

THE /D.SEARCH-LABS: USING THE POWER OF DESIGN TO INTEGRATE DESIGN EDUCATION, RESEARCH AND INNOVATION IN THE CONTEXT OF AMBIENT INTELLIGENCE

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ABSTRACT

This paper presents the vision behind the /d.search-labs within the Department of Industrial Design (ID) of the Technische Universiteit Eindhoven (TU/e). The /d.search-labs is a coordinating organizational structure within the ID department. Through its facilities and activities, the /d.search-labs aims to use the power of design to strengthen the integration of the three parts of the 'Knowledge Triangle': education, research and innovation in the context of the multi-disciplinary field of Ambient Intelligence.

This paper uses the case study of this specific academic design institute to contribute to the discussion of how we can pool the efforts, results and values of design education, scientific research and societal innovation to realize a tighter integration in the realm of Ambient Intelligence. The background of the paper explores the notions behind Ambient Intelligence and how they currently direct education, research and innovation. The main argument of this paper is for the power of design to **integrate** relevant issues, **realize** ideas and **show** a vision. It describes how the combination of these issues through several design-facilities and activities can add value and overcome challenges on multiple areas.

Keywords: Design education, knowledge triangle, ambient intelligence

1 INTRODUCTION

Since the start of the department of Industrial Design (ID) in 2001 at the Technische Universiteit Eindhoven (TU/e) the focus of its education and research is on the design of intelligent systems, products and related services. These designs enrich peoples' lives because of their functionality, ease of use, beauty and the magic of technology.

Through industrial design the results of research on technology, user aspects and aesthetics are integrated and made economically viable. New technology is brought into the market through attractive consumer products, which could not have existed without the new developments. This is the realm of the 'Knowledge Economy', an economy characterized by the recognition of knowledge as a source of competitiveness. Knowledge that is created through science, research, technology and innovation and that is shared and applied through the use of computers and the Internet.

In the 'Knowledge Economy', education, research and innovation are key aspects and especially in the context of designing for Ambient Intelligence they need to be highly inter-dependant. Designing for ambient intelligence is a multi-disciplinary challenge

that requires technological engineers, social scientists and designers to closely work together in a design-driven context. Therefore in 2006, two years ago, the department of Industrial Design proposed to set up the International Ambient Intelligence Lab (/d.search-labs).

2 AMBIENT INTELLIGENCE

Often intelligent products become part of intelligent networks where they can communicate with each other and form a smart environment which provides services to users, can think along and can adapt to the changing needs. This way the intelligent products provide an optimum service without invading privacy or being too much of a burden to the user. This is the realm of Ambient Intelligence (ISTAG, 2001), where services are on the foreground and the necessary technology is outside the user's view. Five key characteristics of Ambient Intelligence are 'Embedded', 'Context Aware', 'Personalized', 'Adaptive' and 'Anticipatory' (Aarts and Marzano, 2003).

2.1 Design Education on Ambient Intelligence at TU/e ID

Since 2001, the TU/e in cooperation with Philips Design and the Design Academy educates students in this new area of design. From the start ID chose for an innovative and practice-based educational model, a revolution in academic education and specifically developed for a new academic design school in a technological environment. Students learn to integrate various approaches in the design process such as human, socio-cultural and technological aspects. Generating original ideas, innovative concepts and building working prototypes are emphasized in the program. Taking into account recent developments in both the professional and educational field ID has based the course on an educational model in which competency development and self-directed learning are pivotal. The metaphor used for this model is 'the student as a junior employee'. This model strongly supports 'learning through doing', where skills and knowledge are generated through cycles of action and the reflection on action. The senior employees, both permanent staff and free lancers, are a multi-disciplinary mix of technological engineers, social scientists, designers and artists with backgrounds in academia and industry.

Internationally this concept is met with interest, appreciation and now even imitation. ID challenged itself to become an educational leader in the world of design and technology, especially in the world of intelligent consumer products, services and systems.

2.2 Design Research on Ambient Intelligence at TU/e ID

The university chose the area of Ambient Intelligence as one of the focal points of their research efforts. At the department of ID the research program is focused on the relationship between users on the one hand and future technologies on the other. On the technology side of Ambient Intelligence the department sees designed intelligence as of great importance for future products, systems and services. This is the field of research of the Designed Intelligence group. The second subject of interest is to create and explore concepts that contribute to better interfacing of systems to users. The User Centred Engineering group investigates the applicability of relevant enabling technologies. They develop 'design and evaluation methods' that establish a close link between concept development and users' goals needs and desires. The research group Designing Quality in Interaction is interested in *how* to design for the relationship and the interactions between the user and the opportunities of the new technology. The

fourth research group is Business Product Design, which focuses on the relation between the intelligent products and society and economy.

2.3 Innovation on Ambient Intelligence

Ambient Intelligence exists foremost in future visions and scenarios [2] that have not been carried out yet. Enabling technologies, such as broadband Internet, wireless networks and embedded systems start to find their way into society. Ambient Intelligence receives a lot of attention in terms of research but from the industrial design perspective only a few results have been translated into social or economic outcomes. To demonstrate that Ambient Intelligence remains a viable area of research for the Knowledge Economy it needs outcomes that prove socially and economically relevant. It demands innovative products, systems and services. It demands more design.

2.4 Knowledge triangle

In the Knowledge Economy, education, research and innovation are the key aspects. They are the three parts that make up the 'Knowledge Triangle'. Education, research and innovation in the context of Ambient Intelligence need to inspire and inform each other. They need tighter links and common ground which design can establish. Therefore, the department of Industrial Design proposes to set up the International Ambient Intelligence Lab (/d.search-labs). The /d.search-labs aims to use the power of design to strengthen the integration of the three parts of the 'Knowledge Triangle', education, research and innovation, in the context of the multi-disciplinary field of Ambient Intelligence (Figure 1).

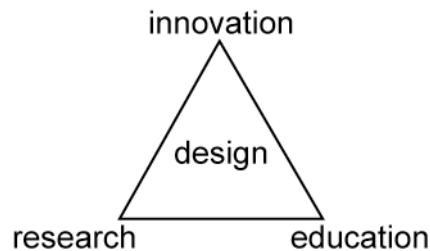


Figure 1 Using design to strengthen the integration of the three parts of the 'Knowledge Triangle', research, education and innovation

3 WHY DOES ID PROPOSE THE INTERNATIONAL AMBIENT INTELLIGENCE LAB?

Although the notion of Ambient Intelligence is apparent throughout the department of Industrial Design (ID), it seems hard for junior (students) and senior employees to experience and understand Ambient Intelligence and what it actually means to live in it and design for it too. To live up to the philosophy of 'learning through doing' ID needs to design and realize its own ambient intelligent environment.

In respect to the knowledge triangle, ID needs to work hard on the integration of the people and the efforts within education, research and innovation. On the research side, ID needs to improve the quality and the usability of knowledge outcomes. In particular, the gap between the research outcomes of the four different groups and the application of these outcomes is still too wide. Excellent research is being carried out within the department but too often it is not picked up by industry or education (Bachelor and

Master tracks). On the education side, good and innovative examples of design are created but these actions often lack the necessary reflection and go unnoticed by researchers or the prototypes need more effort to attract and seduce industry. In industry new innovative technologies are developed that allow for new design opportunities or that should have an impact on the things being taught to the students but often these developments occur outside the radar.

ID faces other difficulties. The fragmentation of the research within the department of ID means that it does not necessarily make the most of the excellence that exists. There is also the difficulty of reaching a critical design mass in both research and education. As a result, talented students and designers are too often attracted by opportunities outside university or outside the department. A centre of excellence with a strong design identity can help reverse this trend, by providing an attractive context for both students and academic and industrial designers. The R&D expenditure of companies is too often attracted by opportunities other than design or other than the design driven research of the department. A centre of excellence with a world renowned design identity, a sense for innovation and entrepreneurial culture, supported with technological know-how and a user centred approach can help reverse this trend, by providing an attractive context for industry to invest.

4 THE POWER OF DESIGN

Design is essentially about developing a vision on the future human world. Technology is basically blind: it does not know what sort of world it is moving to. It has no direction. Users on the other hand cannot imagine yet what future technology is capable of and how it can enrich their lives through magic and value. Design can inform both technology and users by **showing a vision** to those that cannot see yet. The /d.search-labs believes that the vision of how technologies of Ambient Intelligence are to be humanized should come from design. Through humanizing technology the new technologies are made to fit and be part of the rich world and expand its richness. This world is real so the design opportunities are rooted in the real world. They are human opportunities in a socio-cultural and technological context. This context will be explored through design, through transforming the context. The new context in return transforms the human opportunities, values and needs. Reflecting on the transformations provides new knowledge and design criteria for the field of Ambient Intelligence.

Designers can also **realize** their ideas, as they have the skills to make things. Skills and knowledge about model making, form giving, materials, programming, electronics, etc. allow them to realize ideas and visions by making them physical. These working prototypes feed the transformation of the world and can be experienced by users, and inform and inspire students, researchers and industry.

A necessary and important strength of design has always been its ability to **integrate** all the different issues at stake. Designers speak the languages of the different stakeholders. This way user aspects, technological, business and aesthetic issues and personal identity are integrated and come to one in design.

The /d.search-labs proposes to use this power of design to integrate relevant issues, realize ideas and show a vision to generate new knowledge for Ambient Intelligence.

5 USING THE POWER OF DESIGN

5.1 Integrate

The /d.search-labs houses permanent staff, fixed occupants (3-4 years projects) and welcomes temporary residents (students, visiting researchers (6-12 months) and

(foreign) guests (short periods). All guests and new people live and work in the 'same' physical space. Spaces are arranged as such to provide reasons and occasions for communication and cooperation.

The /d.search-labs environment supports communication between distant global partners, through video conferencing facilities and shared virtual spaces. Teams of designers/researchers are able to collaborate on projects 24 hours per day due to different time zones and exchange results to be part of one- and the same research and design team.

5.2 Realize ideas

A strong aspect of the education at ID is that the junior employees are able to build working prototypes and demonstrations. Unfortunately the time of one semester does not allow bringing these prototypes to a sufficient level of detailing and aesthetic quality. The advanced facilities for model making, especially when they are closely linked (physically and conceptually) to the research areas, improve the integration of (Master) students and researchers. The advanced model making facilities are a further motivation for talented students to stay within the department and will attract new students and designers from outside the department.

To support projects and explore and realize ideas in working prototypes the /d.search-labs houses workshops and ateliers for prototyping. These facilities are also used for the /d.search-labs to support the truly innovative projects from education that deserve extra attention to be put on a higher level to attract industry and inform research.

Furthermore the Lab encourages the making of demos and prototypes in multiple exemplars, so multiple people can share the experience. In this way we will improve a common understanding of what Ambient Intelligence means.

5.3 Show-it

Another important aspect within the Lab to communicate, inform and inspire is to show the actions and the outcomes to the people inside or outside the /d.search-labs. Innovative concepts and prototypes deserve a platform and publicity. Therefore, making attractive demonstrations, bringing proto-types to a highly presentable and experiential level and provide a proper forum is facilitated. Showcasing the outcomes of the /d.search-labs will be done online through an attractive website, weblogs, newsletters and regular additions of 'video on demand' (Vodcasts). But also throughout the /d.search-labs exhibitions, video action installations and working demonstrations can be found. Keeping the work close to the people is important to support communication, presentation and a common understanding of Ambient Intelligence.

6 CONCLUSION

To address the aforementioned issues, the department of Industrial Design is proposing the International Ambient Intelligence Laboratory. The /d.search-labs will bring added value in several ways (the formulation is inspired by the proposal of the European Commission for the European Institute of Technology [3]):

- A centre of excellence with a world-renowned design identity provides an attractive context for students, researchers, academic and industrial designers, and industry. The unique design-driven approach will create knowledge for Ambient Intelligence through the act of designing. Learning through doing.
- The /d.search-labs can pool existing resources and talented people to achieve a critical design effort towards the realization and understanding of Ambient Intelligence.

- It will represent a concentration of resources, and thus be able to overcome a serious challenge in matching, or even surpassing, the highest standards achieved elsewhere. Its actions will be based on excellence, and it will thus be one further way in which Industrial Design can make the most of its resources for R&D.
- The /d.search-labs will concentrate on combining the three sides of the knowledge triangle. They will be strongly linked in relation to Ambient Intelligence, because of the /d.search-labs nature and its mix of partners. This will direct teaching and research into new and more productive directions.
- The understanding of Ambient Intelligence feeds back into the design education through novel approaches, innovative methods and prototyping technologies and many informative and inspirational examples.
- The /d.search-labs offers the private sector a new relationship with the education and research at the department of ID that goes beyond what exists today. A closer relationship with business will bring new opportunities for future research. By integrating educational institutions, research groups and companies from different parts of the world, the /d.search-labs will have an edge over traditionally organized studios and laboratories of Ambient Intelligence. It will also bring significant opportunities to attract private finance to the /d.search-labs.
- The /d.search-labs strengthens the innovation dimension within the department and as a result the department becomes more attractive to the business community.
- The newly emerging inter-disciplinary field of Ambient Intelligence requires a new dynamic and flexible working and governance model. The new lab can act as a model for change, exemplifying the benefits of a modern, flexible structure.

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