

# The IDEATE Research Projects: Supporting Design Conceptualizing

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## 1. RESEARCH OBJECTIVE

The objective of the IDEATE research is:

*To analyse the conceptualising phase of the industrial design process and to research ways in which this activity can be supported through tools, systems and techniques for designers.*

Since this research is concerned with the conceptualizing phase of the Industrial Design process, we are interested to know how ideas are generated, how designers create form, and what kinds of tools designers use for this process. One of the goals of our research is the application of these investigations toward the development of new and better tools for the process; tools for creative thinking and visualizing. By focusing on the specific area of Industrial Design, we hope to develop an organized set of multi-nodal tools that can assist the designer in the creation of innovative form by offering extensive visual databases, methodologies, form-giving strategies and organizational capabilities. These results should be implementable in an advanced electronic “environment” which supports the designer in the development of innovative and creative product form.

## 2. HISTORY

The IDEATE Research has been derived from a project done in 1987 called “The Designer’s Toolkit”. The Toolkit was intended to be a single computer program with a series of modules which allowed 3D object definition during the early phases of design. The most interesting attribute of the Toolkit was its attempt to bridge the gap between 2D representations and actual 3D objects. It did this by allowing the designer to quickly generate 3D extruded shapes which could then be frozen as a bit-map and sketched upon. In this way the designer could add details and refinements to the 3D object by using it as an “underlay” drawing.



Six areas of design activity were identified:

- 1 Image retrieval, classification and manipulation
- 2 Visual databases
- 3 Geometric modelling with two-hands
- 4 Sketching
- 5 Networking and shared designing over distances
- 6 Product prototyping and presentation

IDEATE currently supports projects in each of these areas.

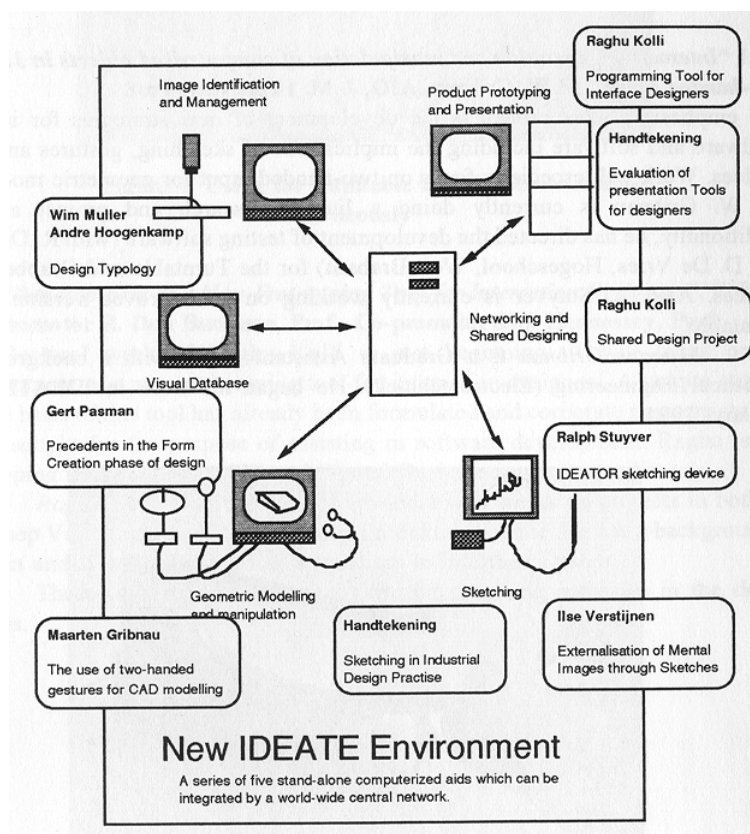


Figure 2: The IDEATE environment and associated research projects

#### 4. PERSONNEL AND PROJECTS

*Jim Hennessey* is a professor in industrial design engineering and chairs the section on Design Techniques, part of the Department of Aesthetics. He is also the director of the IDEATE research group. As an American educator and researcher, he has been active in industrial design and education in three countries over the last 25 years.

##### 4.1 Computerized Tools Research

###### 4.1.1 “Interactive generation and manipulation of computerised objects in 3D using two-handed input”, M.W. Gribnau, AIO, J. M. Hennessey, Prof.

The emphasis of this project is the development of new strategies for intuitive hardware and software including the implications of sketching, gestures and input devices. Work will especially focus on two-handed input for geometric modelling. M. W. Gribnau is currently doing a literature search and project analysis. Additionally, he has directed the development of testing software (with R. Dickhout and D. De Vries, Hogeschool, West Brabant) for the Turntable and Grabber input devices. Also, R. Stuyver is currently working on an improved version of the Turntable.

*Maarten Gribnau* is a Graduate Assistant (AIO) with a background in Electrical Engineering (Electrotechniek). He began his work in IDEATE on 1, January, 1994.

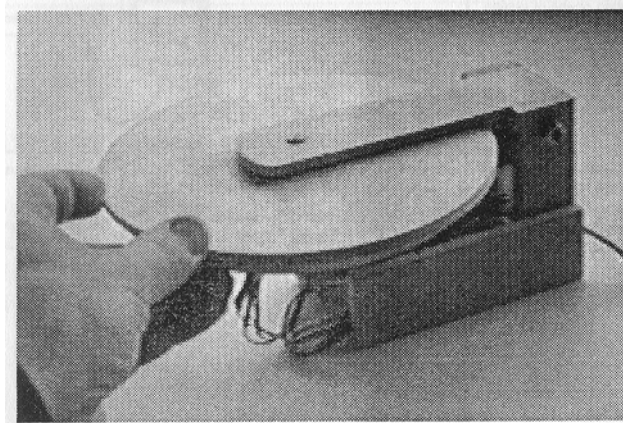


Figure 3: The Turntable

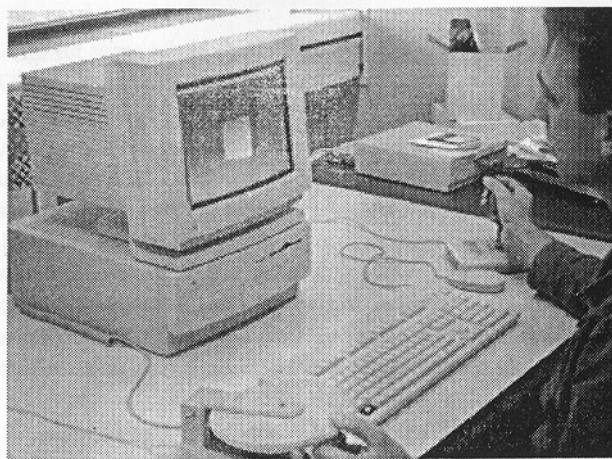


Figure 4: Using the Turntable and Grabber simultaneously

**4.1.1.2 “Development of a New Prototyping Tool for Interaction Designers”, R. Kolli, UD, Promotor R. Den Burman, Prof., Co-promotor J.M. Hennessey, Prof.**

The Doctoral work of Raghu Kolli is just beginning. It will focus on the development of a new prototyping tool for interaction designers. A unique strategy for the basis of this tool has already been formulated and corporate partners are now being sought for the purpose of assisting in software development. Raghu is also developing research on CSCW and Shared Designing over networks.

*Raghu Kolli* is a researcher from India who works on projects in both the vakgroep Vormgeving and the vakgroep Produktergonomie. He has a background in Product and Graphic Design and specialises in Interface Design.

These two projects both focus on the sketching activities in the design process.

#### 4.2 Sketch-related research

##### 4.2.1 "IDEATOR", R. Kolli, UD, R. Stuyver, OBP, M.W. Gribnau, AIO, J. M. Hennessey, Prof.

The first conclusions for this project were finished on 1 September, 1993, and a definitive report was written (see Scientific Publications). High quality, ray-traced (ElectroGig) images of the product were created by R. Stuyver. M.W. Gribnau implemented parts of the IDEATOR interface in a Macintosh-based program which will be used for testing and demonstration. R. Kolli has ended his work on this project in order to develop his Doctoral thesis (see above). We are currently seeking corporate partners for the development of a working prototype of this device for user testing and evaluation.

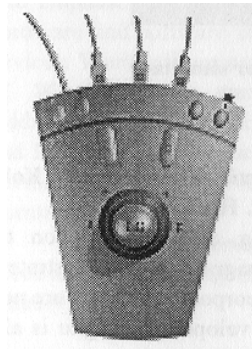


Figure 5: The PAW, for the non-dominant hand

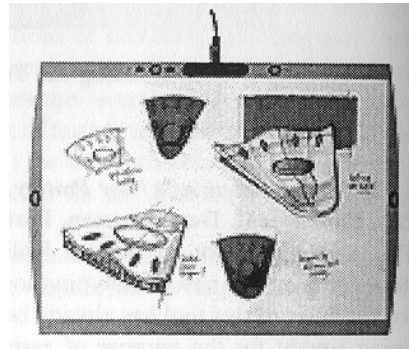


Figure 6: The PAD, Ideator's touch-sensitive LCD Tablet

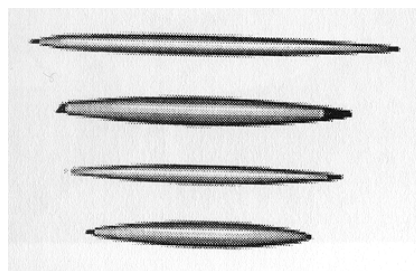


Figure 7: The PENS, which simulate actual design tools

In addition to doing research in IDEATE, *Ralph Stuyver* is responsible for teaching the course IO78a, Computer Visualisation.

4.2.2 “*The importance of paper and pencil sketching to visual imagery and how it can be improved by a sketch tablet*”, I. Verstijnen, AIO, C. van Leeuwen, UD-UvA, W. Muller, UD, J. M. Hennessey, Prof.

Sketching is seen as an extension to visual imagery; in many ways it adds to visual imagery what visual imagery, itself, cannot. By researching the ineffectiveness of visual imagery and what is subsequently added to it through paper and pencil sketching we can extract the remaining needs in order to define functions for the sketch tablet of the IDEATOR and other pen-based systems.

*Ilse Verstijnen's* background is in Psychology at the University of Amsterdam. She has been a Graduate Assistant (AIO) in the IDEATE project since 1 April, 1992.

#### 4.3 Typology-related research

These four projects are all related to the concept of typology in design.

4.3.1 “*Typology and design methods*”, W. Muller, UD, A. Hogenkamp, UD, J.M. Hennessey, Prof.

This project is a definitive research into form-types. The goal of the research is to determine the role of form-types in design by identifying and classifying form-types which can then play a part in the design process. The computer implications of form-types will be applied in the research project of G. Pasman.

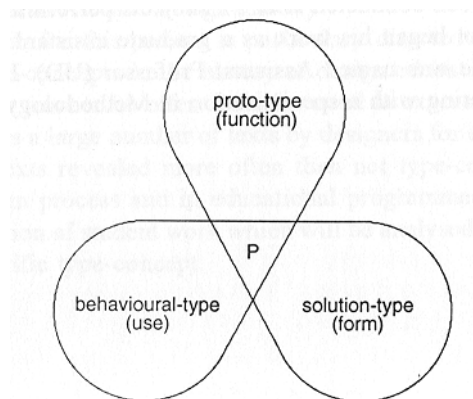


Figure 8 Typology based on Form, Function and Use

*Willem Muller* is an Assistant Professor (UD) and has been researching and teaching in the faculty of industrial design engineering since its beginning in 1969. He is well-known for his book: "VORMGEVEN: Ordening en Betekenisgeving", uitgeverij Lemma, Utrecht, 1990, ISBN 90-5189-039-7.

*Andre Hogenkamp* is an Assistant Professor (UD) with a background in industrial design engineering. He began his research work in IDEATE on 1 September, 1992.

4.3.2 "*The Organisation of Design Knowledge in Precedent-based Design*", G. Pasman, UD, W. Muller, UD, J. M. Hennessey, Prof.

This research has both a theoretical and a practical side. The theoretical goal is to derive an understanding of the actions and strategies industrial designers use in acquiring design knowledge from existing design situations and, later, applying this design knowledge to new design situations.

The results from theory will be used in the development of an image database, which makes use of visual representations of existing form concepts, in order to create a domain-specific knowledge base from which the industrial designer can acquire and apply design knowledge in order to aid the generation and development of new form concepts. The domain of this research is limited to the form-creation process in industrial design.

Thus far, in collaboration with the "Typology and design methods" research, a typological model has been developed for the description and organisation of the design knowledge that can be extracted from existing form concepts. This model will provide a framework for the structure of the image database. In order to verify the model a study has been conducted with 17 subjects performing a design task.

*Gert Pasman* began his work as a graduate assistant (AIO) in December, 1991 and in 1994 he was named Assistant Professor (UD). His background is in Mechanical Engineering with a specialisation in Methodology.



Figure 9: Chairs based on Solution-typical features

4.3.3 “*Type-concepts in the History of Design Education*” J.B.L. van den Heuvel, UD  
Jeroen v. d. Heuvel is an Assistant Professor (UD) and is responsible for developing and teaching courses in Art and Design History.

The research for this project is particularly directed to the existence and development of type-concepts in the history of design education. When a designer decides to become a teacher he often feels the need to express his ideas on design in writing, so there is a large number of texts by designers for educational purposes. Analysis of these texts revealed more often than not type-concepts to legitimize choices in the design process and in educational programmes. On the other hand there exists a collection of student work which will be analysed on the consequences of the use of a specific type-concept.

#### 4.3.4 “History of Form-concepts in Electric Domestic Appliances”, T.R.A. de Rijk, AIO

This historical project asks what form-concepts were used in the industries for domestic appliances in the period 1930-1970, especially in the Netherlands. One of the main research topics is the development of product-types in these industries. What was the contribution of the designer and what role played the principal consumer-acceptance and technical limitations in the arising of these types. The project gives good opportunities to find the actual development of product-types and shall in this way be of great interest to the other typology-research in the IDEATE-project.

*Timo de Rijk* is a graduate assistant with a background in Art History. He began his work in April, 1992.

### 5. INTERRELATIONSHIPS

The projects of J.B.L. v.d. Heuvel en T.R.A. de Rijk are closely related to the “Typology and design methods” project of W. Muller and A. Hogenkamp. All three projects provide valuable material for the research of G. Pasma in collecting and classifying existing form concepts as input for the image database. A cross-project “Image Database Group” has been formed in order to establish co-operation between these research projects.

### 6. RECENT PUBLICATIONS

- Kolli, R., Pasma, G., Hennessey, J.M., “Some Considerations for Designing a User Environment for Creative Ideation”, Proceedings of INTERFACE 93, Raleigh, NC., USA, May 5-8, Published by the Human Factors & Ergonomics Society, Santa Monica, 1993, pp. 112-117.
- Kolli R., Pasma G., Hennessey, J.M., “Deriving the Functional Requirements for a Sketching Device: A Case Study”, Proceedings HCI Conference 93, Vienna, Austria, Springer-Verlag, 1993, pp. 184-195.
- Kolli, R., “Using Video Scenarios for Presenting Consumer Product Interfaces”, Adjunct Proceedings INTERCHI 93, ACM Conference on Human Factors in Computing Systems, Amsterdam, 24-29 April, 1993, p. 61.

- Verstijnen, I., Leeuwen, C. van (UvA), Hennessey, J.M., "Paper and Pencil Sketching to Reveal Implicit Information from Images", Lecture, Tagung Experimental Arbeitende Psychologen und Psychologinnen (TEAPP-Congress), Munich, Germany, 28-31 March, 1994.
- Hennessey, J.M., "Exploring Computer Enhancements for Conceptualizing", Automation Based Creative Design: Current Issues in Computers and Architecture, Edited by T.White and A.Tzonis, Elsevier Publishers, April, 1994.
- Kolli, R., Stuyver, R., Hennessey, J.M., "A Conceptual Sketching Device for the Early Phase of Design", Design and Decision Support Systems (DDSS) Conference, Vaals, Netherlands, June, 1994
- Hennessey, C.J., Stuyver, R., Hennessey, J.M., "CAD and Design", Internal Stage Research Report, Sektie Vormgevings-methodieken, vakgroep vormgeving, TUDelft, 15 Augustus, 1994.
- Dickhout, R., De Vries, D., Gribnau, M.W., Hennessey, J.M., "IDEATE-G", Internal Stage Research Report, Sektie Vormgevings-methodieken, vakgroep Vormgeving, TUDelft, September, 1994

