

## Design in a connected world:

Enmeshing technology and the creative process

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### *Abstract*

*As the problems and processes of new product design become increasingly complex, there is a growing and urgent need to efficiently manage how the design profession innovates, collaborates and works. This paper reflects on the impact of digital technology on the design industry. In particular, it explores how an increasingly fast, pressured and collaborative business environment is affecting the processes used in product design studios. It is suggested that the increasing pace of product design consulting requires new tools to support designers in the design process. While there is skepticism regarding how effectively a computer can simulate the serendipitous nature of creativity, or enhance the creative process, the authors' research suggests ways in which technology can enable contemporary design.*

*The paper reports on a research project to develop a digital platform to enhance the design process. The software, entitled COnCEPT (Collaborative Creative Design Platform), seeks to assist the design profession in responding to the imperatives for speedy innovation and multiple stakeholder collaboration. COnCEPT focuses primarily on supporting the ideation phases, as well as in managing projects and assisting collaborative effort in a distributed team. The development process is interdisciplinary, involving academic, industry and SME partners derived from design, human computer interaction (HCI), information science and computer science backgrounds. Currently under a program of testing, evaluation and iteration, a fully functioning version will be complete by Fall 2016.*

*In this paper, the authors discuss the evolving nature of design in relation to four key areas derived from the findings of their research: (1) the rationale behind the perceived need for ICT in design; (2) the relevance of the platform's features for target users; (3) the decisions taken and challenges encountered in the course of the development process; and, (4) how the efficacy of the platform will be measured.*

*The results of the project suggest that digital software has the capacity to assist designers in navigating their evolving role in business and the economy. In its exploration of the trend towards the deployment of technology in the design process, this paper contributes to the debate on the nature of creative design. Rather than the polar schools of thought heralding an individual's serendipitous creative journey or a collective effort and discourse, the authors theorize how technology can disrupt pervading patterns, posing opportunities to align conventional and virtual methodologies, and to harmonize design and business concerns.*

*The impact of the digital environment is considered in both professional and educational design contexts. While the COnCEPT project has been developed specifically to cater to the need for speedy, distributed collaboration in the product design profession, the principles of this technology also impact other design disciplines, education and technology sectors. The analysis presented in the paper is suggested to lay the foundations for future research seeking to further enmesh technology and the design profession.*

**Keywords:** *Design process; design profession; computer-supported creativity; design management; design collaboration*

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## Introduction

Over the last two decades, significant developments in technology, the economy and business practice have resulted in acceleration in the need for innovation and a constant rotation of new products (Kumar and Whitney, 2007). This is fuelled by instantaneous communications and global connectivity that provide firms and customers with greater awareness of competing products, services and ideas. Raised consumer expectations leads to the desire for more sophisticated products, and innovations rapidly lose the novelty factor. Many firms once considered secure which previously rested on tradition are becoming less competitive in comparison with agile future-focused rivals that are quicker in responding to market trends and customer needs.

There is recognition that continual innovation in product offering, service delivery and business processes are essential for survival (e.g. Brown, 2009; Owen, 2001). There is increasing pressure to deliver new product development (NPD) at a faster rate (Trott, 2008). This is impacting upon the design profession, whether situated in-house or in an external consultancy. The onus is on designers to grasp complex and wide-reaching business problems and quickly produce an adequate solution to meet the requirements of clients and end users alike. As products become more complex, there is a pressing requirement for the input of several disciplines and experts in different domains. Moreover, design and designers are assuming a key and prominent role throughout the NPD (Perks 2005), coordinating and leading the input of a number of stakeholders such as manufacturers, retailers, end-users, as well as the client. Design is striving to understand and balance a plethora of conflicting requirements, creating a very complicated process.

Collaboration has become a theme in design. There has been an evolution in the design industry from a time when designers had the technical knowledge to design *and* make, to a situation where designers and producers are not close in terms of background and geography (Cooper and Press, 1995). Indeed, that most manufacturing now takes place remotely gives rise to the need for international collaborative working, and for interfacing between distinct design and fabrication teams (Kolerevic et al., 2000). This trend is prevalent in the design industry, where there is an increasing need for communication and collaboration amongst stakeholders that tend to be geographically distributed.

As technology has created this shift, it has also affected how NPD occurs, and has changed the nature of design practice at a fundamental level (Lubart, 2005). Indeed, the tools of the design industry indicate the need for efficiency. For example, graphic design software allows two-dimensional sketching, photography software facilitates the rendering of realistic images of potential design concepts, and computer aided design (CAD) and rapid prototyping software allows the generation of three-dimensional prototypes and production ready files. These technologies enable speedier realisation of ideas. However, they do little to assist with the early phases of NPD requiring ideation and creativity.

This paper discusses how technology can be used to assist designers working under commercial pressures. The authors explore the current requirements of the profession, reviewing literature that bridges design, technology and NPD. The research question addressed in the paper is: Can technology enable more efficient design projects? A case study of the development process of software for *innovation management* is presented and explored. The decisions taken in building the components of the tool are discussed. The preliminary results signposts the necessity for further development in the domain, and suggests the need for further research examining the notion of efficiency from the client perspective.

## Current requirements in design

Product design has its roots in industry. While the role played by design and designers in business process has always been complex in its approach, and in the extent of its involvement (e.g. Jevnaker, 1998), it is currently undergoing a period of change and transition. This can be attributed to several factors.

First, design is becoming a more collaborative activity more than ever before. Spurred by new technologies and more technologically sophisticated products, there is a growing requirement for specialist knowledge and expertise in order to undertake complex NPD projects. A greater number of stakeholders is required to participate in the product development process, and within the discipline, new specialisms (such as ethnography, human factors, crowd sourcing and research) bring more focused expertise and methods. This has resulted in a greater fragmentation of the profession (Cruickshank, 2010; Kelley and Littman, 2006). Moreover, the collection, dissemination and analysis of customer data is now an integral factor affecting how organisations innovate, address needs and do business (Aula et al., 2005).

A key challenge in design is to 'join the dots' between diverse knowledge, and in doing so, communication and coordination of expert views is crucial to the success of projects. Merging creativity, technology and business is complex. The trend for large numbers of stakeholders adds a complex but necessary extra layer of activity: research by Un et al. (2010) finds that collaboration with a network of suppliers improves the success rates of product development. In NPD, there is a need for effective collaboration across multidisciplinary and geographically dispersed teams (Arias et al., 2000; Simoff and Maher, 2000).

However, there exist problems in *designing* collectively. First, there are cultural differences between design and other disciplines which hinder the creative process. The unpredictability and uniqueness of every design situation makes systemising design in a commercial context problematic. The core characteristics of designing – for example, fluidity (e.g. Dorst and Cross, 2001), co-evolution of problem and solution (e.g. Lawson, 2005), unpredictable outcomes (e.g. Akin and Akin, 1996; Dorst and Cross, 2001), lack of clear problem definition (e.g. Rittel and Webber, 1973), symbiosis of problem and approach (e.g. Cross, 1997; Suwa et al., 2000), and subjectivity and the role of human actors (e.g. Schön, 1991) – are key features that explain the difficulty in arriving at a model of the process acceptable to all parties.

Second, there are difficulties when it comes to innovating in a group situation. Research remains inconclusive as to whether creativity prospers from lone mavericks or in groups. Some argue that the creative process is aided by the cross-pollination of ideas between members of groups (e.g. Catmull, 2008; Kelley and Littman, 2006). Others conclude that individual thought processes are necessary to arrive at the most innovative ideas (e.g. Cross and Cross, 1996; Lloyd and Snelders, 2003). Since NPD relies on the input of a number of stakeholders, 'innovating by consensus' becomes problematic. However, particularly in innovative modes of NPD, the need to share knowledge amongst contributing disciplines, experts and business functions becomes critical for innovation (e.g. Ostergaard and Summers, 2005; Swan et al., 1999), and improves product development success in a range of ways (Rauniar et al., 2008).

Associated with this are the logistics of enabling remote teams. This is partly being resolved by novel uses of technology to improve team effectiveness (Thomas and Bostrom, 2010), and is especially vital in distributed teams. Collaborating via shared computer interfaces has become increasingly popular over the past decade (Briggs, 2006), enabling the democratic sharing of content. However, Sonnenwald (1996) concludes that designers have found the transition to overt collaboration challenging. Contemporary practice involves cooperation throughout the design process, however this may be unacknowledged, or treated with suspicion, by designers (Edmonds et al., 2005). This can, in part, be attributed to the tools that are commonly yet unobtrusively used in design studios (for example email, teleconferencing, FTP (file transfer protocol), and instant messaging) and which provide a constant flow of communication across distributed teams, as well as more sophisticated tools (such as video conferencing, browser-supported file sharing and online whiteboard brainstorming sessions) which enable the sharing

and real-time editing of project work. The use of such platforms is widespread and increasingly essential in the design industry.

The different phases of the design process require different tools. Technologies such as rapid prototyping and the digital exchange of CAD files can be utilised to for clarity and speed when design firms are dealing with clients or distant manufacturing partners to illustrate ideas during the development and launch phases. However, technologies to assist with the conceptualisation and ideation phases remain under-developed. In recent years, applications have emerged to assist ideation methods and techniques (for instance mind mapping, concept mapping and storyboarding software). Such packages can assist holistic and non-hierarchical creative approaches, and their use of textual and visual resources can spur associative thinking as a route to new ideas. Applications such as wikis and peer-to-peer platforms that allow the sharing of resources, expertise and ideas are becoming a digital accompaniment to traditional contexts. Exploiting both real and virtual worlds enables new possibilities in collaboration, and is becoming widely accepted in the workplace. However, research suggests that such tools are in need of refinement and improvement (Cheng, 2003; Wierenga and van Bruggen, 1998) beyond the mere simulation of real-world techniques.

This discussion exposes a sense of complexity that is having a profound impact upon how designers undertake projects. Under pressure to turn around innovative and creative projects on time, on budget, and responding to the requirements of all stakeholders, it is posited that further assistive tools are required to assist the design profession. It is suggested that the development of software specifically aimed at improving the ideation and conceptual phases of the design process, and therefore enhancing product innovation, is of urgent concern. In design, there is emerging evidence that the use of visually driven ICT can help to support multi-disciplinary collaboration, including participants from inside and outside of the 'core' design disciplines (Leon *et al.* 2014a). This is especially pertinent in today's pressured NPD environment, in which designers strive to balance creative ambiguity early in the design process, with logic later in the process. Moreover, support during the early phases of the process to ensure stakeholder consensus is becoming especially important given recognition that fundamental design changes taken at later stages are likely to carry greater financial risk for the client (e.g. Lu *et al.*, 2014).

In recognition of these requirements, a three-year research project has been established, funded by the European Commission under its Framework 7 ICT Programme. The project, entitled COncEPT (Collaborative Creative Design Platform), aims to develop a new integrated software platform specifically designed to support product designers particularly during the ideation phases of the design process. The project team is interdisciplinary in nature, consisting of European partners from industry and academia from several disciplines, including design, human-computer interaction (HCI) and computer science. This paper describes the development of the software.

The paper now looks in depth at how such technology can be manipulated to be of use to the design industry in navigating this new role. It explores how specific aspects of the design process – chiefly the creative ideation and research phases – can be enhanced by a new generation of technology to specifically address the issues and challenges faced in contemporary design processes. The authors reflect on how the effectiveness of the platform can be 'measured'. The paper concludes with discussion and speculation on the implications of this technology for the future of the design profession, and its applicability to other related domains. The authors consider whether the technology can bring about significant improvements to the working methods of product designers.

## **Case study: The development of the COncEPT platform**

The COncEPT project, established in 2013, involves the complex interplay of a pan-European consortium working together collaboratively, sharing knowledge and skills, as well as undertaking research related to their own specialisms. The team meets periodically to share insights and take

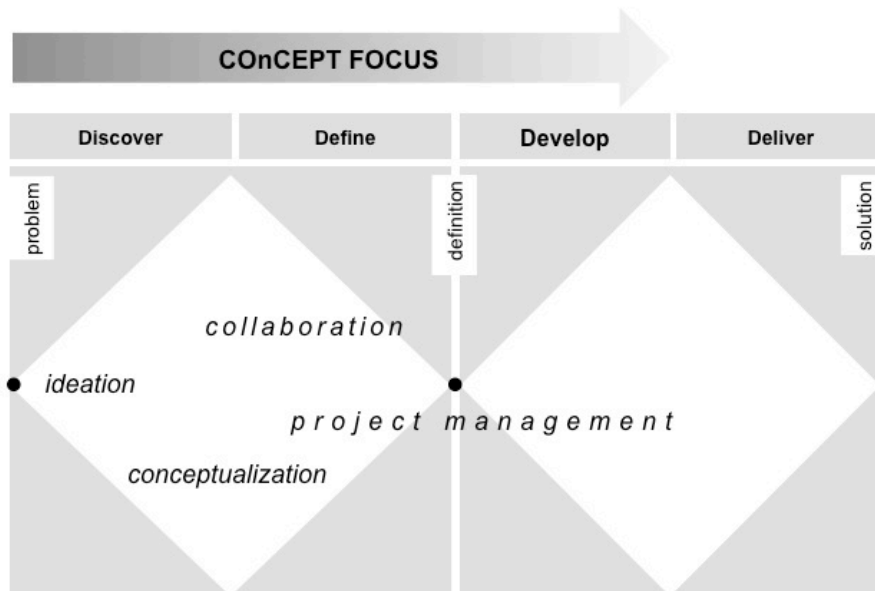
decisions in the platform development via workshops, plenaries and review meetings, as well as speaking regularly on bi-weekly conference calls. The development of the COncEPT software is informed by discovery-driven, qualitative research – including interviews and observation research – with practicing industrial designers. Researchers in the consortium conduct on-going research to develop understanding of the current needs and requirements in contemporary design studios, including the adequacy of tools for individual designers and collaborative teams. The platform is currently platform under a program of testing, evaluation and iteration, and a fully functioning beta version is available. The research presented in this case study looks at two key areas: 1) the decisions taken in the development of the platform based on the insight of designers; and 2) how to ‘measure’ the effectiveness of the software. The authors discuss the challenges in both areas.

### *Aligning Traditional And Virtual: Designing In A Digital Environment*

Collaborating via shared computer interfaces has become increasingly popular over the past decade (Briggs, 2006). It has enabled the democratic sharing of content. For example, wikis allow multiple users to asynchronously create and edit documents that incorporate text and multimedia, while simultaneously keeping an archive, uncovering and highlighting trends, and logging the edits of the various individual authors. Peer-to-peer platforms allow users to share ideas and crowd fund innovations. Others allow for the sharing of resources, skills and know-how (Stokes et al., 2014). Such applications are quickly becoming the digital accompaniment to traditional contexts. Exploiting both real and virtual worlds enables new possibilities in collaboration, and is becoming widely accepted in the workplace.

While the merging of traditional and virtual methods are being developed for some creative settings, there remain shortcomings in how technology is applied in the design industry. Collaboration has typically occurred in a low-tech fashion within design studios, for example via brainstorming meetings, sketching sessions, showing and describing images, and sharing objects. While the tools described earlier in this paper facilitate communication, there remains weakness in how these are integrated with the traditional ways of working.

Digitally replication of the characteristics involved in real world collaboration is impossible and unfeasible, however there are features of its virtual counterpart that are suggested to have significant benefits during the design process. As such, the COncEPT project seeks to harmonise the old and the new, the real and the virtual, inside of its integrated virtual environment. Its focus is on the early stages of the design process – that is ‘definition’ and ‘discovery’, as delineated in the Design Council’s Double Diamond model (2007) – is summarised in Figure 1. These stages are exploratory in nature, and concern the imagining and conceptualization of a solution (by contrast, the latter two stages – ‘development’ and ‘delivery’ – centre on the practicalities of bringing a product to market, and make use of the previously described technical software).



Source: Adapted from research by the Design Council (2007)

Figure 1: COncEPT focus in the design process

During the definition and discovery phases, gaining a firm understanding of the problem, then and defining and refining the brief in collaboration with the client and project team are key outcomes. Activities of central concern therefore are: on the one hand, concept generation and ideation, and on the other hand research, stakeholder liaison and communication, and brief definition and development. Implicit in this is that the unstructured, creative, holistic tasks must be integrated with the structured and formal linear tasks. Indeed, predominantly creative and business concerns are assuming equal weighting in today's competitive landscape.

The platform was therefore being developed as a holistic design environment that enables holistic thinking related to creativity, *and* facilitates linear thinking related to management and project management activities. Figure 2 shows a prototype. Integrating the link between design and organization, three themes emerge which COncEPT aims: 1) to spur creative ideation; 2) to enable adequate collaboration, and; 3) to support management of projects. These are unbundled in turn.



Figure 2: The COncEPT platform, prototype of functionalities

### Spurring Ideation, Creativity And Discovery

Early in the design process, before ideas are developed and refined, the design brief may be unstructured, informal or even non-existent. Therefore, it is the designer's first concern to uncover the nature of the problem, and put structure around the client's requirements, and this involves extensive liaison and discussion with the client team. However, designers describe how clients often request to see several ideas at the early stages of the design process, and the designer must conceive a pool of ideas to present to the client. In theory, this allows the best concept to be selected.

Ideas can be generated using a range of intuitive and systematic creative problem-solving techniques (e.g. Couger, 1993; Malins and Liapis, 2010), such as brainstorming, visualisation, and modelling. Research informs the effectiveness of these techniques, and is therefore crucial to the process. Early stage, discovery-driven design research can take two forms: *creative stimulus*, or *fact check* research. First, appropriate creative stimulus research spurs ideation. Searching personal, shared or online repositories of visual material based on key terms or analogies is a typical method. This strand of research allows the construction of a visual language appropriate to the project, and may help to stimulate ideas and associations. In the business sense, this research is pivotal, since it helps designers to communicate intangible ideas, and provides the structure and clarity needed to progress to the next stage of the project. However, there is an element of serendipity in this process, for example visuals and images may not be tagged, or tagged inaccurately, or get lost amongst vast quantities of images stored on a server. Second, awareness of external, fact check information, for example market trends, advances in technology and existing products, is crucial. This type of data is typically textual or numeric, and housed in a vast array of online and offline sources (for example websites, databases, reports) making finding the appropriate information time-consuming.

Whilst both of these types of research is supported by dedicated, stand-alone software, tools which have the capacity to unite the research findings, and support designers throughout the

ideation process are underdeveloped. Taking this into consideration, the development team have sought to integrate creative and factual in the platform under development. Advanced data-mining algorithms undertake searches to find appropriate textual and visual information from a range of sources, including market reports, news and technology sources, and patent offices. Crucially, algorithms search for broadly similar – as opposed to identical – images in order to stimulate associative thinking (Rehal and Birgersson, 2006). It is envisaged that the system learns and saves preferences over time to fine tune future search results. Resultant data is imbued into the collaborative, generative tools, such as mind mapping, storyboarding and infinite whiteboard functionalities.

### **Enabling collaboration**

How stakeholders communicate and how relationships are managed is crucial to the design process (Liapis, 2008). In an age where face-to-face meetings are infrequent and teams more distributed (e.g. Eris et al., 2014), the online management of such partnerships is necessary to allow the project to progress. There already exists a range of dedicated communication software (for example, shared databases, email, instant messaging, video conferencing), as well as browser-based and social media tools for interaction (for example video sharing and online communities). These systems function through the willingness of team members to actively push, update and share information (Kimmerle and Cress, 2008) with other parties.

The COnCEPT platform is intended to simulate the experience of real world collaboration in a digital environment. Applying the principles of CSCW (computer-supported cooperative work) (Maher et al., 1993), COnCEPT creates a space where its functional toolset is integrated with communication tools. This creates an environment where collaboration can take place both synchronously and asynchronously. For example, as an assistive search engine, COnCEPT presents textual and visual information derived from web sources. While countless web-based materials can complicate designers' research, the platform uses sophisticated search algorithms to assist retrieval of relevant information. It learns which search responses have most value, and weights future results in that direction using case-based reasoning algorithms. In addition, it acts to filter the search results based on tolerances set by the user to enable either more or less associative thinking, which is suggested to be helpful in concept mapping and mind map construction. The platform also enables formal exchanges, which form part of the managerial aspects of the design project.

### **Management of projects**

Administration and paperwork takes up a substantial portion of time in design consultancies, and often detract from time spent on actual design activities. Such duties are typically the responsibility of managers and senior designers who are seldom trained in such tasks (Bruce and Morris, 1998). While dedicated project management software exists on the market, there is no application that provides dedicated support to design businesses. COnCEPT is being developed to address all managerial aspects of the project remotely. Its terminology, features, functions and user interface specifically address the complexities of design. These include the activities currently undertaken by the project manager or design manager, for example, team assembly, the assigning of roles, tracking individuals' time spent on the project, and keeping a log of individual contributions. It provides the effective communication methodology required by distributed stakeholders working asynchronously.

At a deeper business and competitive level, there are significant benefits to project integration. Design entrepreneurs are more likely to have a background that emphasises artistic rather than marketing competencies (Falay et al., 2007). The lack of formal business skills often results in a disparity between fees and work completed (Maciver, 2012). COnCEPT provides a platform to redress this inequality. For example, contracts are automatically generated to formalise projects; non-disclosure agreements can be established between partners; different costing models are inbuilt, and are adjustable according to client; emails relating to the project



can be automatically tagged and logged; timelines can be set to highlight project milestones; and sign off at critical stages can be managed automatically. A summary is presented in Figure 3.

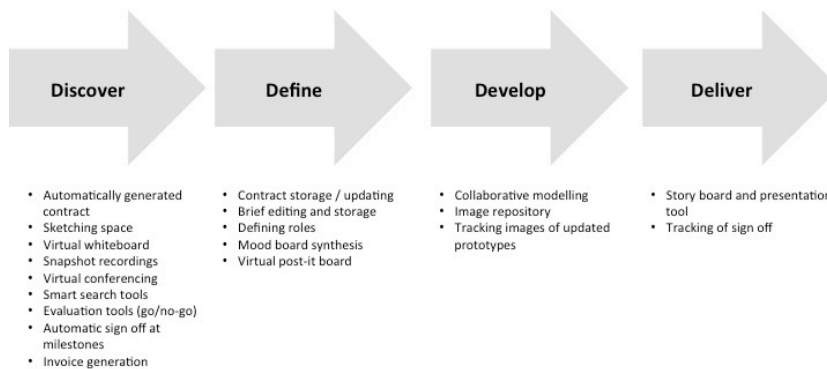


Figure 3: COncEPT functionalities throughout the design process

There are significant business advantages of these features. Stakeholders are offered protection against reneging on contracts. Each party has access to project materials, and this degree of transparency is suggested to prevent disagreement. All materials are included in a single package, reducing duplication. Finally, administration and project management can be easily kept current.

### *‘Measuring’ effectiveness of the platform*

When it comes to analysing the design process as part of the evaluation of the success of COncEPT, the core characteristics of the discipline make this task problematic. The design process is often shrouded in mystery, whereby an individual’s thought processes cannot be externally deciphered (Lloyd and Snelders, 2003). Moreover, since new knowledge is constantly entering the process and altering the individual designer’s interpretations, formalizing a process that is in constant flux is unfeasible (Gero and Kannengiesser, 2004). Indeed, Cross (2001) notes that studies investigating cognition in the design process is usually a unique case study of a single design project (e.g. in Cross and Cross, 1996); a hypothetical protocol study; or a lab-based performance test. Thus, ensuring accuracy and validity of such research is problematic, since the uniqueness of design projects means that the same conditions are never repeated.

## **Discussion: Implications For The Future Of Design Practice And Education**

The competitive, fast-paced global business environment requires fast and efficient innovation. An increasingly stratified, networked and interdisciplinary design profession is required to stay current, informed and innovative. A response enabling designers navigating this transition is of immediate concern. In the contemporary paradigm, where creative and business imperatives are of equal significance, technology can assist individual designers, and the wider NPD team. The platform under development seeks to enable the design process to harmonise both holistic and linear imperatives. It stimulates the ideation process by enabling creative

insight and artificial intelligence to impact on the process, and assists with the engine room work of design management, improving efficiency and rigour of administrative, numeric, and analytical business tasks. The connections made in the platform are summarised in Table 1.

Table 1: Connecting design and business ideals in the CONCEPT software

DESIGN REQUIREMENTS	BUSINESS REQUIREMENTS
Creativity, innovation	Systems
Operand, trigger of innovation	Operand, enabler of innovation
Deals with visuals	Comfort with semantics, figures
Non-hierarchical, integrated	Linearity
Tolerant of ambiguity	Rests on logic
Left brain dominant	Right brain dominant
Focus on the <i>why</i>	Focus on the <i>how</i>

Consolidation of the design process via software has the benefit of assisting designers to reflect upon, and improve, their practice. The ability to assess how projects come to fruition via the tracking tool prospectively provides a route to more efficient design practice, as well as providing junior designers with a way to learn more effectively from senior colleagues. Moreover, snapshots of various milestones allow designers to present work in a clear and coherent way to clients, in turn providing a degree of transparency to a process typically shrouded in mystery. This is suggested to assist in establishing the true value of the designer’s skill and time.

Similarly, the setting in place of an industry standard method of working improves transferability and knowledge sharing, as well as collaboration, between network partners. In itself, this presents substantial consequences for industry competitiveness, both for clients and for design studios. Unlike architecture, which has strict governance and entry requirements, at present design lacks structure in how professionals are considered adequately qualified.

The current platform is designed as a fixed desktop experience. However, further development work will enable it to be extended into other devices to enable a more immersive and ambient design environment. The research by Leon et al. (2014b) argues that collaborative processes are enhanced when using surface table technology in real-world architecture teams. Features in the CONCEPT platform, such as the infinite whiteboard, lend themselves particularly well to gesture-based computer technologies (e.g. PixelSense<sup>1</sup> technology and Lightspace<sup>2</sup> currently in research and development stages at Microsoft), and aim to allow groups to work simultaneously on both the ideation and design of concepts.

Further evaluation of the platform by the CONCEPT consortium is planned. User testing on the current beta are underway. During these pilots, design groups are observed working on pre-set tasks. Resistance and scepticism is expected towards some tools that have been developed for the platform. However, like resistance encountered by many tools which are now industry

<sup>1</sup> See: <http://www.microsoft.com/en-us/pixelsense/whatisurface.aspx>

<sup>2</sup> See: <http://research.microsoft.com/en-us/projects/lightspace/>

standard, ensuring that the terminology and interface uses familiar terms is critical to ensure that the software is intuitive and gains acceptance.

Finally, and in addition to the professional context, CONCEPT will also be evaluated for its contribution to pedagogy. Initial research has ascertained the increasing need for virtual means to enable student collaboration. Subsequent pilots will test the relevancy of a professional tool in an educational context. It is expected that the tracking feature will be particular value, since it will enable tutors to clearly trace the origins of student group work, as well as to assess individuals' contributions. It also allows students to more clearly reflect on their contribution to the design process. Part of the evaluation will consider the potential use of the software in domains outside of product design, such as architecture, the built environment and fashion.

## Conclusion

This paper has outlined the urgent need for new ways to support the early phases of the design process. It has been suggested that IT has the potential to assist designers in navigating the complex nature of design problems, both by triggering innovative and creative thought processes, but also by facilitating the practical tasks which consume much time in modern practice. The CONCEPT platform seeks to resolve this and other tensions existing in the design industry, attempting to enhance how the design process unfolds by providing the optimum conditions for rapid innovation and project review. By providing tools within the platform that can support collaboration and track project progress, it improves existing low-tech means of recording and documenting projects. It also responds to the commercial environment by integrating the perspectives of partners.

In addressing the increasingly fast turnaround of projects, and the need for greater levels of collaborative practice, the CONCEPT project has sought to develop a unified, consistent and integrated design environment. It aims to seamlessly facilitate a range of collaborative situations, while also organising and tracking the process. This is suggested to address the challenges of communication in a cross-disciplinary team, which is particularly helpful when innovating alongside global partners.

This is a relevant and valuable proposition in today's inclusive and business-oriented design world. As designers are being asked to solve problems of greater gravitas, to consider the repercussions of their design decisions, to manage business practicalities, and to collaborate with distributed and interdisciplinary partners, more adequate tools to enable best practice are undoubtedly required. Technology has the potential to provide a transparent environment in which to undertake NPD, and to allow the relationship between design and other stakeholders to be harmonised. Finally, it is suggested that in aligning both creative and business imperatives, and in unifying specialist expertise, technology can ultimately enable a streamlined process towards more relevant and successful products.

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