

DISTRIBUTED INNOVATION

Steven MacGregor concludes his series of features on research he has been carrying out over the last few years.

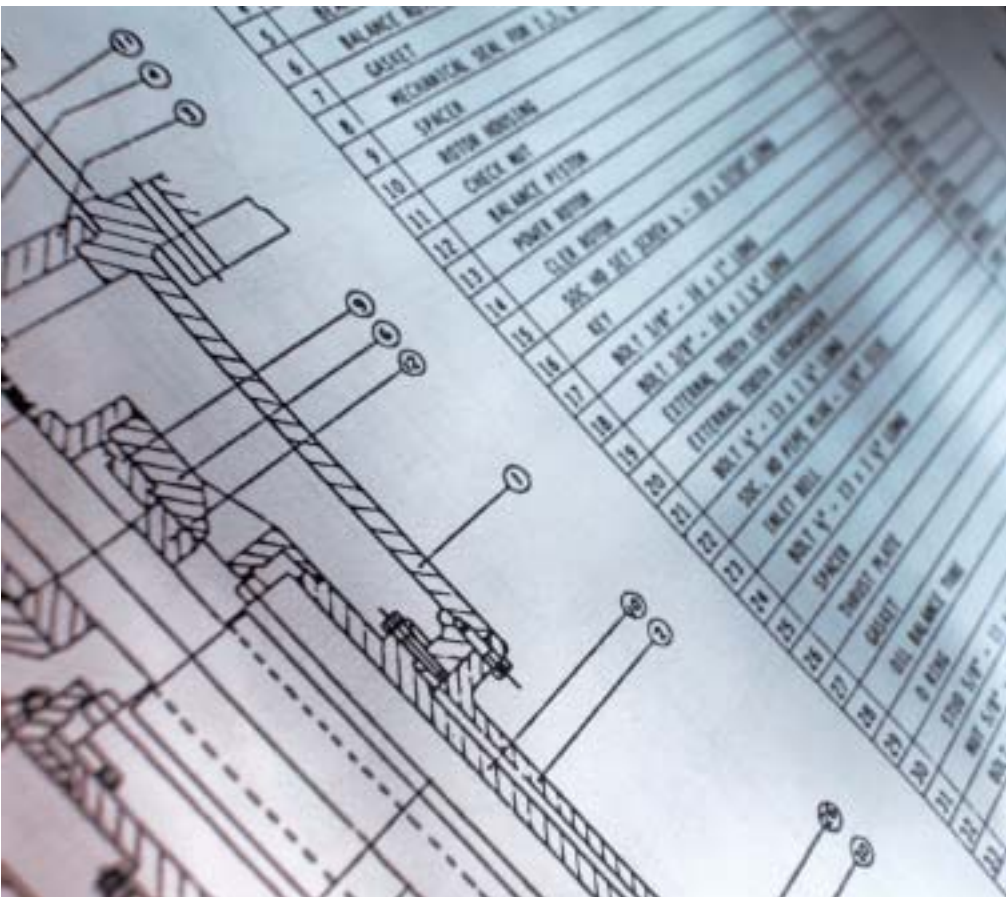
This is the third and final article on a Strathclyde University PhD¹ in distributed engineering design. The first article was published in *Engineering Designer*, July/August 2001, and discussed some findings from the first industrial case study in ABB Vetco Gray, focusing on information sharing in distributed work. The second article, published in two parts, (January/February 2003 and March/April 2003) discussed a section of the literature review showing the research to be rooted in the computer supported cooperative work (CSCW) and knowledge management fields. Here, some results from the second main case conducted in the Packaging Design and Technology Centre in Lever Fabergé are presented, together with the overall result of the research and present activities. Specifically, the theme of innovation is discussed within the context of distribution.

Defining innovation

These days, innovation is everywhere. That is, the term is highly visible in both industrial and academic communities – with efficient practice remaining a goal for both. It seems to have succeeded knowledge management as the current buzzword and Holy Grail for organisations looking to increase value, and for consultants to increase business. Organisations like London Innovation² and the DTI's future and innovation unit are indicative of the importance of innovation, now regarded in many circles as the single greatest point of leverage for sustainable growth in an organisation.

Taken from the Latin *novare* (to make new) the Oxford English Dictionary defines the act of innovation as to: "make changes in something established, especially by introducing new methods, ideas, or products". London Innovation defines it as 'the invention of new technologies, products and production processes, through the successful exploitation of ideas'. Whatever the disparities between modification and invention, common elements in innovation seem to be the concept of newness, exploitation and sustainable success. In other words, a process that can turn ideas into value.

Terms including innovation ecology and knowledge innovation abound within many and varied fields. However, the design community has more claim to the term innovation than most, with the design of products central to the concept of adding organisational value. If innovation is the value-added exploitation of ideas, design activity has the potential to make many of those ideas reality. The design process, in being an inherently social activity is also closely linked with the creation of innovative cultures where the workforce interacts to exchange ideas and transfer large amounts of knowledge. Design practice is often the application or context for many innovation strategies. Yet it is not easy to do, particularly in organisations where established cultures of low-risk, short-term rewards are pervasive. Many sources of help are available, including the Art of Innovation³



from IDEO general manager Tom Kelley, which aims to show how a value-adding, innovative culture can be created within an organisation.

However, few people examine innovation as it happens across the physical space. Presumably, there is enough to contend with examining the core concept with its associated processes and cultures. Likewise, the field of distributed work or global design is complex enough in its own right without adding further challenges. Yet the need exists to examine innovation and original design within the context of distribution – increased innovation is one of the primary benefits that can result from bringing dispersed global design communities together in the design process. However, further research and development is required to minimise the barriers to innovation that presently exist. For example, benefits including becoming aware of different design perspectives and using colleagues' high experience levels are marginalised by being unaware of work going on at other sites and the unavailability of distributed colleagues.

The Lever case

The second main case study of the PhD research took place in the Packaging Design and Technology Centre of Lever Fabergé (Lever). Lever must innovate continually due to the level of competition in the fast moving consumer goods (FMCG) market and rate of change of customer preferences. This provided an original design environment comparison with the adaptive/variant design activity present in the first case in ABB Vetco Gray (ABB VG). The same data collection methodology was used to investigate distributed design activity and related concepts including knowledge management. Findings emerged across four main themes in both cases, namely, distributed activity, design process, knowledge and people.

The incidence of distribution was high in both cases, although higher in Lever. Distributed activity as a percentage of overall work (questionnaires) was perceived to be 18 per cent in ABB VG and 50 per cent in Lever with daily incidence sourced from daily diaries of 56 per cent and 61 per cent respectively. On-site observation showed that almost daily, distributed interaction would occur during certain stages of a project. Figures for overall activity and daily incidence together with observation shows that distributed interactions are:

- Short – 5 to 15 minutes;
- Frequent – day to day and on a daily basis, and;
- Highly influential in terms of proceeding and shaping work – critical information received, questions asked, decisions made.

Asynchronous communication was slightly more prevalent in both cases and accounted for day-to-day distributed activity. Synchronous communication was the norm when problems were encountered or time was short. Asynchronous communication is predominant due to the difficulty in ensuring availability of a distributed colleague while it also allows thought, digestion and understanding of complex or important problems. There were more collaborators directly involved in the design projects of Lever than in ABB VG, including customers, design houses, marketeers, and suppliers. Unlike ABB VG, most distributed problems in Lever were internal to the organisation, dealing with different functions like marketing, as opposed to similar functions outwith the organisation.

Knowledge and information is crucial for distributed work. Forty per cent and 34 per cent of time was perceived to be taken sourcing or locating relevant information and knowledge in Lever and ABB VG respectively. Important initial questions are needing to know if it exists and if so, where to get it. With respect to people sources in Lever, distributed colleagues know more than a collocated colleague 56 per cent of the time and colleagues from another floor or department know more 43 per cent of the time. These figures were 51 per cent and 57 per cent in ABB VG. They reinforce the belief that distributed design, and its many challenges, occur within the same site as well as different countries and time-zones. The second figure is lower in Lever showing that the case site does not contain as many opportunities for knowledge transfer as ABB VG. Re-design of the physical space may therefore support distributed work.

Important considerations for management and people include clearly specifying the function identity and structure of the team. Comparative sizes of each collaborative team is also important – problems were encountered when one partner was significantly larger, leading to inconsistent points of contact and a lack of trust. Each aspect should be considered in light of the specific profile of distributed work, which differs from the collocated space. Trust was shown to be required on two

levels, the social – do I feel comfortable working with you? and the professional – am I confident that you can do the job? Culture was also divided into four groups – geographical, company, discipline and technological.

Many of these findings resulted in the creation of the Distributed Design Workspace, a type of ecosystem, which details the main elements and interactions in the distributed space.

In summary, the Lever case highlighted several main elements necessary for improved original design and innovative practice, in general, and over distance:

- The need for physical models – Unlike ABB VG, Lever designers needed continual feedback from physical mock-ups, without which visualisation and the transfer of creative thought proved difficult. Rapid prototyping facilities were indispensable to the evolution of ideas, and presented a real barrier to the effectiveness of distributed design.
- Importance of the physical space – the design of the collocated space should not be neglected when working in the virtual space. The environment should be conducive to team and group communication and the transfer of knowledge.
- Core and extended team strategy – The core creative team at Lever were supported by a number of design 'satellites', who would conduct extra design work and provide a greater knowledge of local market conditions. In many cases, design experience was of a lower level and a knowledge transfer process of 'Do-Aid-Guide-Disengage' was in place.

Although Lever were generally aware of the importance of these elements, as with the ABB VG case, several main needs existed for improved distributed work:

- Distributed training – the need for a greater understanding of the unique challenges provided by distribution and knowing how to design and communicate at distance.
- Distributed context – the complexity of the distributed space, including dozens of characteristics which uniquely define the challenges of each distributed project.
- Increased awareness – low levels of awareness in the distributed team across several categories was the root cause of many distributed failures.

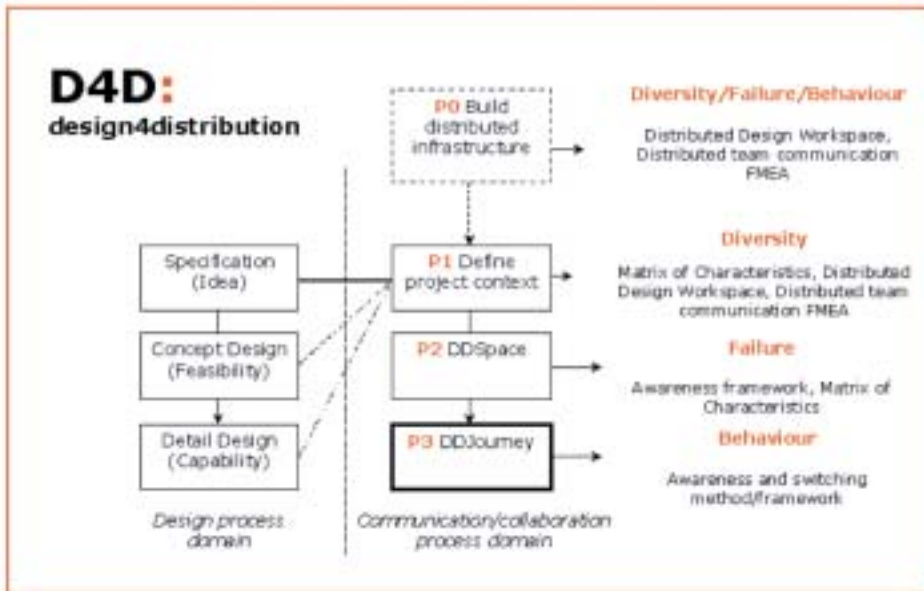


Figure 1

■ Distributed process management – representation of distributed behaviour and the differences from collocated work is required in order to effectively prescribe appropriate actions.

The D4D framework

These needs together with other thesis findings resulted in a specification for the D4D (Design for Distribution) framework, shown in Figure 1.

The D4D framework does not change the core design process but only adds support at appropriate points. Figure 1 shows the four main stages of D4D in the communication/collaboration

process domain. Each stage may be implemented separately or together depending on the needs and commitment to distribution within an organisation. Each phase is generated by three key distributed themes as shown – diversity, failure and behaviour. These are supported by a variety of tools and methods as listed. For example, the FMEA includes the examination of 30 distributed failures in team communication and the awareness framework has six new elements for distributed success.

Testing in Ikerlan

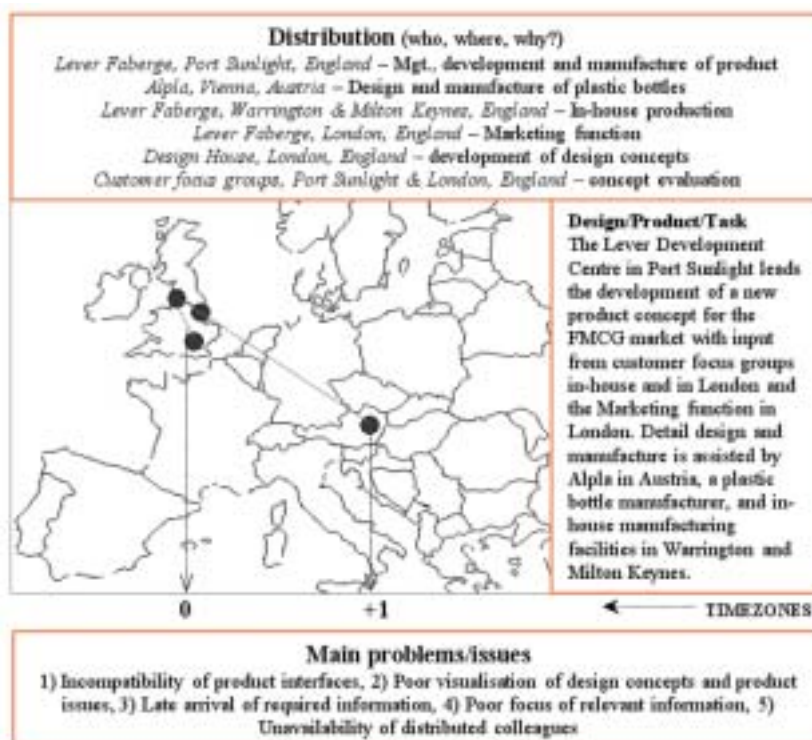
The thesis outputs are currently being

tested and integrated in projects at Ikerlan technological research centre in the Basque Country, Spain. Ikerlan is part of the Mondragon cooperative (MCC) which is comprised of over 150 design and development companies. MCC provides an industrial testbed to implement and refine research within the design field.

At the moment much of the research thrusts are aimed at augmenting levels of innovation in the NPD process, and developing supporting infrastructures to facilitate this. One example is the CONex project which aims to develop an organisational reference model for extended innovation. Developing the organisational network, through a series of stages from structured to extended development, is achieved through adding elements in the domains of new product processes, people networks and interaction, and technology. Modelled in a stepwise fashion the CONex project could be termed as an organisation's capability or maturity for supporting extended innovation. Crucial interfaces in the supporting infrastructure include evolution, from a process level, to a holistic innovative culture and then extending this from one's own organisation to the extended network. The MCC group, in containing a high number of diverse organisations, is an ideal testbed for developing concepts of innovation in the extended environment.

References

1. MacGregor, SP (2002) Describing and supporting the distributed workspace: Towards a prescriptive process for design teams, PhD Thesis, DMEM, University of Strathclyde, Glasgow, Scotland.
2. www.london-innovation.org.uk/
3. www.theartofinnovation.com/



A typical distrib-uted project in Lever.

About the author

Dr Steven MacGregor is a postdoctoral industrial investigator involved with live design and development projects at Ikerlan technological research centre. His PhD thesis and ongoing research activities in distributed design and development can be found at www.design4distribution.com.

Steven's previous articles in Engineering Designer.

- ◆ Distributed design: A focus on information sharing, July/August 2001, page 6;
- ◆ Crossing the research fields – Part one, January/February 2003, page 29;
- ◆ Crossing the research fields – Part two, March/April 2003, page 22.