D.Doc

MAKING DESIGN DOCTORATES ACCESSIBLE

Building a common language of design representations for industrial designers and engineering designers

Impact Case Study

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Loughborough University
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Year of completion: 2009
Discipline/field: Industrial design
Type of Doctorate (e.g. PhD, DDes, ArtD) PhD
Supervisor(s) Dr Mark Evans
Dr Ian Campbell

Abstract

To achieve success in today's competitive environment, companies are realising the importance of design collaboration during new product development. The aim of this research was to develop a collaborative design tool for use by industrial designers and engineering designers. To achieve this, a literature review was undertaken to understand the working relationship among the two disciplines during new product development. Following this, empirical research through interviews and observations outlined three problem areas: conflicts in values and principles; differences in education; and differences in representational tools and methods. The latter was chosen because the problem area of design representations was found to be highly significant.

In looking at bridging differences in design representations, a taxonomy comprising 35 forms of sketches, drawings, models and prototypes was generated. A second stage of empirical research was conducted to establish the popularity of each representation and the type of design

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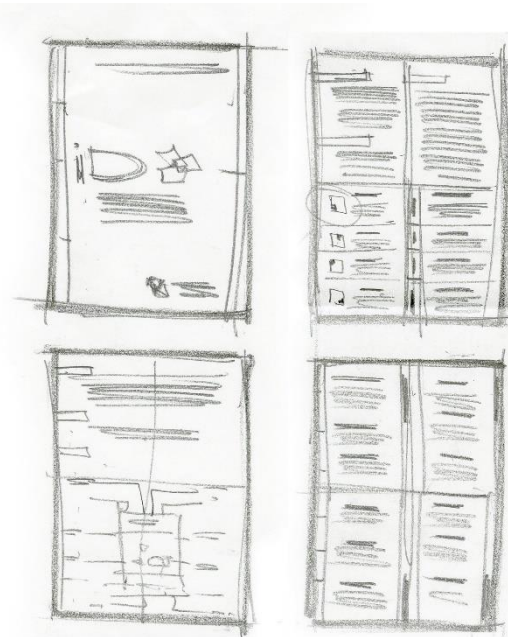
/ technical information that industrial designers and engineering designers communicated with. The information was indexed into 'CoLab' cards that would enable the two disciplines to gain joint understanding and create shared knowledge when using visual design representations.

Following a pilot evaluation and minor modifications, student and practitioner interviews with a case study were employed to assess the significance of CoLab. The findings revealed that 82% of the interviewees felt CoLab to have built a common ground through the use of visual design representations. 75% gave a positive rating when asked if the system would enhance collaboration and 91% gave the physical cards a positive response as it provided instant access to information and allowed easy sharing. This thesis is a step towards a greater understanding of collaboration between industrial designers and engineering designers. The use of the CoLab system provides the prospect of achieving a common ground between the two disciplines.

Summary of impact beyond academia

On completion of the PhD, one of the supervisors (Evans) worked with the doctoral researcher to convert the knowledge framework embodied in the PhD into a graphic design solution that was suitable for dissemination to the practitioner community. This resulted in a prototype of the fold-out iD Cards design tool that identify 32 key types of design representation categorised as Sketches, Drawings, Models, Prototypes; when they are used; and for what types of information (Design or Technical). Each individual representation panel includes a number, name, indicative image and brief description. Additional information is provided about the project and how to use the design tool.

Based on robust data from the PhD, the approach embodied in the iD Cards facilitates more effective NPD through enhanced design methods, communication, team working and inter-disciplinary collaboration. Having presented a prototype to

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the Executive Board of the Industrial Designers Society of America in 2011, the fold-out iD Cards were approved for production and distribution to its members.

In response to positive feedback and on-going demand, in 2014 the fold-out iD Cards were translated into a free smartphone app that enabled global distribution and further impact.

Underpinning research, context and summary of methodology

The research responded to a need to enhance communication and understanding between industrial designers and other professions during NPD. The research commenced in 2005 and was undertaken by Dr Eujin Pei (PhD researcher, Loughborough University 2005 – 2009), Dr Mark Evans (Reader, Loughborough University 1991 – present) and Dr Ian Campbell (Reader, Loughborough University 2001 – present). Evans and Campbell had practitioner backgrounds in industrial design and engineering design respectively and, having identified communication problems between designers and engineers during their pre-academic careers, sought to resolve these through academic research with the support of Pei.

Following a literature review and interviews with 31 industrial designers and engineering designers in the UK and Singapore, differences in the language used for design representations and a general lack of understanding of how they were used were identified as key barriers to communication (Pei, Campbell, Evans 2010). This resulted in an original taxonomy of design representations comprising 37 types of sketch, drawing, model and prototype (Pei, Campbell, Evans 2012). The accuracy and relevance of the taxonomy was confirmed via interviews with 27 industrial designers and engineering designers from 17 companies. The interviewees were also asked when the design representations were used and for what types of information. The outcomes from the interviews provided rich data that had the potential to standardise language and increase understanding in the role and contribution of design representations. After investigating ways in which this information might be presented, the need for immediacy and portability resulted in a physical card-based format being selected and developed. Prototype cards were designed by the researchers and refined following interviews with industrial designers, engineering designers and academics (total 10). Validation of the final version involved interviews with 61 stakeholders. A two week case study in which the mocked-up 114 double sided full colour playing card-size cards were employed during NPD was also undertaken (Pei, 2009). The overwhelmingly positive response to the cards during all stages of the final validation indicated that they had the potential to enhance understanding and collaboration during NPD during design education and professional practice.

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Having validated the contribution of the knowledge framework (Pei, 2009), post-doctoral research and development was undertaken to make the tool available to practitioners. This resulted in completely revised graphic design solution and use of a two-sided, 8 x 3 panel A3 paper Z Card format (iD Cards, 2011] that was launched by the Industrial Designers Society of America in 2011 (Evans, 2011). In response to demand, a modified pdf download of the iD Cards was made available via IDSA web site (iD Cards download).

References produced by researcher from/during doctoral research

Pei, E., Campbell, R.I., and Evans, M.A. (2010) Development of a tool for building shared representations among industrial designers and engineering designers, CoDesign Journal, Volume 6 Issue 3, p139-166. ISSN 1571-0882, DOI: 10.1080/15710882.2010.510197

Pei, E., Campbell, R.I., and Evans, M.A. (2011) A taxonomic classification of visual design representations used by industrial designers and engineering designers. The Design Journal, Volume 14 Issue 1, 2011 pp64-91 DOI: 10.2752/175630610X12877385838803

Pei, I. (2009) Building a common language of design representations for industrial designers and engineering designers. PhD Thesis, Loughborough University

iD Cards (2011) – Physical Cards

Evans, M.A. and Pei, E. (2011), From PhD to IDSA: Case Studies in the Evaluation of Design Tools. In 2011 International Conference of the Industrial Designers Society of America, New Orleans USA, pp.1-10 available at https://www.idsa.org/members/evans-dr-mark-loughborough-design-school-loughborough-university-uk

iD Cards PDF download
https://www.idsa.org/sites/default/files/IDSA%20iD%20Cards.pdf

Details of impact

Validation by the Executive Board of the Industrial Designers Society of America

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Production and distribution of 5000 physical iD Cards to members by the Industrial Designers Society of America in 2011

Use to define the profession on the Industrial Designers Society of America website.

Conversion to PDF for the Industrial Designers Society of America website

REF2014 Impact Case Study

Over 18000 users of the app in its first two years since launch in 2014

Finalist award for the fold-out iD Cards in the 2011 International Design Excellence Awards

Promotion by global design organisations that include Design Denmark, German Design Council, Ornamo Finland, British Industrial Design Association and Design Institute Australia

2016 Educator of the Year Award by the Industrial Designers Society of America for contribution of Evans to research-informed design education

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