

[RE]SEARCH

SYNOPSIS

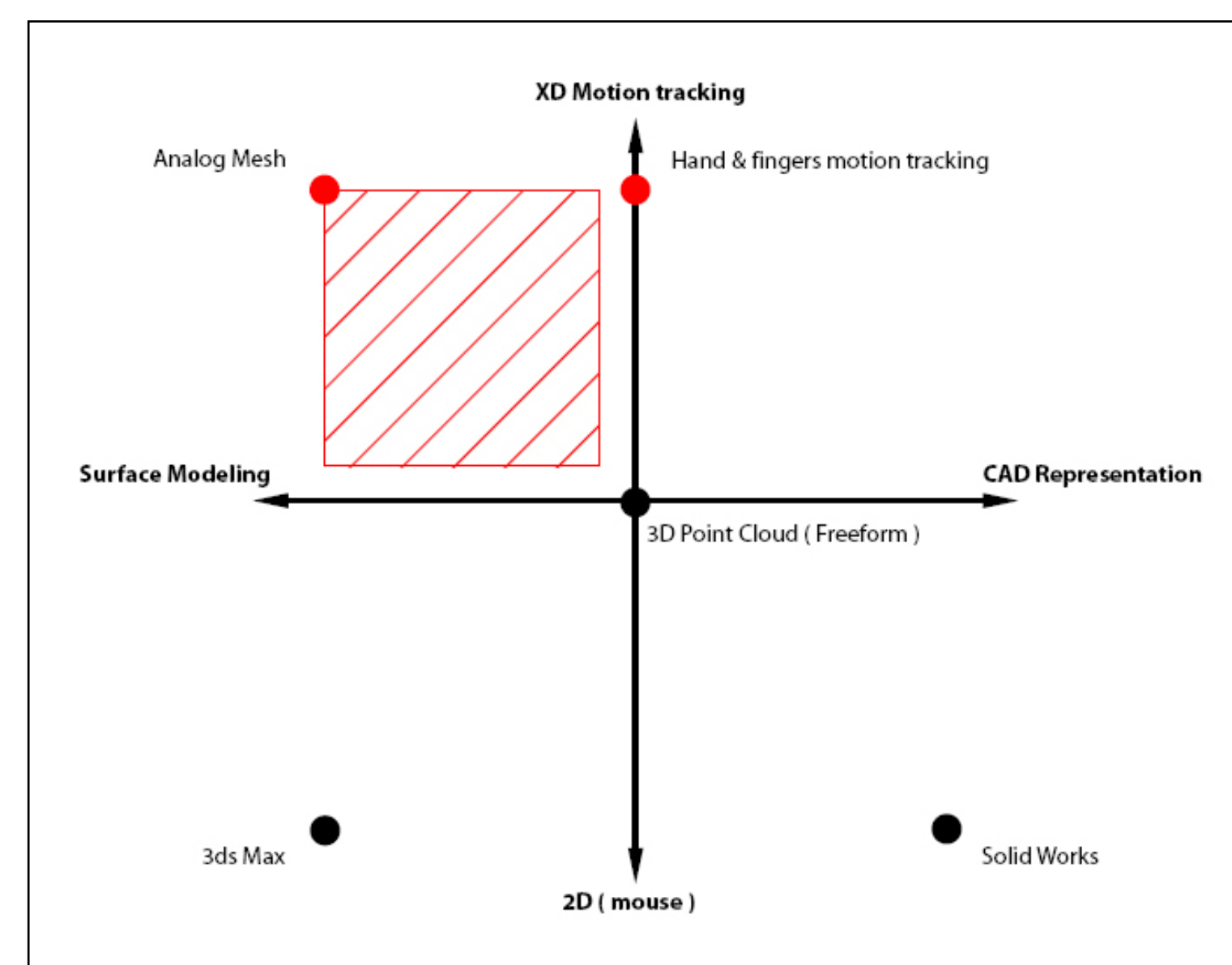
Our [re]search is aiming at the identification of essential voids in the support of design processes offered by commonly available methods and tools. Some remarkable results were obtained during design sessions with novices and experts by engaging them in tangible experiments that were designed to stimulate and enhance their skills, tacit knowing and creativity that enables them to represent their ideas and concepts in an intuitive way.

We explored and captured the differences in designers behavior during use of "analogue" and digital representation tools. We will explain our laboratory experiments, test results, educational embedding and creative opportunities that emerge from hybrid design tools. Furthermore we propose an exciting hybrid design tool to bring the tacit and tangible elements of design back into CAD systems.

We follow two different routes in our attempt to identify and fill the voids. In the first procedure is a set of observations to measure the effectiveness, various shaping and representation techniques. Knowledge about learning curves, time constraints, idiosyncrasy, quality of design results and focus of particular design methods gives insight in peoples abilities to improve and support decisions about the structure and content of the "best" curriculum for industrial design engineering students.

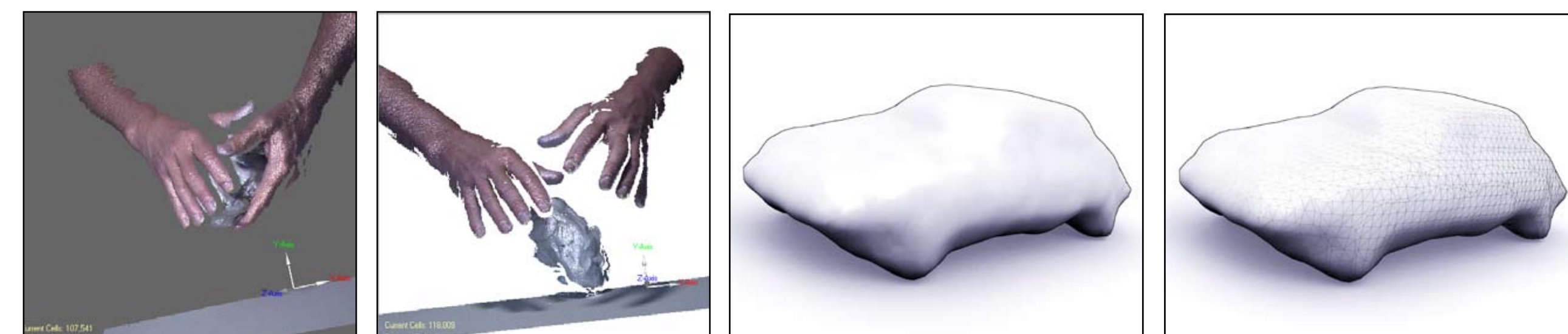
The second procedure is the creation of a prototype of a hybrid design tool to stimulate intuitive and imaginative skills. For the experiments, we used nine (9) haptic representational configurations and set-ups, and involved over 95 test subjects per experiment. In these configurations the subjects performance of form giving and shaping techniques were captured, observed and rated.

FRAMEWORK



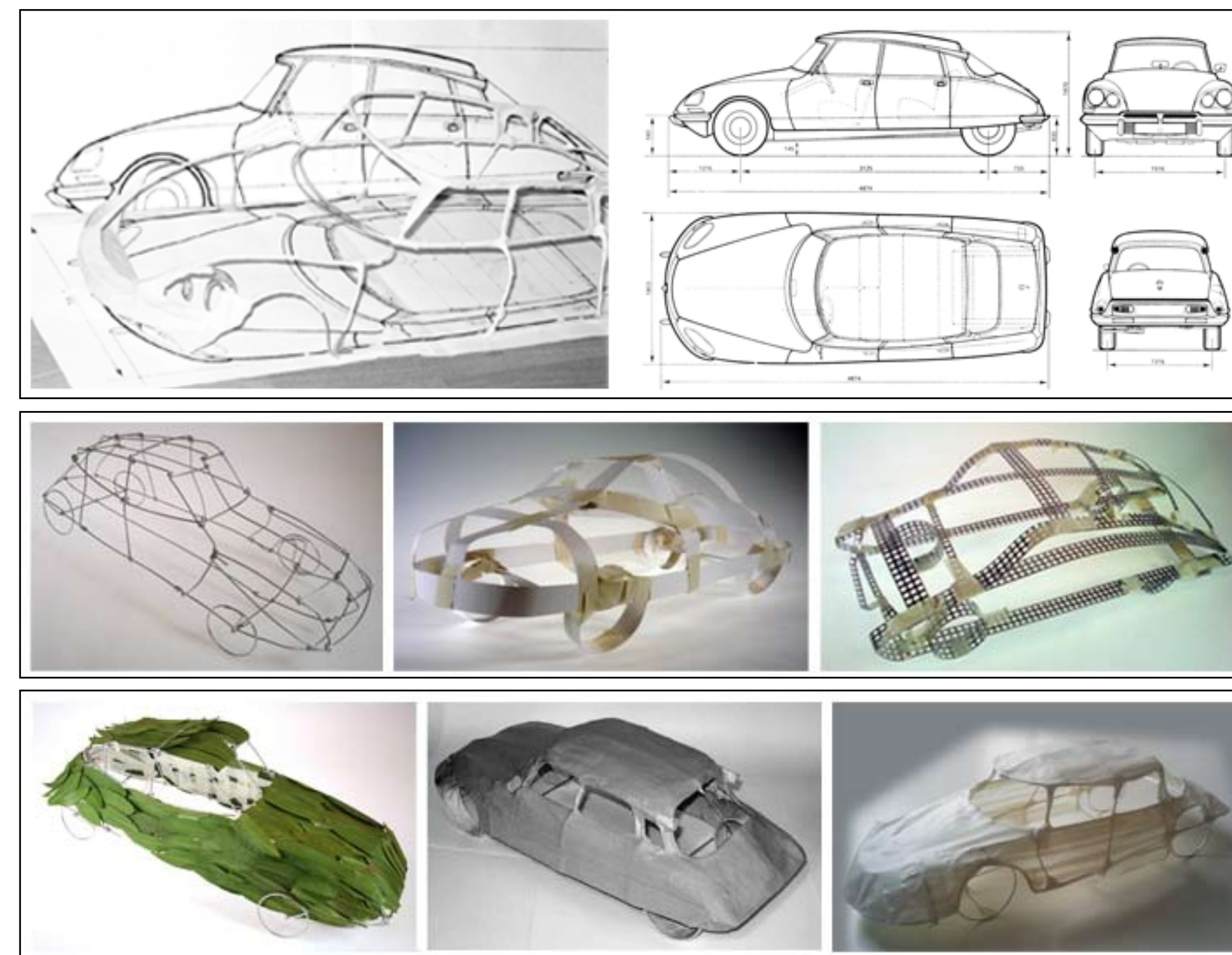
TWO-HANDED INTERACTION

Two-handed interaction, leading to virtual models created by tangible interaction being transformed into virtual mesh iteration(-s).



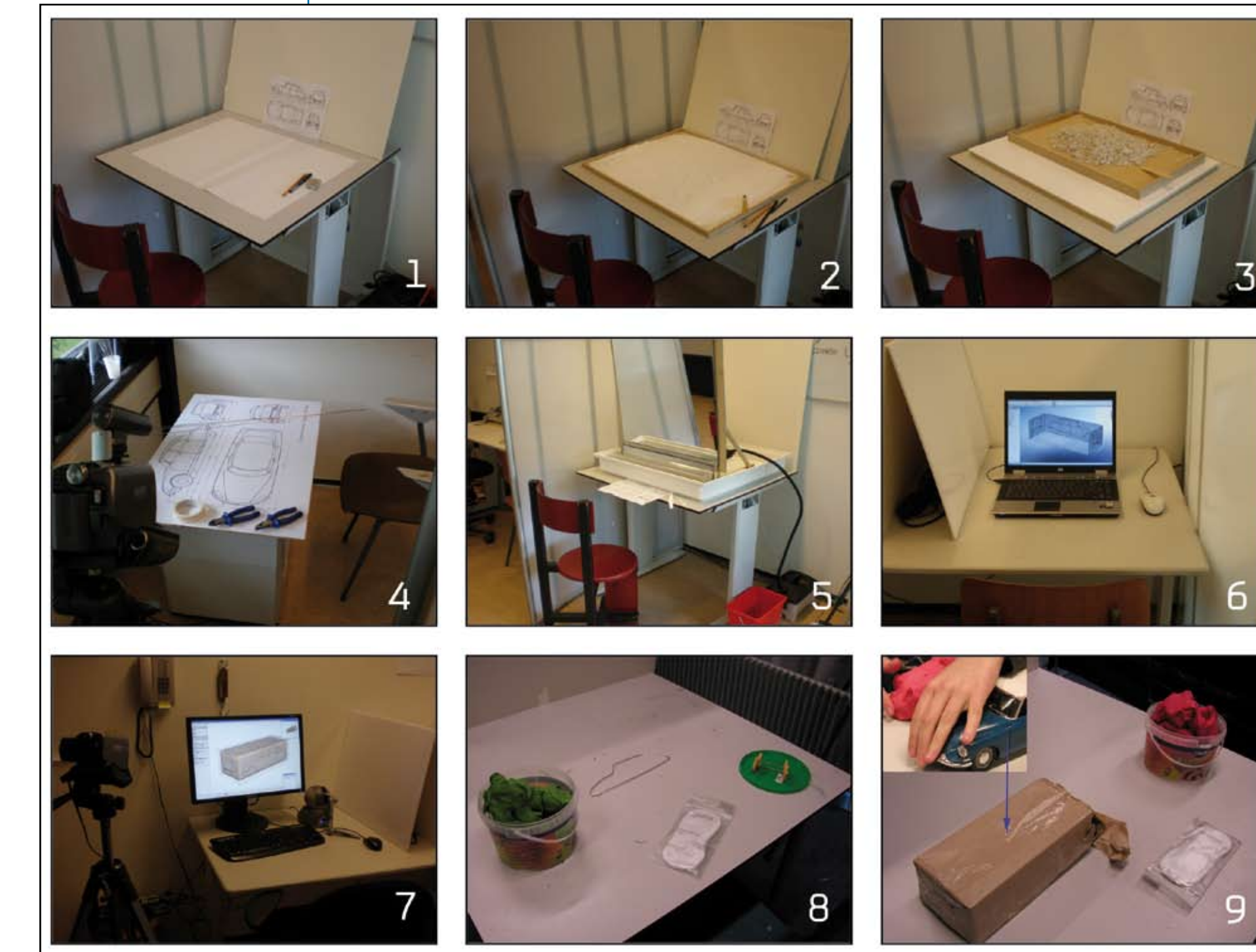
EXPERIMENTATION

A EDUCATIONAL EMBEDDING OF TANGIBLE EXPERIMENTS



Scaling and 2D to 3D transformation from orthogonal projections of artifacts, into tangible wire frame. Various materials, multiple solutions and idiosyncratic choice architecture.

B LABORATORY TESTING ON NOVICE AND EXPERT DESIGNERS WITH TANGIBLE EXPERIMENTS



Nine (9) haptic test benches for three-dimensional design representations:

- 1: Pencil Sketch test bench
- 2: Sand Sketch test bench
- 3: Sculpting test bench
- 4: Wire Plying test bench
- 5: Steam Sketching test bench
- 6: Solid Works test bench
- 7: Virtual Clay test bench
- 8: Blindfold Tacit test bench
- 9: Blindfold Tangible test bench

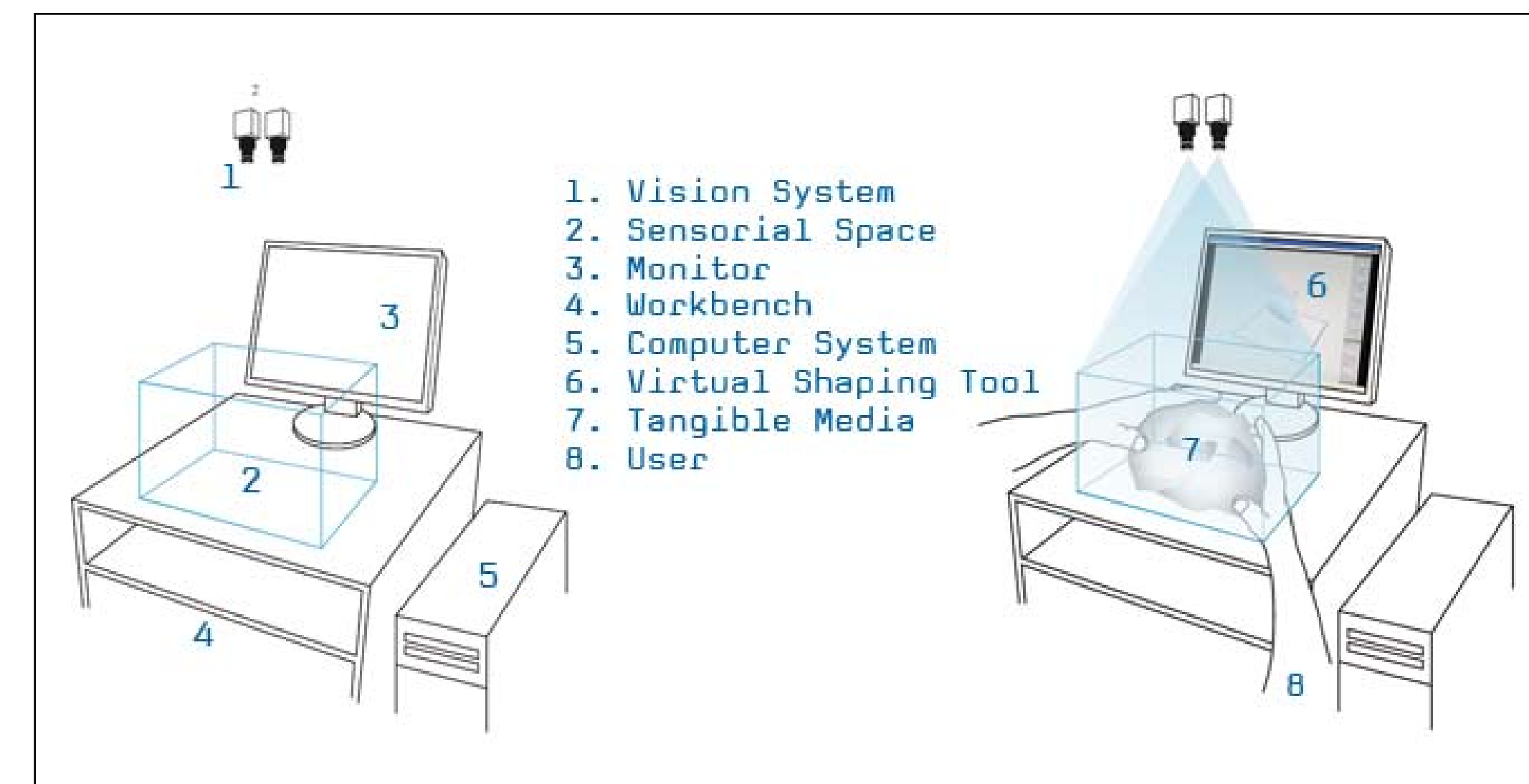
RESULTS¹

	pencil	sand	steam	sculpting	plying	3d solid	virt.clay	b.tacit	b.tangi.
number of participants	25	38	40	34	28	22	21	79	79
total high speed video test time edited [mm:ss]	26:00	16:00	20:00	25:00	24:00	34:00	46:00	n.a.	n.a.
real total video test time [h:mm:ss]	3:28:00	2:08:00	2:40:00	3:20:00	3:12:00	4:32:00	6:08:00	7:13:00	7:04:00
average test time per participant [mm:ss]	08:19	03:22	04:00	05:53	06:51	12:22	17:31	05:29	05:22

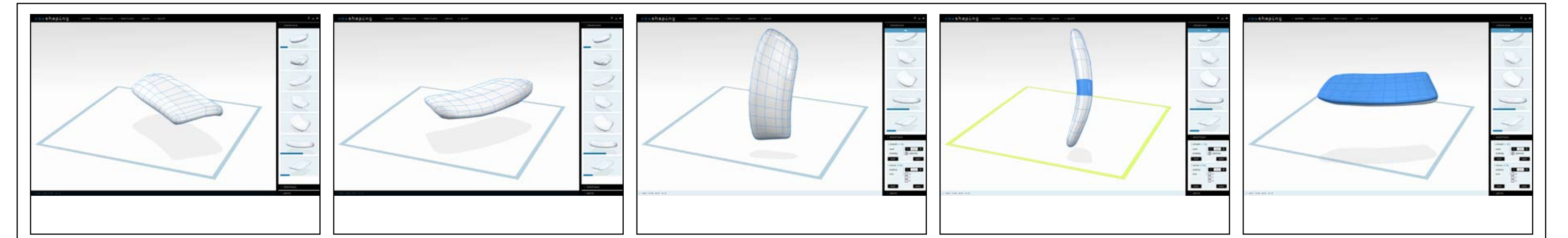
1) results shown in chart are based on preliminary analysis and evaluation of datasets of ongoing [re]search

HYBRID TOOL

PRODUCT DESIGN TOOL: VIRTUAL DESIGN ASSISTANT (VDA)



Virtual Design Assistant Workbench



The Virtual Shaping Tool in action - Polygon Mesh Iterations. Synthesizing different mesh iterations is a strong and important feature of the VDA Workbench, as well as the possibility of inserting raw functional elements during the design process leading to multi-layered manufacturing during ideation and conceptualization.