-5e1a-4b35-8afe-dca0aa08f35a/vive-pdp-ce-ksp-family-2.png
OUR VR TOOLS: COMPUTER

The more powerful the better:

- Corsair Obsidian 750D Airflow Edition Full Tower
- ASUS X99-E LGA 2011-v3 ATX Intel Motherboard
- Intel Core i7-6800K 3.4GHz LGA 2011-3 Boxed Processor
- EVGA 16GB 2 x 8GB DDR4-3200 PC4-25600 CL16 RAM memory
- EVGA GeForce GTX 1080 Classified 8GB GDDR5X Gaming graphic card
- EVGA SuperNOVA 850 Watt ATX Power Supply
- Intel 600p 512GB NVMe M.2 Internal SSD
OUR VR TOOLS: SOFTWARE

Tilt Brush
by Google

gravity sketch

AUTODESK® VRED®
FRONT END: DEFINING PRODUCT ARCHITECTURE (PACKAGING)

By Jorge Rodriguez
FRONT END: DEFINING PRODUCT ARCHITECTURE (PACKAGING)

grid sketch
FRONT END: DEFINING PRODUCT ARCHITECTURE (PACKAGING)
EXPLORATION: 2D AND 3D TANDEM
EXPLORATION: 2D AND 3D TANDEM
EXPLORATION: 2D AND 3D TANDEM

By Kyle Greathouse
EXPLORATION: 2D AND 3D TANDEM
CAD DEVELOPMENT
CAD DEVELOPMENT
VALIDATION AND REFINEMENT
VALIDATION AND REFINEMENT

Cameron Bresn critiques Raleigh Haire's project
CRITIQUE

Tim Anness and Paul Hoste from FCA Design critique DAAP students
PHYSICAL MODEL STILL NECESSARY

By Cameron Bresn
IMPACT IN OUR COURSEWORK

**Industry**
- FRONT END
  - design brief generation
  - product architecture
- IDEATION AND SELECTION
  - aesthetic concepting
  - 2D sketch exploration
- REFINEMENT
  - CAD modeling
  - Physical scale modeling
  - Physical full scale modeling
  - VR visualization
- PROTOTYPE

**Academia – with brief**
- FRONT END
  - design brief generation
  - product architecture
- IDEATION AND SELECTION
  - aesthetic concepting
  - 2D sketch exploration
- REFINEMENT
  - CAD modeling
  - Physical scale modeling
  - Physical full scale modeling
  - VR visualization
- PROTOTYPE

15 weeks
IMPACT IN OUR COURSEWORK

**Industry**
- **FRONT END**
  - design brief generation
  - product architecture

- **IDEATION AND SELECTION**
  - aesthetic concepting
  - 2D sketch exploration

- **REFINEMENT**
  - CAD modeling
  - Physical scale modeling
  - Physical full scale modeling
  - VR visualization

- **PROTOTYPE**

**Academia with VR – with brief**
- **FRONT END**
  - design brief generation
  - product architecture

- **IDEATION AND SELECTION**
  - aesthetic concepting
  - 2D-3DVR sketch exploration

- **REFINEMENT**
  - CAD modeling
  - Virtual scale and full size evaluation
  - Physical scale modeling

- **PROTOTYPE**

15 weeks
IMPACT IN OUR COURSEWORK

**Industry**
- **FRONT END**
  - design brief generation
  - product architecture
- **IDEATION AND SELECTION**
  - aesthetic concepting
  - 2D sketch exploration
- **REFINEMENT**
  - CAD modeling
  - Physical scale modeling
  - Physical full scale modeling
  - VR visualization
- **prototype**

**Academia with VR – no brief**
- **FRONT END**
  - design brief generation
  - product architecture
- **IDEATION AND SELECTION**
  - aesthetic concepting
  - 2D sketch exploration
- **REFINEMENT**
  - CAD modeling
  - Physical scale modeling
  - Physical full scale modeling
  - VR visualization
- **prototype**

15 weeks
IMPACT IN OUR COURSEWORK

Industry

- FRONT END
  - design brief generation
  - product architecture

- IDEATION AND SELECTION
  - aesthetic concepting
  - 2D sketch exploration

- REFINEMENT
  - CAD modeling
  - Physical scale modeling
  - Physical full scale modeling
  - VR visualization

Academia with VR – No brief

- FRONT END
  - design brief generation
  - product architecture

- IDEATION AND SELECTION
  - aesthetic concepting
  - 2D-3DVR sketch exploration

- REFINEMENT
  - CAD modeling
  - Virtual scale and full size evaluation

- Physical scale model evaluation
- Full scale physical model

15 weeks
IMPACT IN OUR COURSEWORK

FRONT END

IDEATION

REFINEMENT

physical modeling
IMPACT IN OUR COURSEWORK

More in-depth exploration, refinement, or the expansion of the design scope (more solid front end, animation, virtual reality experience, more detailed CAD, etc.)
Using Autodesk VRed for Virtual Reality visualization
VRED PROFESSIONAL 2017 VS 2018
VRED 2017 VS 2018
VRED 2017 VS 2018
VRED 2017 VS 2018
Conclusions
CURRENT BENEFITS

Enhancement of student projects:

- Iterative generation and visualization of design proposals at any scale.
- Output enhancement for students who are proficient at 2D sketching.
- Result enhancement for students who are not proficient at 2D sketching.
- Acceleration of CAD modeling process.
LIMITATIONS

Viewing experience limited to one person.

AR headsets are already exploring collaboration.

Autodesk VRed has shown demos that indicate this is in the Works.

https://www.youtube.com/watch?v=y3tvbUkZ8fI
LIMITATIONS

No haptic feedback.

Axon VR – haptic gloves
Extreme Tech – haptic body suit
Tesla Suit – haptic body suit
Hardlight VR – haptic body suit

ETC
THE REVOLUTION IN OUR PROGRAM
We needed to identify upcoming trends and be one step ahead.
Transportation design – from vehicle design
To human mobility
AUTOMOTIVE DESIGN

- automobile
- auto-centric viewpoint
- competitive
- individual
- industry culture
- artistic and conceptual approach
- skill-based single-discipline
- modeling
- viscom
- aesthetics
- trend research
POTENTIAL BEYOND DESIGN

TRANSPORTATION DESIGN

- automobile and land
- water
- air
- vehicle-centric viewpoint
- competitive
- individual driven collaboration
- industry culture
- skill-based single-discipline
- modeling
- viscom
- aesthetics
- artistic and conceptual approach
- user-centered design
- trend research
The need to innovate – beyond transportation design, within human mobility
The need to innovate – beyond transportation design, within human mobility

Designing the future of the MOBILITY EXPERIENCE
RESEARCH-INFORMED | SYSTEMIC | MODEL FOR INDUSTRY
problems & solutions | collaboration & multi-discipline | experiment
VEHICLES | PEOPLE/THINGS | INFRASTRUCTURE
interior/exterior | UX-UI | behavior | devices | software & hardware

TRANSITION
Project prompt:
How can passengers on shared vehicles feel special, like they would in their own vehicles?

What can the offerings of an automaker be in the mobility marketplace of the future?

Industrial Design + Communication Design
Project prompt:
How can we communicate with a vehicle that is not controlled by a human? How can it communicate with us? What do we need to make that happen?

The language of autonomous vehicles

Industrial design + psychology + industry
THE CHALLENGE

To make this transition we need to innovate and:

• Be at the forefront of technology.
• Generate new workflows.
• Become more efficient to fit more complexity in the same time span.

VIRTUAL REALITY GREATLY ENABLED THIS.
THANK YOU!

HOW CAN WE COLLABORATE?