AR & VR in design for manufacture
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DR E. UNVER, DR O. HUERTA, M. DAWOOD

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- Research Outputs, and Websites, Animations
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PARTNERS

- University of Huddersfield (Academic)
  - [https://www.hud.ac.uk/](https://www.hud.ac.uk/)

- Bulgarian Partner (Academic)
  - [https://tu-sofia.bg/](https://tu-sofia.bg/)

- Turkish Partner (Academic)
  - [http://www.uludag.edu.tr/](http://www.uludag.edu.tr/)

- Turkish Partner (Commercial)
WHAT ARE TECHNICAL DRAWINGS (GA, DETAIL, BOM, BS-8888)

Assembly Instructions. (Example)
Place gear turn into hole
Place bearing 2 in hole above
Place bearing 1 in other hole
Place shaft in place
Use nuts and bolts to secure in place
Place Shive tube in place
Use nut to keep in place
Place other drive tube into place and secure with nuts
Insert spring inside housing and place housing over drive tube
Place smaller spring (item 6) onto nut and install with the gear holder
Place gear paddle into place and secure down
Place item 4 into position and secure with nuts and

Attach steering wheel to the backplate using the nuts and bolts (item 3)
PROJECT BACKGROUND

- **Project title:** Enhancing Technical Drawing Skills in Design & Engineering Education Using AR and VR Tools

- **Problem Statement:** There are concerns from higher education (HE) institutions and industry about the decline in standards of technical drawings (TD) (BS-8888) due to the lack of understanding of basic geometric construction and the conventions of drafting skills that underpin the best practices.

- **Aim:** Using a multi-disciplinary design-based research methodology, this European funded research project combines pedagogy and technology to approach TDs education problems; and to develop an AR/VR education solution to address learning difficulties.

- **Funding:** €156k (Co Funded by the Erasmus+ Programme of the European Union)

- **Duration:** 2 Years

- **Outputs:**
  - Animations / Simulations
  - VR app development for HTC Vive
  - AR / VR Development for Android Mobile platform
As well as comprehensive literature review, we carried out a “Needs Analysis*” where 25 Likert-type scale (five-point) and 5 open-ended questions were asked in a survey with 320 people in different education and sectoral positions in three different countries. In this survey, 252 people from Turkey, 58 people from Bulgaria and 10 people from the UK participated.

*Needs analysis is an element of designing or reviewing a curriculum. Its purpose is to establish key learning outcomes and requirements in the design and delivery of a course or learning activity.
RESEARCH: NEEDS ANALYSIS

As an example, “Analysis of the perception of Technical Drawings questions” showed that:

1. 76% of the participants believe they have "efficient Technical Drawing knowledge and skills required by their profession"

2. 70% find themselves confident for "using a common language in technical drawings and awareness of standards such as BS, ASME, ISO, DIN".

3. 73% said they have good skill in “Practical TD to support their theoretical technique knowledge”.

4. 88% of participants think that it is vital “to have technical drawing reading skills for technical staff“

5. 84% of participants are aware of the importance of TD perception due to “technical drawing reading mistakes which cause discarded or low quality products"
TOOLS

- **Software:**
  - SOLIDWORKS and 3DS Max (3D Modelling and Animation)
  - Photoshop, Illustrator and InDesign (Storyboarding and Editing)
  - Unity and Programming (C#) (VR/AR Applications)
  - Adobe Premiere and After Effects (Video and Sound Editing)
  - Keyshot (Rendering of Animations)

- **Hardware:**
  - HTC Vive
  - Android 7.0+ Smartphone
  - Samsung Gear VR

- **Work:**
  - Huddersfield – Design, Ideation, Storyboarding, Digital Modelling, Animation, Technical Drawings
  - Bulgaria – Car in production by Bulgaria, VR Development in Technical Content
  - Bizpark – Web Development, AR Application
  - Uludag – Engineering Knowledge, Technical Requirements
Vehicle being produced by Bulgaria for Formula student race team used as the centrepiece of the project to show real world applications.
METHODS:
DESIGN THINKING / DESIGN COUNCIL DOUBLE DIAMOND

PROJECT KICKOFF

DRAFT VISION CONCEPT

Towards full product development

DESIGN PROCESS

DISCOVER
Research
Diverging
Primary research
Rip the brief
Don't know
Could be

DEFINE
Synthesis
Converging
Ideas

DEVELOP
Ideation
Build, test, iterate
Implementation

DELIVER
Evaluation
Build, test, iterate
Out

Original Brief, Question, Challenge
Unstructured research findings
Final Brief, How Might We... (HMW) Questions
Ideas
Answer, Product, Solution
STORYBOARDING AND IDEATION

- Six Storyboards developed for AR and VR
ANIMATION PROCESS

- [https://www.youtube.com/watch?v=OwzmQS4yubl&list=PLRzfaYGqHLCrGfX7M-CtC-MIPGCWgN-3r&index=3](https://www.youtube.com/watch?v=OwzmQS4yubl&list=PLRzfaYGqHLCrGfX7M-CtC-MIPGCWgN-3r&index=3)

- SOLIDWORKS Car Model (Model assets if needed)
- SOLIDWORKS Drawing of part needed in Animation
- Key frame Animation in 3DS Max
- Export from 3DS Max to Keyshot to Render
- Import frames into Adobe Premiere
- Edit any frames in Photoshop to add information
- Add Sound and Information to animation
- Export
- Feedback
- Improve
Gamification exploration done in Unity to understand the impact on T&L

(Credit: Navid Azhar – Digital 3D Designer)
**AR DEVELOPMENT**

- **Car in AR** – Virtual car in a real environment with the use of a phone camera

- AR application produced by Bizpark
VR DEVELOPMENT

- VR Development done by Bulgaria for use with the HTC Vive (Unity and C# Programming)  See: https://www.youtube.com/watch?v=tJn91VWsfaw
- Choose a module.
- Watch animations and see course content

- Download application for your android 7.0+ phone to test
CURRENT RESEARCH OUTPUTS

- Conference Paper (Planned) An international conference connecting people in CAD research, education and business CAD’19, June 24-26, 2019, Singapore
- Journal Papers (Planned) Journal of Mechanical Engineering Research in Turkey
BEST PRACTICES

Communication and Data sharing:

- Facebook (Closed Group)
- WhatsApp, Skype and Facebook Messenger for conference calls (Weekly or Bi-Weekly)
- Google Drive (Data sharing for Non-confidential Data)
- Visit to partners (2 x Turkey, 1 x Bulgaria and 2 x UK for all Partners paid by EU)
- YouTube (Video based progress report)

Difficulty with international partnership

- Language, methods, management, deadlines, workload
- Access to the tools, hardware and skillset available

Final Conclusion

- Project is ongoing. The tools developed have not been used for T&L. This will be done in the evaluation phase which will be in the next 6 months.
QUESTIONNAIRE

https://www.menti.com/

Code: 79 16 0

1. Grab your phone
2. Go to www.menti.com
3. Enter the code 79 16 0 and vote!
QUESTIONNAIRE

- Generic Questions (2)
  - Question 1: Which improvements would you recommend for this project? (Max 5 words)
  - Question 2: Are you interested in collaborating in a similar subject area which uses AR/VR and Animations? If so, which project ideas (Max 5 works)

- Quiz Questions (5)
  - Question 1: Which platform/technology do you think this application should be developed further (Android, Apple, Windows, Others)
  - Question 2: Have you used AR/VR applications for teaching and learning? (Yes, No, Briefly, Not Interested)
  - Question 3: To what extent do you agree with the following statement: Computer generated animations gives user a better understanding of the subject (Yes, No, Maybe, Not Interested)
  - Question 4: Which part of this project interests you more? (AR, VR, Animations, All, None)
  - Question 5: Which of the following communication have you used more for research and collaboration purposes? (Facebook, WhatsApp/Skype/Messenger, Personal visits, others)
THANK YOU

Contact us: info@vrindesign.org
QUESTIONNAIRE ANSWERS
Go to www.menti.com and use the code 79 16 0

1. Grab your phone
2. Go to www.menti.com
3. Enter the code 79 16 0 and vote!
Which improvements would you recommend for this project? (Max 5 Words)

- It would be good to have an evaluation of the implementation of the tools - did they effective helped learning and how?
- Drawing/modelling techniques
- Softwares: Nuke
- Vr/ar collaboration
- bring devices to presentation
- Colaborativo teching
- Healthcare
Are you interested in collaborating in a similar subject area which uses AR/VR and Animation? If so, which project ideas? (Max 5 Words)

- Yes. Construction details
- Yes - looking at other design areas
- In architecture
- Wellbeing
- Mix reality
- healthcare design
- Pass
- Construction críticas processes
- On site visualization
- Social housing
Which platform do you think should be used for the further development of this application?
Have you used AR/VR applications for teaching and learning?

- Yes: 4
- No: 5
- Briefly: 2
- Not Interested: 1
To what extent do you agree with the following statement: Computer generated animations give users a better understanding of the subject.

- Yes: 9
- No: 2
- Maybe: 2
- Not Interested: 1
Which part of the project interests you more?

- AR: 1
- VR: 2
- Animations: 5
- All: 4
- None: 4
Which of the following communication platforms have you used more for research and collaboration purposes?

- Facebook: 1
- Facebook Messenger: 4
- WhatsApp: 3
- Skype: 3
- Personal Visits: 3
- Others: 3

Show the winner