

## A View of Design (and JMD): The French Perspective

A quick glance on history of science and engineering shows that the creation and invention of technical products has held a great appeal in France. A tradition of inventiveness, engineering, and entrepreneurship has developed over the past several centuries; some famous mechanical and industrial pioneers, for instance, Gustave Eiffel, Louis Renault, André Citroën, André Michelin, Marcel Schlumberger, Louis Blériot,<sup>1</sup> and William LeBaron Jenney<sup>2</sup> are alumni of the Ecole Centrale Paris. Technical realizations like the TGV<sup>3</sup> train or Concorde airplane also illustrate this tradition of design.

The French research in design is anchored in the mechanical discipline. In the late 1980s, a design community was progressively constituted through the desire to merge mechanics with computer science. An academic network, named PRIMECA (*Pôle de Ressources Informatiques pour la MECAnique* or Computer Science Resource Association for Mechanics), was created to promote the use and development of integrated design and manufacturing approaches in mechanics and to encourage the training in computer aided mechanical design and manufacturing. This network—still active nowadays—had a major influence on research in design. Several French researchers (including ourselves) are heirs of PRIMECA. This network probably was instrumental to the successful development in France of well-known CAD software, now in a leading position in the worldwide market. The success and the dynamism of this network also may contribute to a delay in the participation of the French design community to the Design Society as it emerged initially in Europe.

Since then, the scope of research in design has been widened, going from mechanical design to CAD and industrial engineering. As in other countries, design has now become open to the societal challenges of the 21st century. The French design community now looks to integrate standard engineering with disciplines such as human factors, marketing, cognitive ergonomics, knowledge modeling, and artificial intelligence. New fields, such as systems engineering, sustainable design, customer-oriented design, or information management, have significantly emerged and constitute progressively their corpus of knowledge. Some research in design can be seen as a part of industrial engineering, keeps a “tools-oriented” paradigm, and certain themes like PDM or PLM are being particularly well represented.

Another particularity of France lies in its system of engineer education beside universities, the Engineering School (“Grandes Ecoles”) system. This system allows the establishment of strong connections with industry and a relative quick feedback of industrial needs on the curricula. It is common that Masters’ thesis work (and also Ph.D. with the system of the national Central Investment Fund for Research Enhancement grants) takes place

within companies. This system feeds research issues that are anchored in an industrial ground, and research in design is often pulled by the main French industries (i.e., automobile, aeronautics, and energy). This fact will be reinforced by the recent decisions of the French government concerning the autonomy of Universities (e.g., a new right of the Universities to set initial professor salaries and maybe soon to have merit raises and promotions to full professorships done locally by the University rather than centrally by the Ministry of Education) and the “Grand Emprunt” (“Big Loan”) project for education and research fostering virtual laboratories between university faculties and companies.

With these strong industrial connections, design research is then generally more context dependent and tools oriented and puts a stronger value-creation requirements than in the United States. This is why design processes, design knowledge and competences, design organization, design platforms, digital prototyping, design management, and integration of methodologies may be strongly emphasized by French design researchers. Rigorous approaches of “action-research” types derived from management sciences are often used to improve design methods and tools in an industrial context. A design research project is generally conducted in four stages:

1. A first observation round of design practices leads to design processes representation and to a diagnostic analysis.
2. Next, industrial improvement leads as well as a series of scientific issues are established, resulting often in several state-of-the-art assessments.
3. New models are proposed.
4. These models are integrated into a design platform, a design methodology or guideline, which is deployed, at least partly, in the industrial context, to globally assess the algorithmic efficiency as well as the organizational acceptance or effectiveness. For this last point, deployment protocols and organizational performance measurements must be also designed.

In summary, design research in France is considered as fully successful and completed if it can reach or has reached stage 4 above. For a Ph.D. research program in an industrial context, combining the identification of precise scientific issues and the corresponding state-of-the-art with a completed proof of concept in a company makes it difficult to draw sharp scientific conclusions and report them in published papers, which is the international rule.

In addition, it is worth noting that traditionally French design researchers have suffered from a language barrier with regard to international publications—all written in English. This problem has been not only due in part to their inadequate overall knowledge of English but also due to the way of writing: Use of linguistic precautions, use of metaphors, a wish to have a global vision of the problem, too much time spent in issue justification, emphasis on the limits or the weak points instead of facts and results. After all, French has been the language of diplomacy! In the past

<sup>1</sup>The first aviator to cross the France-England Channel, and the founder of Blériot Industries, becoming later Aérospatiale being further integrated into EADS company.

<sup>2</sup>Considered as the inventor of steel-made skyscrapers and the first skyscraper designer: the Home Insurance Building of Chicago, 1885.

<sup>3</sup>The TGV French train has the world speed records on commercial railways; 515 km/h in May 1997 and 575 km/h in April 2007.

decade, with increased French participation to European projects, the acceptance of the English language prominence, and the pressure for international publications, things are changing and French researchers are more and more accustomed to scientific English writing.

From these elements, an interesting question is Why are there so few French researchers publishing in JMD?

The journal is well known by researchers in mechanism analysis and synthesis, and robotics, and is considered as a leading Journal in this field. They constitute the majority of the contributors to JMD, but they have now a more targeted journal, the *Journal of Mechanisms and Robotics*. In addition, design automation is less studied as such in France, for the reasons evoked above, namely that design deals with other domains. JMD requires careful analysis models, with solid mathematical formalisms and frequent use of statistics, design of experiments, or applied mathematics. Again, the French researchers in design do not often make this formalization effort, being more results oriented.

But things are moving fast. The JMD scope and recent special issues have been more open to multidisciplinary issues. French researchers are also influenced by the American rigor and way of publishing. Globalization tends to act by reinforcing research quality, but preserving in the meantime historical differences and particular local nature. As a matter of fact, two upcoming events in design engineering, organized by the French design community, may be of interest to the JMD readership:

- The second CSDM conference, standing for Complex Systems Design and Management (see <http://www.csdm2011.csdm.fr/>), in Paris in Dec. 7–9, 2011, is cosponsored by INCOSE and co-organized by Ecole Polytechnique, Ecole Centrale Paris and Supélec, three “Grandes Ecoles.”
- The IDMMÉ—Virtual Concept international conference (Integrated Design and Manufacturing in Mechanical Engineering—see the 2010 event at <http://www.idmme-virtual-concept.estia.fr/>). This biennial conference (whose first event was held at Ecole Centrale de Nantes in 1996) emanates from

the PRIMECA network and is now under the scientific partnership of ASME, Design Society, CIRP, and the Association Française de Mécanique. The next event will be a joint meeting with the Italian and Spanish design communities and will take place in 2013 in Spain (venue to be confirmed).

It is fair to say that the French design community is quickly integrating with other design communities across the world and has not only much to learn but also much to offer. We expect that some of that will happen through JMD’s publications.



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