

PROJECT PRESENTATION

by Umberto Cugini (Politecnico di Milano)

Abstract

This document describes the project main goal, the technical approach and the expected achievements of the T'nD project.

Deliverable n°:	D0	Issue n°:	1
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Keywords:

Project presentation, Objectives, Technical approach, Achievements.

Approval status

Author:	U. Cugini	Politecnico di Milano	Project Coordinator
Approved By:	U. Cugini	Politecnico di Milano	Project Coordinator

Dissemination

Public

Document details

Document identifier	T'nD/10/PoliMI/R/04001-1.0	
Deliverable/Output n°:	D0	Contributing Companies
Type of deliverable:	R (report)	
Issue Date:	15.02.2004	
Contract n°:	FP6-IST-2002-001996	
Project n°:	001996	

Revision table

Issue	Issue date	Modifications
1.0		Final issue

Electronic file details

Master file location	T'nD public WEB site	
Filename	D0-1.0	
Internal ref		

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1. Project Summary

<u>Contract number:</u> FP6-IST-2002-001996 <u>Priority:</u> FP6-IST 2.3.1.6 Multimodal Interfaces

List of Participant: Politecnico di Milano - Italy think3 – France FCS – Control Systems – the Netherlands Universitè d'Aix-Marseille II – France Pininfarina S.p.A. – Italy Eiger S.L. – Spain Alessi S.p.A. – Italy Universitat de Girona – Spain

<u>Total cost::</u> EUR 3.404.411,00 <u>Commission funding:</u> EUR 2.219.999,00

<u>WEB page</u>: www.kaemart.it/touch-and-design <u>e-mail:</u> tnd@kaemart.it

2. Project main goal

Today, industrial designers are used to produce physical mock-ups of products by modeling and manipulating clay. Designers have their knowledge about controlling shapes in their hands, and the skill they have developed is a high value to be preserved. Current haptic technology is mainly based on point based force feedback allowing for the simulation of a local point contact. That is not appropriate and satisfactory for simulating a full hand contact and interaction with virtual objects.

The project aims at developing a *novel system for shape generation and modification based on novel haptic interaction and intelligent shape manipulation operators* in order to *exploit existing manual skill of designers*. Designers will be able to work with their full hands, as they do in their daily work, using a novel haptic device, for modeling product shapes. Haptic technology will be integrated together with modeling operators for providing a working environment offering high degree of usability and acceptance, comfort of usage, flexibility for any kind of user, including inexperienced users. The system will capture the design intent, inferring commands to apply from designers' haptic gestures. Designers will be able to manipulate generative constraints using their hands, and not mathematical equations and formula.

Using the system developed in the frame of the project, based on the integration of novel hardware and software technology, designers -instead of directly generating shapes- will be able to control with their hands generative constraints of geometric shapes, in the sense that they will be able to control directly the global evolution and modification of shapes.

3. Key issues

The following key issues will be addressed in the three main research areas:

In the field of *haptic technology*, an extended version of FCS HapticMaster will be used as basic platform, equipped with a strong and stiff 6-DOF device carrying simulated clay modeling tool with two handles.

In the field of *shape modeling techniques*, the emerging technologies that the project will further investigate and develop include sweep-based and voxel-based techniques. The major open issue concerns the definition of an appropriate theory allowing discrete schemes to support fine quality shape generation.

In the field of *cognitive ergonomics*, usual ergonomics criteria and principles will be extended with new aspects that will be developed analyzing T'nD designers' cognitive processes. The new principles will then be adapted to the specifications of T'nD haptic and shape modeling systems.

4. Technical approach

The project work plan includes three main phases: the first phase planned in the first year is dedicated to identify, set and consolidate the research technological backgrounds in the areas of haptics, geometric and shape modeling, and cognitive psychology, and to define the system requirements; the following phase, mainly planned across the second and third year, is dedicated to the specification, development and testing of the *T'n D system* where intelligent shape manipulation operators are integrated to haptic devices based on full hand interaction; the last phase planned in the third year is focused on the evaluation of the system and of the project results, with the industrial partners of the project, and also with external users.

5. Expected achievements/impact

The project will yield the following:

- Improvement of theoretical foundations in the field of shape modeling and haptics in respect to state of the art.
- Scenario showing the evolution and specifications for future haptic interaction methods and devices.
- Improvement of cognitive ergonomics theories, including integration of vision and haptics in human-machine interaction.
- Stand-alone components:
 - new haptic manipulator, performing real-time rendering of complex shapes, and providing full-hand interaction;
 - new shape modeling techniques, supporting easy and intuitive creation and deformation of shapes.
- Prototype of an innovative system integrating shape modeling and haptic manipulator.
- Best practice for end users.

The integrated system has to show high-level performances to be daily used by designers. Thus, it should be easy and intuitive to use, and should provide shape manipulation functionalities, that make designers save time and effort in complex shape design (for example, the system will provide "scraper" operators for smoothing the shape, intuitive operators for assisting the definition of constraints, and more). One of the most innovative aspects provided by the system is that designers are not expected to know mathematics behind geometric modeling for designing shapes.

The system has to be exploited as an integrated environment, thus requiring some more effort after the end of the project before being a product ready to be a commercial one. The project, anyway, contributes to the definition of new ways of shape modeling in the product design sector. Possible commercial solutions might be developed further at long term, for example, dedicated solutions to car design, appliances design, garment design, and others.

The integrated prototype will consist of a Computer Aided Styling system with all the modeling and rendering facilities, and with an interactive interface based on a haptic device equipped with end effectors supporting the interaction with full hand. That allows designers to describe, modify shapes exploiting the manual skill of designers who are used to mould clay, or in general, physical mock-ups.

6. Coordinator contact details

Prof. Umberto Cugini Dipartimento di Meccanica – Politecnico di Milano Via La Masa, 34 - 20158 Milano – Italy e-mail: umberto.cugini@polimi.it tel. +39 02 23998257 – fax +39 02 23998202