

Chapter XV

A Virtual Environment to Support the Distributed Design of Large Made-to-Order Products

Robert Ian Whitfield

CAD Centre, University of Strathclyde, UK

Alex H.B. Duffy

CAD Centre, University of Strathclyde, UK

Alastair Conway

CAD Centre, University of Strathclyde, UK

Zhichao Wu

CAD Centre, University of Strathclyde, UK

Joanne Meehan

CAD Centre, University of Strathclyde, UK

ABSTRACT

An overview of a virtual design environment (virtual platform) developed as part of the European Commission funded VRShips-ROPAX (VRS) project is presented. The main objectives for the development of the virtual platform are described, followed by the discussion of the techniques chosen to address the objectives, and finally a description of a use-case for the platform. Whilst the focus of the VRS virtual platform was to facilitate the design of ROPAX (roll-on passengers and cargo) vessels, the components within the platform are entirely generic and may be applied to the distributed design of any type of vessel, or other complex made-to-order products.

INTRODUCTION

Despite being faced with a situation where computers were generally being used for the processing of data, Mann and Coons identified the possibility of using computers as “partners in the creative process” to facilitate the hypothesis exploration process and consequently produce an escalation of “scientific creativity” (Mann & Coons, 1965). They stated:

It is clear that what is needed if the computer is to be of greater use in the creative process, is a more intimate and continuous interchange between man and machine. This interchange must be of such a nature that all forms of thought that are congenial to man, whether verbal, symbolic, numerical, or even graphical are also understood by the machine and are acted upon by the machine in ways that are appropriate to man's purpose. (Mann & Coons, 1965, p. 3)

To achieve Mann and Coons' vision requires a fundamental understanding of the creative process as well as being able to develop computer tools to attain human and computer symbiosis.

Whilst the vision of a shared understanding between man and machine of all forms of thought has not yet been realised, Cummings discussed the degree to which automation (provided by intelligent decision support systems) could be introduced within the decision process, indicating where computers may be utilised in facilitating this shared understanding (Cummings, 2004). Cummings cites Fitts' list (Chapanis et al., 1951) as representing the respective strengths of humans and computers within the decision making process. Humans are regarded as being better at: perceiving patterns, improvising and using flexible procedures, recalling relevant facts, reasoning inductively, and exercising judgement, whereas computers are regarded as being better at: responding quickly to control tasks, repetitive and routine tasks, reasoning deductively, and

handling many complex tasks simultaneously (Chapanis et al., 1951).

Despite not being included within Fitts' list, Cummings acknowledges an increasing need for the use of computational decision support to help humans navigate complex decision problems.

The CAD Centre was established in 1986 as a research and postgraduate unit within the Department of Design Manufacture and Engineering Management at the University of Strathclyde. The aims of the Centre are to develop the computing technology to support a creative design partnership between man and machine, and to deliver the underlying technology, techniques, and approaches to industry. To achieve these aims, the CAD Centre has evolved research education and technology transfer programmes.

This paper briefly discusses one of the initial visions of the CAD Centre: the intelligent design assistant (IDA) which addresses both the views of Mann and Coons whilst considering how to leverage the benefits of both human and computer within this partnership. The third section discusses how the IDA vision has been realised within a virtual design environment that provides management support for the life-phase design of ships—the VRS virtual platform. The development challenges are discussed within the fourth section, and its use within the context of the design of a ROPAX vessel is described within the fifth section.

THE INTELLIGENT DESIGN ASSISTANT PHILOSOPHY

A characterisation of Mann and Coons' design assistance philosophy is that of the intelligent design assistant. Figure 1 illustrates some key complementary roles that a designer and an IDA are proposed to play within the scenario of intelligent CAD.

In this scenario, designers are initiators of a discourse; they retain authority and control over

20 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/virtual-environment-support-distributed-design/22175

Related Content

Knowledge Creation and Student Engagement Within 3D Virtual Worlds

Brian G. Burton and Barbara Martin (2017). *International Journal of Virtual and Augmented Reality* (pp. 43-59). www.irma-international.org/article/knowledge-creation-and-student-engagement-within-3d-virtual-worlds/169934

Networks and Industrial Clusters

F. Vieira (2008). *Encyclopedia of Networked and Virtual Organizations* (pp. 1058-1065). www.irma-international.org/chapter/networks-industrial-clusters/17724

Meta-Analysis Research on Virtual Team Performance

Ying-Chieh Liu, Janice Burn and Susan Stoney (2008). *Encyclopedia of Networked and Virtual Organizations* (pp. 933-943). www.irma-international.org/chapter/meta-analysis-research-virtual-team/17709

Augmented Reality Applications and Usage Examples in the Metaverse Age

Hakan Altinpulluk and Yusuf Yildrm (2023). *Handbook of Research on AI-Based Technologies and Applications in the Era of the Metaverse* (pp. 144-164). www.irma-international.org/chapter/augmented-reality-applications-and-usage-examples-in-the-metaverse-age/326028

VR Presentation Training System Using Machine Learning Techniques for Automatic Evaluation

Yuto Yokoyama and Katashi Nagao (2021). *International Journal of Virtual and Augmented Reality* (pp. 20-42). www.irma-international.org/article/vr-presentation-training-system-using-machine-learning-techniques-for-automatic-evaluation/290044