08
2022

MADE SMARTER
INNOVATION

USE CASE

Pashley
SINCE 1926

ALECS
Articulated Lightweight Electrically-assisted Cargo Solution

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INTRODUCTION

Pashley Cycles is one of very few companies still manufacturing bicycles for commercial and consumer markets here, in the UK (in Stratford-upon-Avon, to be precise).

Pashley is a traditional engineering company. It designs in 3D CAD, but is typically quick to fabricate physical prototypes when developing new models. A key limitation of this approach is that it is harder to realise (and therefore visualise) the changes - which happen frequently at early stages of development - due to the availability of representative parts.

In the case of this tilting e-assisted cargo trike, not only was there the commercial pressure of bringing the product to market quickly, but also the need to put the concept in front of potential customers for early feedback. Furthermore, the design consortium included two additional organisations – Simpact Engineering, responsible for developing the tilting mechanism, and Foresight Innovation, responsible for manufacturing the cargo box, so good communication around an up-to-date design was critical.

With the help of WMG at the University of Warwick, Pashley took its first steps into the world of immersive visual models and virtual reality.

In order to make "virtual" a "reality" for Pashley, WMG used Autodesk VRed software to take Pashley's CAD data and create realistic and functional models, which could then be reviewed and utilised in a variety of formats. For example, for high level, commercial discussions and reviews (both internal and external), highly realistic visuals were created using panoramic HDRIs and backplates, and raytracing, and for more functional, engineering reviews, OpenGL was used for rendering whilst interactions were scripted in python for use in either desktop mode or through virtual reality headsets and hand controllers.

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THE WORLD OF IMMERSIVE VISUAL MODELS AND VIRTUAL REALITY.

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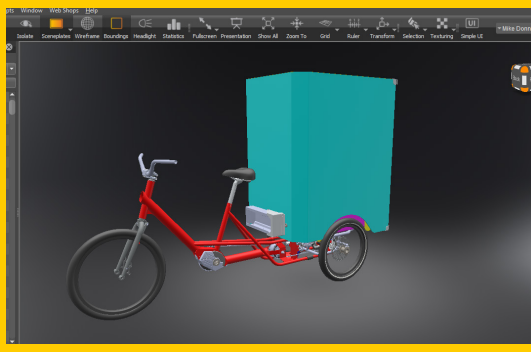

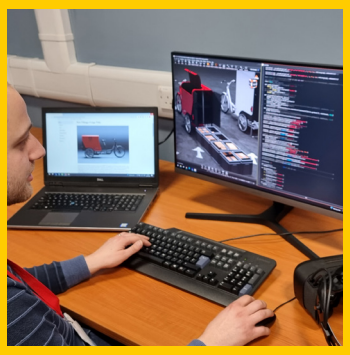

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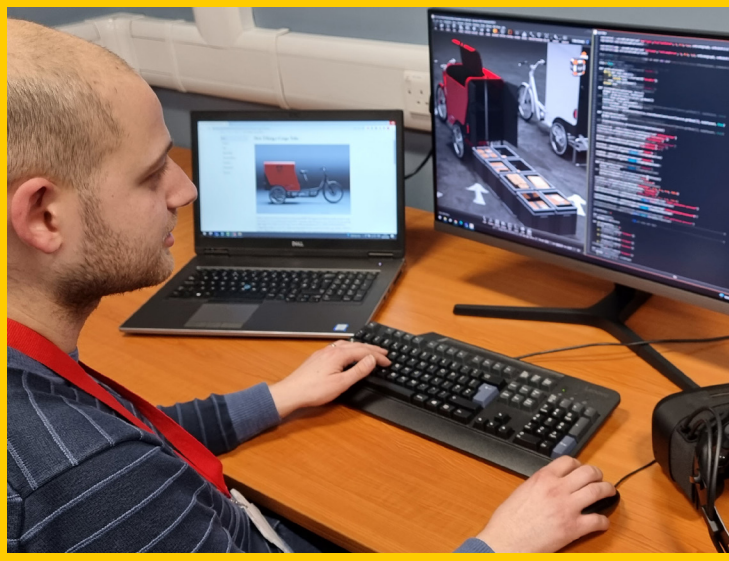
THE CHALLENGE

In the rapidly evolving and growing last-mile delivery sector, the need to get new products to market quickly is critical.

Pashley recognised this when they made the strategic decision to develop a new and novel concept for a tilting, e-assist cargo trike. This would be a high-risk and high-cost development project for Pashley, and from the outset, they wanted to break the mould and move away from the traditional, slow and inflexible approach of concept sketch to physical prototype and evolution. Pashley wanted to exploit the possibilities of digital development tools, and the speed and agility they could bring in terms of fast and efficient product development, but didn't have the internal skills to hit the ground running.



Scripting the VR Interactions

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THE SOLUTION

Pashley and the project consortium approached WMG to tap into their experience in digital design representation and immersive technologies.

More specifically, Pashley wanted a realistic representation of their design concept, and the ability to interact with, and quickly iterate the design. WMG and Pashley discussed what approaches, technologies and outputs would deliver the most value for the business, and for the development of the proposed new product. The solution agreed upon and developed, utilised design visualisation software to rapidly visualise early 3D data, applying materials and textures to represent the design intent, with the ability then to tailor the output format to suit a range of applications, from internal design review to commercial customer engagement. The output therefore ranged from immersive and interactive models viewed through VR headsets to static photo-realistic renders.

HDRI Lighting Full Render

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THE TECHNICAL STUFF

The solution developed by WMG used Autodesk VRed software, largely because it enables a quick progression from CAD to a realistic model/review experience.

Coupled with the addition of a materials library (Adobe Substance) and the ability to script functions and interactions in Python, VRed gives a broad range of potential outputs with a fast and efficient workflow (very useful for incorporating and viewing design iterations in a fast-moving, design environment.

Hardware used included a relatively powerful workstation (we had 128Gb of RAM and 12 processor cores) with an Nvidia Quadro RTX8000 graphics card, but for the majority of the work, this spec. was unnecessary and most of the development work was done on a £4k Dell laptop. A good graphics card is important, however, for achieving a high frame rate for the VR experience, and will significantly impact the time taken to ray trace still renders (we're currently trialling Nvidia gaming cards as an alternative to Quadros as they should provide high performance at a fraction of the cost).

High Render Final Models

Render model placed in real world lighting.

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THE IMPACT

Whilst the use of design review or game engine software to present and interact with design data is not a new concept, its application within an SME with what was previously a very traditional approach to new product development, led to significant advantages on this project.

Product development was in fact a collaborative effort, with Pashley leading and Simpact (an engineering consultancy) and Foresight Innovation (sustainable materials for cargo applications) also contributing to the design and engineering. Design communication was therefore critical in the decision-making process, so taking this into a digital world (particularly during the pandemic, when face-to-face interaction was difficult, and at times impossible) really enabled the consortium to iterate and evolve the design rapidly. Furthermore, the quality of the digital solutions and experience developed meant that there were no unpleasant surprises when the design moved into the prototype stage, and the novel design and forward-thinking approach employed was rewarded with the Nick Carpenter Innovation Award, from the Niche Vehicle Network.

Final Product

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THE PROCESS

01 IMPORT DATA

02 ORGANISE AND OPTIMISE

03 FIX "NORMALS"

04 MATERIALS AND TEXTURES

05 LIGHTING

06 RENDER / VR

07 RENDER

08 VR

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01 The first step is to get the data into VRed. Many proprietary CAD formats are accepted.

02 Assess the incoming feature tree and group/optimise where appropriate.

03 Check the normals of the imported surfaces and flip if necessary to ensure the software see them all the right way up.

04 Add materials and textures to the model, from VRed's own library (limited), or an external library.

05 Add lighting to the scene using directional, spot or planar lights.

06 At this point, we need to decide what the purpose of the model will be – do we want to create highly realistic looking static renders or do we want a dynamic model we can interact with in VR.

07 For raytraced rendering, we're not particularly concerned about the "weight" of the scene, so can continue to add to/tinker with materials and lighting etc.

08 For an interactive VR model, we need to be much more careful regarding the complexity of the scene – We need to interact with the data in real-time, so need a good frame rate, which needs computing power.

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WMG THE UNIVERSITY OF WARWICK