中文摘要

對一個立體的設計作品(包括建築，工業及產品設計)而言，爲了讓設計更爲完整，設計者必須在形塑的過程中重複的對其設計進行修改。著圖形運算技術的高度發展，虛擬輔助設計(Virtual Reality Added Design, VRAD)的成形使得立體塑模的過程產生了很大的變化。起傳統的方式，VRAD讓設計者可以藉由虛擬建模的方式，花費更少的時間及資源在立體塑模的過程上(Ouyang 1996)。

目前市面上的虛擬建模軟體多是使用游標視窗選單系統(Window-Indicator-Menu-Pointer, WIMP) (Gross and Kemp, 2001)來控制，瀏覽以及修改立體的設計型態，雖然設計者大都能習慣以及接受這種像在紙上作業的設計模式，但是在２Ｄ的介面上做３Ｄ的設計多少還是會有一些限制，這就是爲什麼在平面的規劃外還要加上製作實體模型的過程。計者能夠直接用手在實體模型上作修改及瀏覽的動作。使是藉著透視或等比例的瀏覽，這些動作還是很難在2Ｄ平面上靈活運用。基於上述的理由，許多案子開始致力於發展超越2D介面的3D建模互動架構，而對設計者來說，建構，修改以及瀏覽一個實體模型最重要的就是手勢的動作(Nemeth, 1984)。此，使用手勢做爲與VRAD環境間之互動基礎模式的架構成爲一個熱門的主題。Nemeth在1984曾經提出在虛擬建模環境中自然的運用手勢來完成設計的系統架構。Nemeth甚至編輯了一套能夠形塑及定義空間的手勢準則。

然而，今日的虛擬建模軟體爲了設計者的需求(擬真，特殊效果的強化)，指令變得複雜而難以控制一般人在不經過訓練的情況下所能自然發揮的手勢不超過12種(Liang, 1997), 顯然無法滿足目前虛擬建模軟體所需要的指令數量，而配合手勢所製作的軟體幾乎不具相容性及延伸性，因此，在排除WIMP的情況下，單靠手勢系統真的能夠完整的幫助設計者在建模的過程中更直覺且更有效率嗎？而結合WIMP後要如何才能保有手勢系統該有的優勢而不顯的多餘呢？本研究的目的在於藉著實驗及分析的過程，發展一套能夠妥善結合手勢與WIMP的系統，減少設計者在建模過程中所花費的時間及資源。

本研究提供了一個系統讓設計者能藉由自然手勢使用當前主流的 3D 設計軟體而不受限制，除此之外，更能刺激設計者在建模過程產生新的設計想法。由實驗的結果，更能針對不同使用者做出配套的手勢指令。

關鍵字：虛擬建模，手勢輸入，游標視窗選單系統，人機介面

abstract

During the process of design, the artifact (architects, but also mechanical, civil, and industrial engineers) must be revised many times in modelling process. Fortunately, advanced developments of graphics computing technology make the process of modelling changed by Virtual Reality Added Design (VRAD).In VRAD, designers waste less times and resource than traditional by virtual modelling (Ouyang 1996).

Most virtual modelling programs use a Window-Indicator-Menu-Pointer (WIMP) (Gross and Kemp, 2001) interface to control the creation, viewing and modification of 3D forms. Although designers have become accustomed to this way of working, which derives from traditional paper-based practice, working on a three- dimensional artifact through a two-dimensional interface has some limitations. That is why, in traditional practice, designers often develop a physical working model in addition to two- dimensional projections. The designer can add and remove pieces to the physical model, point to certain elements or identify directions and dimensions by their hands in three-space. These operations are clumsier in two dimensions, even with an isometric or perspective projection.

For market demand (imitative reality and special effect), the commands of immediate virtual modelling programs have become more complex and difficult to control. The average people are no more than twelve without extra training programs having the amounts of natural gestures dominated by (Liang, 1997). In evidence, the amounts of the gestures are deficient for the present needs of VRAD programs. The modelling programs that operate in gestures develop almost without continuity and popularity. However, without WIMP, can designs use a more naturally and efficiently approach –the gesture system– manipulate models in virtual modelling environment? And how do we keep the advantages of gesture systems after combining WIMP? Therefore, the purpose of this research is to make the system that combine gesture and WIMP properly by experiments and analysis. By using the system, designs will expend less times than only WIMP or gestures in modelling process.

This research provides an interface that allows designers to communicate with the major virtual modelling programs by using their most mobile devices-hands. In addition, the system proves the part of the concept demonstration and a platform for experimentation. I have to demonstrate several simple tests, in which particular gestures are bound to particular operations.

Keywords: virtual modelling, Gesture, Window-Indicator-Menu-Pointer, Human Machine interface