

The Process Improvement Impact on the Styling Workflow of an Industrial Design Company

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ABSTRACT

The renovation of the process represents a must for an industrial company involved in the design field. The process is moving from an entirely manual to a digital workflow, so much that sometimes users find many difficulties in the approach to the new tools. In particular, analyzing the methodologies of work it is easy to find out a big gap between the styling phase and the creation of the 3D model. One question to investigate is how much the style of a model starts to be influenced by the technological tools designed to construct it.

Starting from an accurate study of the Italdesign-Giugiaro process we present the efforts made to overcome the issues and define a more designer-oriented workflow, with the aim of the European Research Project SmartSketches.

Categories and Subject Descriptors (according to ACM CCS): I.3.3 [Computer Graphics]: Line and Curve Generation).

1. Introduction

Nowadays, for an industrial design company, it is very important to renovate its work process in order to maintain high position among the competitors in the design field, offering the most recent, advanced software and hardware tools, having the capability to easy data-exchange with customers and co-designers and using the most recent innovations in visualization and virtual reality. Such renovation however has its serious flaw: new technologies, that would be a great help for the designers in the realization of their ideas, are so sophisticated that only a special training enables a proper use of them. This means that a huge number of designers, accustomed to traditional methods in their work, would have to undergo such training and this in turn could result in switching their attention from the sheer act of creation to the utilization of technologically advanced tools. The ideal process would be more designer-oriented, that would focus on the needs of the users so that the knowledge, experience and sensibility acquired by designers throughout the years of their work would not be lost.

2. Traditional (manual) workflow

Till 5-6 years ago the typical workflow of a styling department started from the four view technical drawing, usually made in 1:10 scale, with some handmade rendering sketches in order to offer a vision of the model's look.

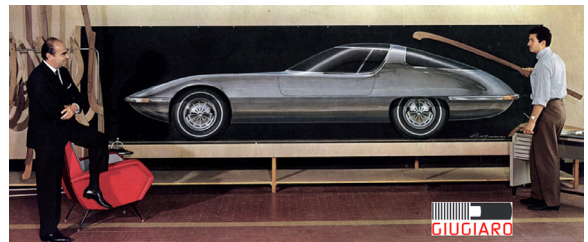


Figure 1: *The traditional methodologies of work in a styling department, adopted up to 5-6 years ago (in particular the real scale 2D drawing).*

Successively the sketch was converted in 1:1 scale and then the real model creation began: the scale model (usually 1:4 or 1:5 scales) was realized in clay, wood, fiberglass etc., depending on the complexity level of the model. Every modification on the style was made directly on the model, adding or erasing material if needed.

Dependant on how well the project proceeded, a next step in its successful accomplishment was the construction of the model in a real scale (1:1). In this phase all the changes require a lot of time: they are all made directly on the model after the style evaluation by a designer and the project management. A typical hand work instrument used at this step to define the changes in the shapes and style motif is the taping, that is directly used on the model to sketch the modifications. The taping will be then a reference for the modeler to perform the variations.



Figure 2: The taping, a very efficient traditional methodology that nowadays has been transferred in digital.

This workflow is very expensive and time consuming, and the realization of a real scale static model of exteriors with a good definition of the particulars and with colors takes not less than two weeks of work.

3. Virtual workflow

Basically what has changed in the last few years in the technology implementation is that the workflow has been much more digitalized and virtual reality and simulation have achieved an enormous importance. The real model creation phase has been moved to the end of the styling process and nowadays we can say that the major part of it is completely digital.

The passage between a traditional phase to a digital one requires a particular attention in order to be properly implemented in the company workflow.

Actually, following closely the designers' work and understanding the way a project is developed, we observe that there is a big gap in the process between the styling phase and the creation of the 3D model.

This article will take Italdesign-Giugiaro as an example of a company that introduced the virtual tools in its process. In particular, the results of the efforts made by the research project SmartSketches, in which we are involved as end users, will be presented.

SmartSketches is a user-centered approach to introduce computer-based tools in the early stages of product design. With this approach it will be possible to make the system suitable for those designers and stylists that today still prefer to work in a traditional manner, with paper and pencil.

It is easy to understand the main role of the *process*: the company presenting the best method is one step ahead of its competitors.

Italdesign-Giugiaro is the company that offers services to the car makers, starting from the first styling idea to the engineering of the product. Its workflow has always been one of the most advanced in terms of competencies, efficiency, time plan and competitiveness.

4. Optimization of the process

The "perfect" work methodology does not exist: it needs to be updated from time to time to remain competitive; specially the work instruments and in particular the necessary hardware and software tools have to be the best ones present on the market.

The optimization of the process needs the introduction to the users of the *work-with-a-computer* culture. Although not accustomed to high technology, they have to gradually face the digital work instruments. It is not only about changing the methodology, but the whole philosophy of work and so such transformation needs time and proper decisions to be taken.

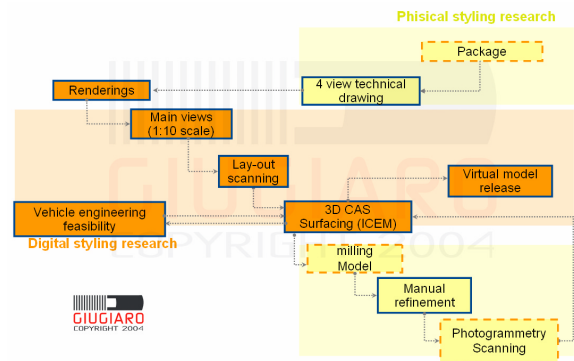


Figure 3: The figure represents the Italdesign - Giugiaro styling workflow with a color difference between the physical and the digital phases.

The adoption of the CAx underwent a big transformation in the workflow as most of the processes are becoming virtual and, for example, the first evaluations on the model are taken in front of the 3D in the Virtual Reality Centre. The main benefits are the improvement of the end-product quality, the optimization of the process and a reduction of costs and production's time.

On the other hand, the introduction of software tools requires personnel that gradually get used to such equipment: it is evident that with the new generation of designers there is a big change in the matter of work capabilities. The exchange of competencies between the old and the new generation of designers has not been totally transferred yet: not always the knowledge that the manual way of working offers is kept "saved". The enormous amount of data of the traditional methodologies is difficult to learn by young designers, mainly because the working tools are completely different and the CAx does not offer the same approach as the manual work techniques.

For companies that are market oriented, such as Italdesign-Giugiaro, the efforts made in the research should have a direct impact on the workflow in order to get the best results in the shortest time possible.

Italdesign-Giugiaro is continuously working to find a way to improve the internal company process. The aim in general is to obtain a workflow more designer-centred. To carry this out, it is needed a big effort in order to find new tools and make them available also for the "old generation"

of users. Actually, even if a designer follows the whole process at the base of his “new creature”, he does not directly work in all the phases as he used to in the past.

5. Issues found in the process

The designers so far have been less involved in the mathematic characterization of the 3D model and in the definition of the real model. This happens because, as we said previously, they cannot follow the project directly but they need help of some specialized technicians able to deal with the CAS software (Computer Aided Styling).

Current commercial tools, even offering much functionality that enables users to better express their creativity in the complex models generation still do not meet the designers’ needs.

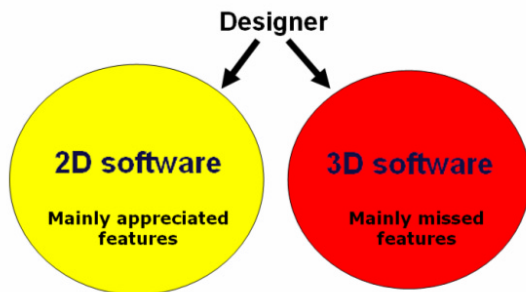


Figure 4: The graphic shows Designers’ preferences toward work 2D software.

Analyzing the phases of designers’ work we found out that the applications are extremely technical and, in consequence, they are very difficult to be adopted as daily work instruments by most of the designers, who do not have the necessary technological background to use them.

Moreover, the software lifecycle in an advanced company is not very long: companies are continuously searching for new applications in order to get the best ones, possibly before the competitors; the main company surface tool is often changed and it makes it senseless to invest a lot in training people who are not familiar with such complicated applications.

Currently, the software is still based on the WIMP (Windows, Icons, Menus, Pointing devices) paradigm, which makes it less appropriate to be adopted at the early stages of product and model design.

For all those reasons, pencil-and-paper sketches, in the first stages of design, are still the best work-methodology to represent the creative ideas in a fast way.

Talking with several designers, mainly seniors (experienced and competent in the field, used to traditional ways to perform their work), we can see how flexible they are, open to new technologies and to the use of innovative computer aided tools.

There is only one problem regarding the virtual reality innovation: even if designers appreciate new technologies,

they do not like to use them. Let us analyze their work approach in order to understand the problem.

The workflow procedure is the following: first of all, a designer starts to “put down” the idea in the four view technical drawing (handmade phase), but obviously, it is not enough to freeze the style. There is a basic need to evaluate the whole new concept passing from the 2D to the 3D view, in order to move and rotate the model, making sure that the surfaces match together and the result satisfies the starting idea. Often the new solutions need to be verified in a real scale model then.

While in the past this step was achieved by the construction of a real model (time and cost consuming activity, but efficient), at this point in the modern method there is the introduction of the figure of CAS operator, a technician with some knowledge of design that is an expert of 3D software and helps the designer in the creation of the mathematic 3D model.

6. Designer vs. CAS operator

This is a delicate point of the process: at one side there is a designer, who does not possess the knowledge of the methodology to approach to 3D software and needs to transfer his idea (that has not been fixed yet: it is important to be underlined) to the operator that will transform it into a 3D virtual model. On the other side we have a CAS operator that has to understand the designer’s style needs and make them match to the technical rules and eventually to the limitations of the software.

The designer has a certain 2-dimension vision of a car model, but he still does not know how to represent it in 3D and how to deal with the 3D applications. The operator should understand the concept (usually expressed through sketches and explained by words) creating a mathematical model, that most of the times is a personal interpretation of the designer’s idea.

From the designer’s point of view the figure of the CAS operator is often a disturbing element: his not direct involvement in the project creates in fact many misunderstandings between the two professional figures. Designers prefer to work on the model on their own, even in the 3D model phase, without any assistance with the 3D applications.

7. CAS Systems

Designers like to try out new ways to perform their work but after testing the software offered on the market they still prefer to start their work in the traditional way, sitting at a table with a white piece of paper and a pencil on a side.

They feel free working in this way without any constraints, any disturbing feeling “against” as (they say) the monitor of a computer and without the risk to lose the final result, forgetting the real objective represented by the idea of a new concept.

The problem is that, usually, programmers that approach to the creation of a new tool, do not understand the designer’s work very well: mainly they see the idea of a crea-

tivity as “putting down new ideas” instead of focusing a bit more on the process at the base of the creation of a new concept.

Of course we are aware of the enormous effort made by the software houses in order to create “the perfect” product, but still a lot has to be done in order to get a good support for the designers’ work. The users still see too many limits in the tool and, not being able to deal with them, results in the distressful feeling of incapacity for working in new environment.

In consequence, designers often attempt to learn how to use the software and adjust to the different methodologies, but finding it difficult, they either abandon using the software or they use it anyway, but focusing on the technical rather than on creative side of designing.

We can say that products as the surface modelers are excellent tools able to follow the whole mathematical phase of a project, from the styling to the A class surface (the last mathematical phase, where the style is freeze) and even to the engineering. Unfortunately we must add that, definitely, they are CAS-operator tools, not designer tools.

8. Common Style

One of the results of a large scale usage of the advanced computer aided systems of design in the styling departments of the automotive companies is that nowadays the style of a model starts to be influenced by the technological tools designed to construct it.

The lines that compose the surfaces, the shapes and some of the stylistic solutions that characterize the objects have some common elements, similar in the various styles.

The question would be: is this method a common way to interpret the design of this century? Or maybe is there the basic need to accomplish somehow the rules of the CAx application? It would be very interesting to perform an accurate research on this topic.

Another question is: would a new interactive tool offer to the designer a way to directly interact with the shapes of a model in 3D at first stages, being independent from the CAS operator and their influences in the style, without being limited by technical issues?

We tried to find an answer to this question with the SmartSketches research project trying to fulfill designer-centred approach using new generation tools.



Figure 5: *Some examples of similarity in solving the style of a side view in different car companies.*

9. The SmartSketches approach

Italdesign-Giugiaro has always been investing important resources in new technologies, and one of the current researches carried out by the company is a project, founded by the European Commission, called SmartSketches (IST-2000-28169).

The project consortium is composed by different partners: university (INESC and FEUP from Portugal), research institutes (Fraunhofer Institute from Germany), developer company (Icem Surf R&D from Germany, MIND from Portugal), and end-users companies (Italdesign-Giugiaro and Elasis from Italy, Centimfe from Portugal and Barski-Design from Germany).

SmartSketches is a user-centered approach to introduce computer-based tools in the early stages of product design. The aim is to develop innovative user interfaces, using a multi-modal approach and improving the usability of CAD and CAS systems in the early stages of product design.

Acquainted well with the main software tools used in the design phases, Italdesign-Giugiaro offers good support for the user requirements and for the evaluation and benchmarking of the developed applications in terms of performances, user friendliness and applicability of the results in the daily business.

9.1 Target

The ideal target is to cover the gap between creative skills and very technical applications developing a new tool to be used in the early styling phase of the design process. The new tool should offer support to the everyday users’ work with new multimodal interfaces, giving the possibility to different users with various experiences to interact in an easier way with the tool without the need to have a deep knowledge of the software. Additionally, the tools should be based on easy and intuitive sketches to accomplish design tasks.

9.2 Expected results

The expected project results are a set of products, as an example could be mentioned input devices operating in

immersive environments like a 3D pen, which allows designers to work in a virtual 3D space on a CAD model with the support of immersive modeling techniques, in order to move designing processes into virtual environments and make them work in real time.

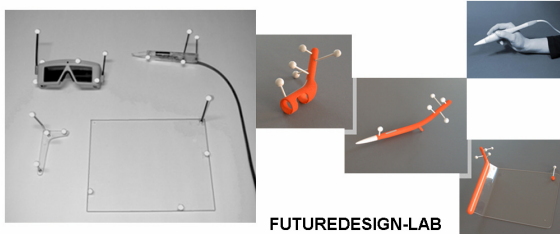


Figure 6: The new tools to interact with the system designed by Barski - Futuredesign Lab.

The tool should be well integrated with the existing commercial tools in order to improve the available functionalities and obtaining faster data exchange; in this way the new instrument will be easier to operate at different steps of the process and it will speed the process up since the early stages of the styling definition.

Some concrete results have already been tested. There are two tools currently working from the SmartSketches team: those are SketchAR and GIDeES.

9.3 SketchAR

SketchAR (Collaborative Free-Form Surface Sketching in Mixed Reality - developed by Fraunhofer Institute of Darmstadt, Germany) is a system that supports three-dimensional modeling not only in space, but also in augmented realities, synchronizing visual data with the precise CAD representation of the product. The integration of a modeling essence, modeling functionality, and data export/import capabilities allows SketchAR to make the difference to traditional VR-systems. Another added value of this software is the introduction of a parametric 3D package model, to provide designers with the main bonds of the package: in this way they would have the basic technical constrains useful for a good approach to the project.

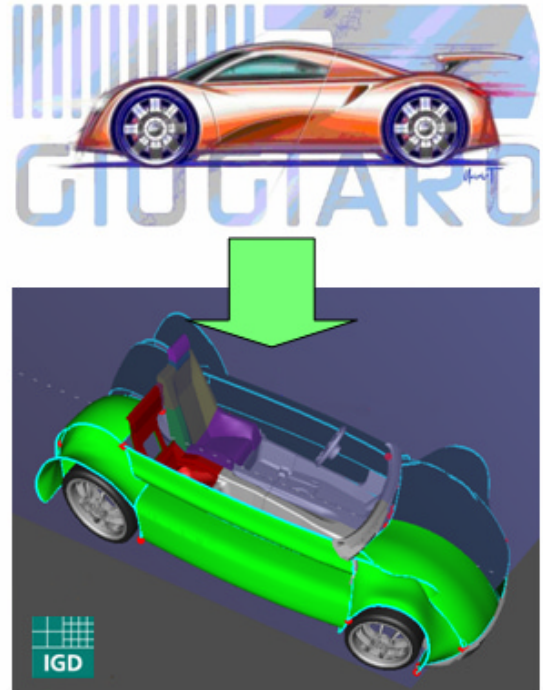


Figure 7: The SketchAR system.

9.4 GIDeES

GIDeES (Gesture-based Interactive Design System) allows users to interact with the system using easy input gestures and sketches (Calligraphic Interfaces) to enter commands. In this way it will be possible for a designer to easily create some defined shapes as curves, shapes etc.

9.5 Sketch Based Retrieval

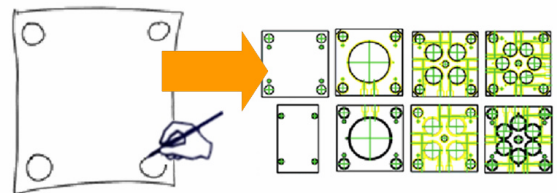


Figure 8: The Sketch based retrieval system.

Another useful result of SmartSketches is the sketch based retrieval, the possibility to have an access to an information store in an easier and more intuitive way than on a normal database. In certain cases in fact, the designer may spend a lot of time searching for previous technical solutions, which is hard to find since it is stored in static archives with gigabytes of data.

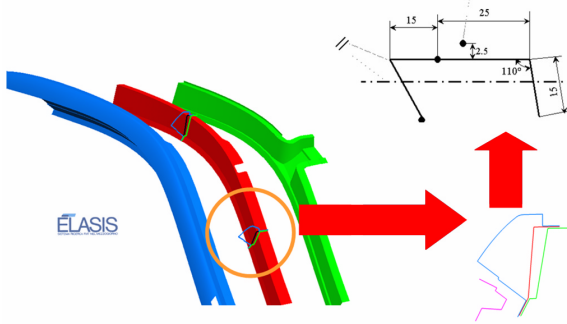


Figure 9: Automotive applications of the Sketch based retrieval system.

This module of the SmartSketches project can be viewed as a Plug-In to integrate into the 2D editor offering mechanisms for reuse and retrieval of past drawings or elements from ready-to-use libraries of components.

9.6 ICEM implementations

Additional functionalities have been implemented by the commercial software partner Icem, following Italdesign – Giugiaro’s requirements in order to be integrated by the software on the market and offer to the users the main new interactive functionalities developed in the project.

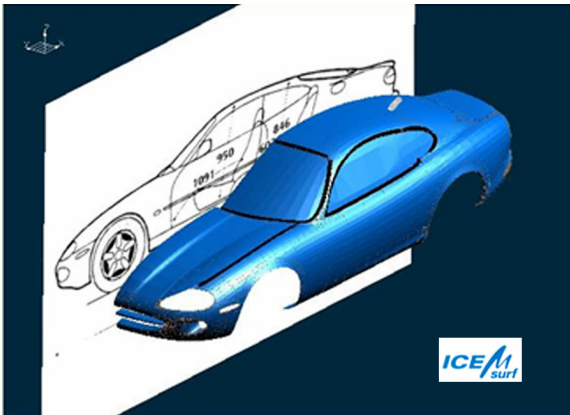


Figure 10: The Sketch-on-surface implemented by Icem

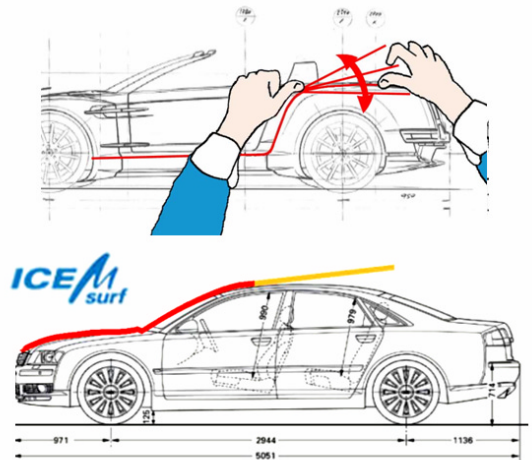


Figure 11: The virtual-tape implemented by Icem.

10. Conclusions

The SmartSketches project investigates in one of the more interesting field related to the need to overcome the existing gap between the real model creation and the mathematical 3D model realization.

Due to the fact that it is a research project that explores in a new field, it is clear that, at the moment, the result is still far from an industrial reality. In fact it does not offer yet the potentiality to afford an engineering project in the correct way.

In this sense, the collaboration between design centers, software houses and research institutions should be closer, in order to better understand the problems and the issues of the designers-users that approach to that new software. But of course this analysis represents the right way to start developing a tool that would make the workflow more designer-centered.

Generally, the introduction of new interactive tools at the early stages of the design process, would contribute to make the process more user friendly and designer oriented. In this way designers could have a larger freedom in performing their work, without all the technical bonds and with the possibility to investigate in new shapes and innovative style solutions.

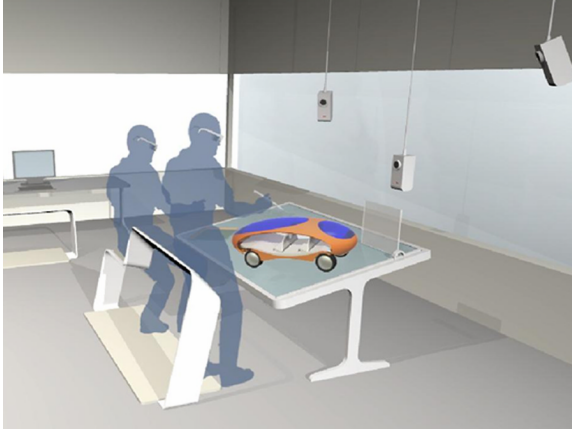


Figure 12: The ideal work of designer in the next future (directly in 3D space).

The advantages for the car companies will be the simplification and speed-up of the approach for the early stages of the styling definition, by the development of new integrated instruments usable at different steps of the process. At the same time there will be the integration with existing commercial tools in order to improve the available functionalities obtaining an easier data exchange. This will make possible that users with different professional skills will be involved in the digital process, increasing consequently the company process' competitiveness.

The final aim of the effort made in the research is supporting the users (designers and engineers as well), along the whole development process, providing them with new tools, easier interaction, new methodologies in order to increase productivity, helping them in performing their jobs, making it easier to use the new advanced technologies, sharing and capturing knowledge and experiences.

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