

THE FACTORS SHAPING DESIGN RESEARCH AND ITS RELATIONSHIP WITH INDUSTRY

Fatima Saikaly, Politecnico di Milano, Italy

The Distinction Between External and Internal Factors

The interplay of several different factors has been shaping the nature and evolution of doctoral research in design and its relationship with industry. These factors were divided into external and internal factors. The distinction between external and internal factors was borrowed from a model of the history of sciences,¹ concerned with the study of the evolution of scientific paradigms and theories (Findeli and De Coninck, 2002). According to this model, internal factors depend mainly on the internal logic of design. External factors depend on economic, social, cultural and political issues.

Following this model, the main external factors shaping the nature and evolution of doctoral research in design and its relationship with industry are the following: the higher education reforms, the decision makers stances, the programmes' contexts and the new challenges and orientations of academic research. The followings are the main internal factors: design research as a young field of inquiry, the 'nature' of design in various contexts, the different areas of design research and finally the growing design complexity.

Strategy and Methods of Research

The identification of these factors resulted from the case studies of ten PhD programmes in design (Saikaly, 2004).² The study covered seven countries where a considerable number of graduate programmes in design was found.³ The criterion for the selection of the programmes was the consideration of the best practices in doctoral education in design. Each case study was divided in three parts: the study of the PhD programme; the study of a selected PhD thesis and an interview with the coordinator or a supervisor of the programme (Saikaly, 2003; Saikaly 2005).⁴ Recently, a questionnaire was sent to a list of twenty-two experts⁵ in design research. Ten of these experts⁶ answered the questions. The questions are:

- What are the most significant (research and theoretical) trends within your PhD programme (or doctoral education in design in general)?
- Is there an increasing demand of this kind of design research?
- What about its relationship with industry?
- What do you think about the future of this kind of design education?

The study and analysis of the collected material are reported in the following sections.

External factors

Higher Education Reforms

Higher education reforms, such as changes in the structure of higher education, in the status of higher education institutions or in the nature of doctoral education, are among the several external factors shaping doctoral research in design. For example, in the Australian (Davis, 2003) and the British context (Archer 2000; Durling 2000) these changes due to higher education reforms were more evident than in other contexts studied.

In Britain for example, in 1965, local and regional colleges that taught art and design considered as ‘vocational’ subjects amalgamated to form polytechnics. As a consequence, a first degree in design was offered.⁷ In 1992, Polytechnics became self-governing universities. Doctoral degrees in practitioner disciplines such as design were introduced. Then, in 1997, the UK Council for Graduate Education published its famous report “Practice-Based Doctorates in the Creative and Performing Arts and Design.”⁸ This event marked the launch of doctoral programmes in design in Britain. Several universities extended “[...] the requirements for the award of their Ph.D. degrees, allowing the submission of practical work as part of the candidate’s independent and original contribution to knowledge.”⁹ In particular, the latter reform shortened the distance between academic research from one side and practice from the other side.

Decision Makers Stances

Another factor that is contributing to the actual state of doctoral research in design is the knowledge stances of academic decision makers. In the studied Ph.D. cases, decisions concerning the Ph.D. programmes were mainly made by the heads/coordinators of Ph.D. programmes.¹⁰ In most of these cases the choices of the decision makers were significantly influenced by their educational background, professional background and personal vision concerning design and design research.

This was evident in many cases such as the PhD programme in *Conception de Produits Nouveaux* structured within the Laboratory *Conception de Produits Nouveaux et Innovation, Ecole Nationale Supérieure des Arts et Métiers, ENSAM Paris*. The coordinator of the PhD programme, Prof. Robert Duchamp, who is also the founder of the laboratory finds practice and the collaboration with industry fundamental aspects of their programme and he argues: “[...]. Our research candidates can’t make a PhD if there’s no a practical application to their research project. I think that, today, the characteristic of a research, once concluded, is to be able to introduce new courses for the development of new knowledge. [...]”¹¹

In another example, Prof. George Stiny, the coordinator of the PhD programme in *Design Computation, Massachusetts Institute of Technology*, argues: “There are people on the faculty, not in *Design and Computation*, but in *Building Technology*, who run big projects, and where Ph.D. students do one piece or part of that project as a Ph.D. I think it has much to do with the personality of the people who are running the programme. We could do it that way, but I don’t like this kind of organization. I don’t think it has much to do with design. I’m just not very keen on big projects, I’ve run several, but I’ve never really run one that I thought students learned any more or did any more than they would had if they just worked on their own. The most successful students are the one who worked on their own and did their own things and were motivated in terms of what they were interested in. That’s the way I did mine, but I didn’t do mine in design. I did my Ph.D. in mathematics and I don’t know, they just left me alone for three years. You know, I had to see my advisor occasionally, let him know what I was doing. But there was no classes to take or any pressure to do something that they wanted you to do. I thought that was successful.”¹²

Programmes’ Contexts

In some cases, doctoral programmes belonged to a kind of ‘scientific’ context. The surrounding environment, such as the different departments, conferences, initiatives and activities, etc., were mainly characterized by scientific ‘attitudes.’ In these cases, a scientific approach to doctoral programmes was adopted and basic research was dominant. This, for example, was noticed during the visits to the doctoral programmes *Design and Computation* at the Massachusetts Institute of Technology and *Design and Innovation* at the Open University.

In other cases, doctoral programmes belonged to an ‘art and design’ context. In these contexts design practice was a dominant activity. This was very evident in two cases, the doctoral programme in *Art and Design* from Sheffield Hallam University and the doctoral programme in *Industrial Design and Multimedia Communication* from the *Politecnico di Milano*. In both contexts, Sheffield and Milan, design is considered as a driving force for regional regeneration and industrial competitiveness. In these doctoral programmes, applied research was often adopted.

Challenges and Orientations of Academic Research

The last external factor is the different challenges that face all the areas of academic research, with design research no exception. Among these challenges (*Centre National de la Recherche Scientifique*, 2002; Jonas, 2003) is the classical distinction between “fundamental research” and “finalized research.” The tendency is towards seeing research as an integrated space of different activities. Another challenge is the classical distinction between “theoretical priorities” of knowledge and “research tools.” The tendency is towards renewing methodologies and research problems by opening the way to new possibilities. The distinction between distinct disciplines, with each discipline assigned its specific camps and methods, is another challenge. The tendency is towards interdisciplinary research. Finally, “complexity” challenges and the need to face this challenge with new ‘thinking tools’ must be considered (ibid.).

All these challenges are orienting research within organisations towards multidisciplinary, interdisciplinary and transdisciplinary¹³ practices and thinking; towards the redefinition of the evaluation and consideration modes of the “social demand;”¹⁴ and towards reinforcing systematically, within each institution, a collective practice of scientific auto-reflectivity based on the existence of permanent places for exchanging ideas and debates (ibid.).

Internal Factors

Young Field of Inquiry

The fact that doctoral research in design is a relatively new field of inquiry¹⁵ can be considered the most significant factor shaping the nature and evolution of design research. In fact the study of the launch and evolution of doctoral programmes in already established disciplines,¹⁶ with a long research history and tradition, has shown that the existence of an initial phase of development is very common and is an important phase of evolution of all academic disciplines (Byrne, 2001; Friedman, 2003; Krippendorff, 1999).

Byrne (2001) makes a comparison with anthropology: “Anthropological inquiry has thrived on conflicts between different epistemological and theoretical traditions for over a century. The discipline grew because the conflicts offered tremendous opportunities to improve our knowledge about contested topics. The struggles spur anthropologists as a collective to discover more about our species, history, socio-cultural systems and options. [...]”

‘Nature’ of Design in Various Contexts

The ‘nature’ of design varied from one doctoral programme to another, and as a consequence the nature of design research also varied. This change in the ‘nature’ of design depended mostly on the curriculum of the doctoral programmes and their relative intentions. The ‘nature’ of design and its dependence on the curriculum and the intentions of doctoral programmes can be better understood through the following example.

In describing the curriculum of design education within the Bauhaus tradition, Findeli (2001) developed the archetypal model represented in figure 1. A three-part structure, art / science / technology, was developed. The structure was enclosed in a general purpose for design.

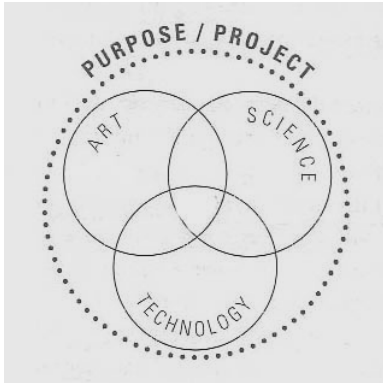


FIGURE 1. An archetype of design curriculum (Findeli, 2001).

In changing the articulation between the components of the curriculum, the relative weight of the three dimensions and the general intention, the nature of design and the general purpose of design varied as shown in figure 2. This was similar in the case of the doctoral programmes studied, where the 'nature' of design depended mostly on the curriculum and the intention of the doctoral programme. These curricula consisted of different embodiments. Embodiments were given different degrees of importance and were articulated in different ways, and had different overall purposes.

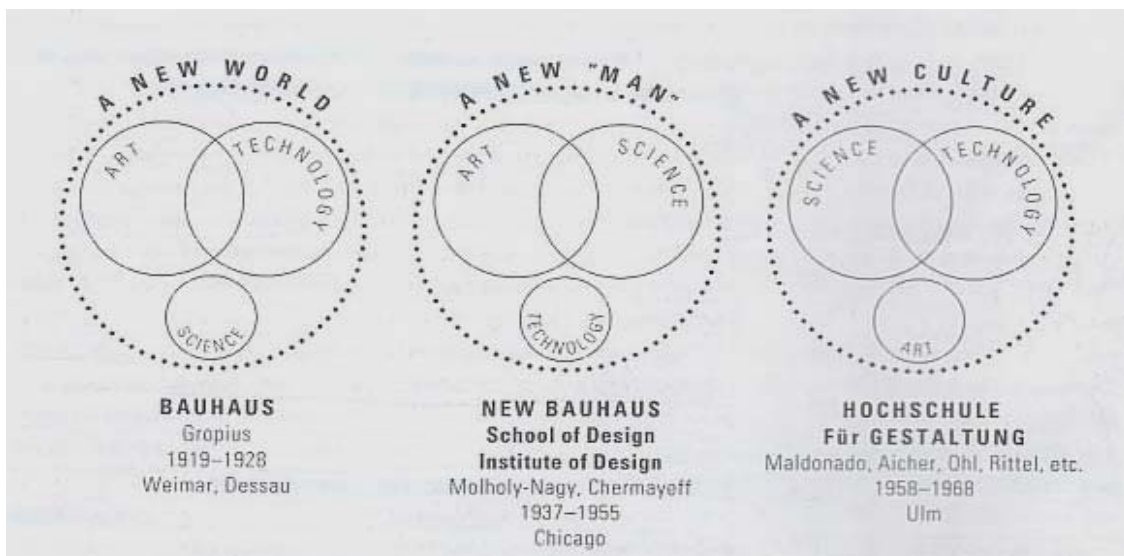


FIGURE 2. Three historical embodiments of the archetype (Findeli, 2001).

Areas of Research

The areas of research are among the internal factors that are contributing in shaping the nature and evolution of doctoral research in design and its relationship with industry. In each doctoral

programme several areas of research were identified. In some areas of research, such as *artificial intelligence in design, computer support for collaborative design, design cognition, shape representation and synthesis, digital modelling and rendering*, etc., design research and design discourse are very similar to research and discourse in scientific disciplines.

In other areas of research, such as *modelling product attributes, modelling the integration of professions within the conception process, creative practice, new product development, tangible computing, intelligent environments*, etc., design research is practice-oriented and the resulting discourse is reflexive and interpretive.

Growing Design Complexity

Among the internal factors that have been contributing to the current state of design research, the notion of complexity can be considered as a fundamental issue. It is undeniable that the practice of design has been facing, during the last few years, a growing complexity (Duchamp, 1999; Findeli, 2001; Findeli and De Coninck, 2002; Jonas, 2003; Pizzocaro, 2000a; 2000b).

Duchamp (1999) identifies three levels of design complexity: the intrinsic products complexity, the managerial complexity and the complexity of implementation processes. Findeli (2001) and Findeli and De Coninck (2002) articulate four areas of design complexity: methodological complexity, products complexity, problematics¹⁷ complexity and impact complexity. Pizzocaro (2000a; 2000b) argues for a complex design environment.

For a comprehension of such complex and evolutive design environments, it was found necessary to complement, but not replace, 'traditional' research training with a kind of "complex intelligence" (Findeli, 2001; Findeli and De Coninck, 2002; Le Moigne, 2003, 2004), i.e. the acquisition of methods that permit the perception, description and modelling of complex design situations in order to simulate them, make decisions, intervene, act and then evaluate results.

As a consequence, research should be carried out within, rather than applied to, these systems (Findeli, 2001; Findeli and De Coninck, 2002; Jonas, 2003; Le Moigne, 2003, 2004). The 'project' in these research settings gains a much stronger 'theoretical' status and becomes the terrain of design research, the design project as a support for the theoretical investigation. New research approaches has emerged, whose theoretical framework were inspired by systems science, complexity theory and practical philosophy (ibid.).

Conclusion

Doctoral research in design is in the phase of developing its own educational and methodological core. A progressive research programme, an agenda of core research topics and the quality of design research are among the main interests of the international community of design researchers. The studied cases of ten PhD programmes in design demonstrated a weak relationship between doctoral research in design and industry with only one exception, the PhD programme in *Conception de Produits Nouveaux* of the *Ecole Nationale Supérieure des Arts et Métiers Paris*. In the latter programme, most research projects are developed in partnership with industrial contexts.

The fact that a weak relationship exists between doctoral research in design and industry was also confirmed by the experts points of view. Many of them argue that there's a need to inform and educate industry of why they should contribute to doctoral research in design through

collaborations and funding. It is important to mention that this is not the situation in few countries where governmental efforts, through national policies were made. Countries such as Denmark, Finland, Norway, Sweden, Canada and Korea where design is seen as a major competitive asset in an era of saturated global markets (Korvenmaa, 2000).

In Finland, for example, the Finnish National Fund for Research and Development sponsored a project to investigate the condition and future challenge of Finnish design. As a consequence the ministries of education and of trade and commerce settled up a working group to produce a national policy programme. A mission declaration, released by the Finnish Government, considered design as a success factor for the future. Then a Round Table of Design was established in order to increase the exchange of design knowledge and expertise with industry. And recently a national, multi-disciplinary research programme in design ranging from theory creation to r&d and covering social and cultural aspect was launched (ibid.).

Another positive example about the collaboration between design research and industry is from Korea where recently the Korean Government launched design policies to support Korean design. The result was the creation of a network of collaboration between universities, industry and government. Basic design research projects are financed each year by the government and done in collaboration between universities and industries (Lee, 2000).

Notes

1. Refer to Alain Findeli and Pierre De Coninck's paper: Findeli, A., and De Coninck, P., 2002. "Une Formation Universitaire de Recherche en Design et Complexité." *In: Les Sciences de la Conception. Enjeu Scientifique du XXI^e Siècle. En Hommage à Herbert Simon, Lyon, France, 15-16 Mars 2002.* Lyon, France: INSA Lyon.
2. The study was developed in 2003/2004 and was one of the two strategies I adopted during my doctoral research where the main focus was on the methodologies of design research:
Saikaly, F. 2004. *Doctoral Research in Design: Towards the Designerly Way.* Ph.D. thesis, Politecnico di Milano.
3. An unpublished research that I developed in 1999 at the *Politecnico di Milano*, focused on the mapping of undergraduate and postgraduate design programmes offered in different geographical-cultural contexts. One of the results of the study was that the majority of Ph.D. programmes in design were found in northern America, Australia, Europe and Japan, and that most of these programmes were launched during the 1990s. The selected countries for the study are: Canada and the USA from northern America; Australia; France, Germany, Great Britain and Italy from Europe and Japan.
4. The description of the best practice criterion, the list of selected PhD programmes in design; the methods used; the main findings and the discussion of the results of this empirical work can be found in the following publications:
Saikaly, F. 2003. Design Re-Thinking: Some Issues About Doctoral Programmes in Design. *In: Techné: Design Wisdom: 5th European Academy of Design Conference, Barcelona, 28-30 April 2003.* (on-line: <http://www.ub.es/5ead/PDF/10/Saikaly.pdf>).
Saikaly, F. 2005. Approaches to Design Research: Towards the Designerly Way. *In: Design System Evolution: 6th European Academy of Design Conference, Bremen, 29-31 March 2005.* (CD Rom and on-line: http://www.verhaag.net/ead06/fullpapers/ead06_id187_2.pdf).
5. The theoreticians that were considered experts in design research are: the ones who have several publications concerning the topics of design research and doctoral research in design;

coordinators of PhD programmes in design and those involved in the structuring and orienting of doctoral research.

6. The experts who answered the questions are:

- Dr Michael A R Biggs, Professor of Aesthetics and Associate Dean Research, Faculty for the Creative and Cultural Industries, University of Hertfordshire;
- Dr. Lily Díaz-Kommonen, Coordinator PhD programme, Systems of Representation & Digital Cultural Heritage, Media Lab, University of Art and Design Helsinki / UIAH;
- Dr David Durling, Professor of Design, School of Arts, Middlesex University;
- Dr. Giancarlo Ferrigno, Director of the Politecnico di Milano's Doctoral School, Full Professor of Electronic Bioengineering, Bioengineering Department, Politecnico di Milano;
- Dr Ken Friedman, Professor of Leadership and Strategic Design, Department of Communication, Culture, and Language, Norwegian School of Management, Design Research Centre, Denmark's Design School;
- Dr. Terence Love, Department of Design, Curtin University, Western Australia;
- Dr Darren Newbury, Birmingham Institute of Art and Design, University of Central England;
- Dr Charles L. Owen, Distinguished Professor Emeritus, Institute of Design, Illinois Institute of Technology;
- Dr. David Pijawka, Coordinator PhD programme, School of Design, College of Architecture and Environmental Design, Arizona State University;
- Dr. Silvia Pizzocaro, Associate Professor, INDACO Department, Faculty of Design, Politecnico di Milano

7. Before this date a vocational award was assigned. It was known as the National Diploma in Design (NDD). Then a more academically based award was established, the Diploma in Art and Design (DipAD). Then came the transition to undergraduate degree. For an in-depth study, refer to David Durling's paper: "Design in the UK: Some Reflections on the Emerging Ph.D." In: D. Durling and K. Friedman, eds. *Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000*. Stoke-on-Trent: Staffordshire University Press, pp 317-327.

8. United Kingdom Council For Graduate Education. 1997. *Practice-Based Doctorates in the Creative and Performing Arts and Design*. United Kingdom: UK Council for Graduate Education.

9. For an in-depth study, refer to Bruce Archer's paper: "A Background to Doctoral Awards." In: D. Durling and K. Friedman, eds. *Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000*. Stoke-on-Trent: Staffordshire University Press, pp 257-260.

10. In six of the ten studied cases, the post of head / coordinator of the doctoral programme existed. During the interviews, they explicitly expressed their choices about the philosophies, intentions, contents and areas of research adopted within the programmes and their relative motivations.

11. Duchamp, R., 2002. Personal communication (Interview, 25 July 2003).

12. STINY, G., 2003. Personal communication (Interview, 28 May 2003).

13. For a detailed description of each practice refer to: *Centre National de la Recherche Scientifique, 2002. "Extraits du schéma stratégique du CNRS 2002."* [online]. Available from: <http://ns3833.ovh.net/~mcxapc/docs/ateliers/lemoign4.pdf> [Accessed 28 July 2002].

14. Social demand is expressed by various actors such as local and public authorities, professional groups, enterprises, financial institutions, editors, media, justice, consumer associations, nongovernmental organisations, etc.

15. About the topic of design as a young field of inquiry, refer to:

Durling, D., and Friedman, K., 2000. "Introduction." In: D. Durling and K. Friedman, eds. *Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000*. Stoke-on-Trent: Staffordshire University Press, pp 1-2;

Friedman, K., 2000. "Form and Structure of the Doctorate in Design: Prelude to a Multilogue." *In: D. Durling and K. Friedman, eds. Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000.* Stoke-on-Trent: Staffordshire University Press, pp 369-376.

16. Comparisons were developed with disciplines such as physics (Friedman, 2003), anthropology (Byrne, 2001) and communication (Krippendorff, 1999).

17. According to Findeli *in: Findeli, A., 2001. "Rethinking Design Education for the 21st Century: Theoretical, Methodological, and Ethical Discussion." Design Issues, volume 17, number 1, p 12: "the French word 'problématique' is an important concept of Foucault's archaeology. In design it is the result of the complexification of mere product-centred problems in terms of social, economic, symbolic, political, etc. issues."*

References

ARCHER, B., 2000. A background to doctoral awards. *In: D. Durling and K. Friedman, eds. Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000.* Stoke-on-Trent: Staffordshire University Press, pp 257-260.

BYRNE, B., 9 September 2001, Re: Will design research go beyond non-reflexive modes of inquiry? *PhD-Design* [online]. Available from: phd-design@jiscmail.ac.uk [Accessed 4 January 2002].

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, 2002. *Extraits du Schéma Stratégique du CNRS 2002* [online].

Available from: <http://ns3833.ovh.net/~mxcapc/docs/ateliers/lemoign4.pdf> [Accessed 28 July 2002].

DAVIS, D., 2003. A working model for postgraduate practice based research across the creative arts. *In: D. Durling, and K. Sugiyama, eds. Doctoral Education in Design, Tsukuba, Japan, 14-17 October 2003.* Tsukuba: University of Tsukuba, pp 15-24.

DUCHAMP, R., 1999. *Méthodes de Conception de Produits Nouveaux.* Paris: Hermes Science Publications.

DUCHAMP, R., 2002. Personal communication (Interview, 25 July 2003).

DURLING, D., 2000. Design in the UK: some reflections on the emerging Ph.D. *In: D. Durling and K. Friedman, eds. Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000.* Stoke-on-Trent: Staffordshire University Press, pp 317-327.

DURLING, D., and FRIEDMAN, K., 2000. Introduction. *In: D. Durling and K. Friedman, eds. Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000.* Stoke-on-Trent: Staffordshire University Press, pp 1-2.

FINDELI, A., 2001. Rethinking design education for the 21st century: theoretical, methodological, and ethical discussion. *Design Issues, volume 17, number 1, pp 5-17.*

FINDELI, A., and DE CONINCK, P., 2002. Une formation universitaire de recherche en "Design et Complexité." *In: Les Sciences de la Conception. Enjeu Scientifique du XXI^e Siècle. En Hommage à Herbert Simon, Lyon, France, 15-16 Mars 2002.* Lyon, France: INSA Lyon.

FRIEDMAN, K., 2000. Form and structure of the doctorate in design: prelude to a multilogue. *In: D. Durling and K. Friedman, eds. Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000.* Stoke-on-Trent: Staffordshire University Press, pp 369-376.

FRIEDMAN, K., 2003. A new year for Design Research News. *Design Research News* [online], volume 8, number 1, January 2003.

Available from: <http://www.jiscmail.ac.uk/lists/design-research.html> [Accessed 09 January 2003].

JONAS, W., 2003. Mind the gap! – on knowing and – not knowing in design. *In: Techne: Design Wisdom: the 5th European Academy of Design Conference, Barcelona, 28-30 April 2003.*

- KORVENMAA, P., 2000. Design research and the wealth of nation. In: D. Durling, and K. Friedman, eds. *Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000*. Stoke-on-Trent: Staffordshire University Press, pp 447-452.
- KRIRIPPENDORFF, K., 1999. A field for growing doctorates in design. In: R. Buchanan, D. Doordan, and L. Justice, eds. *Doctoral Education in Design, Ohio, 8-11 October 1998*. Pittsburgh, Pennsylvania: The School of Design, Carnegie Mellon University, pp 207-224.
- LEE, K-P., 2000. Triad collaboration between school, industry and government for bridging research and practice in design. In: D. Durling, and K. Friedman, eds. *Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000*. Stoke-on-Trent: Staffordshire University Press, pp 453-460.
- LE MOIGNE, J.-L., 2003. Editorial. L'intelligence de la complexité a et à deux mains: celle qui tient le pinceau et celle qui tient le ciseau. *Interlettre Chemin Faisant MCX-APC* [online], number 22, Novembre-Décembre 2003.
Available from: <http://ns3833.ovh.net/~mxcapc/interlettre.php> [Accessed 20 Novembre 2003].
- LE MOIGNE, J.-L., 2004. Editorial. Sur l'exercice de l'intelligence de la complexité: travailler à bien penser, une éthique de la compréhension. *Interlettre Chemin Faisant MCX-APC* [online], number 23, January-March 2004.
Available from: <http://ns3833.ovh.net/~mxcapc/interlettre.php> [Accessed 15 March 2004].
- PIZZOCARO, S., 2000a. Research, theory and design culture: a knowledge growing within complexity. In: S. Pizzocaro, A. Arruda, and D. De Moraes, eds. *Design Plus Research, Milano, Italy, 18-20 May 2000*. Milano, Italy: the Ph.D. programme in industrial design, Politecnico di Milano, pp 90-95.
- PIZZOCARO, S., 2000b. Complexity, uncertainty, adaptability: reflections around design research. In: D. Durling and K. Friedman, eds. *Doctoral Education in Design: Foundations for the Future, La Clusaz, France, 8-12 July 2000*. Stoke-on-Trent: Staffordshire University Press, pp 247-254.
- SAIKALY, F. 2003. Design re-thinking: some issues about doctoral programmes in design. In: *Techné: Design Wisdom: 5th European Academy of Design Conference, Barcelona, 28-30 April 2003*. (on-line: <http://www.ub.es/5ead/PDF/10/Saikaly.pdf>).
- SAIKALY, F. 2004. *Doctoral Research in Design: Towards the Designerly Way*. Ph.D. thesis, Politecnico di Milano.
- SAIKALY, F. 2005. Approaches to design research: towards the designerly way. In: *Design System Evolution: 6th European Academy of Design Conference, Bremen, 29-31 March 2005*. (CD Rom and on-line: http://www.verhaag.net/ead06/fullpapers/ead06_id187_2.pdf).
- STINY, G., 2003. Personal communication (Interview, 28 May 2003).
- UNITED KINGDOM COUNCIL FOR GRADUATE EDUCATION. 1997. *Practice-Based Doctorates in the Creative and Performing Arts and Design*. United Kingdom: UK Council for Graduate Education.