Manifesto: Design Thinking Becomes Foundational

Larry Leifer and Christoph Meinel
Stanford University, Stanford, California, USA
Hasso Plattner Institute, Potsdam, Germany

Abstract With the integration of design thinking into engineering education, a missing link has been created between the science-focused, context-independent part of engineering and the human society-focused, context-dependent aspect. The latter area has long been neglected, partly due to the uncertainty that comes with the unpredictability of human behavior. However, years of design thinking research have improved our understanding of the method's underlying principles. As a result, there has been a breakdown in the skepticism toward design. We can now instrument and quantify design behavior, measure its impact, validate engineering work, and continuously advance our knowledge of design thinking and ourselves. In this paper, we argue that design is ready to become a foundational science for engineering, alongside scientific fields such as physics, chemistry, and biology.

The idea that design thinking is foundational for engineering and, therefore, in an engineering education, is derived from the following five questions. These propositions need to be taken together and in context because in all things human centric (business, design, society, …) the knowledge worth having is and must be **context dependent**. This point-of-view balances the equation with physics and math, whereby the knowledge worth having must be **context independent**.

(1) How might we address and measure the NEEDS of society?

While engineering has been described as the application of science and mathematics to the needs of society, up until now we have known and taught our students very little about finding and understanding the needs of society. Thus we have indirectly turned out half-built engineers. These were engineers who could only serve the explicit needs of others without a direct understanding of who had the need and why. With the advent of the design thinking paradigm, this situation has changed. Engineers are now taught how to engage with society through empathy training, coping with multiple points of view, actively managing teamwork, and realizing the full potential of product and service prototyping (experimenting). In effect, a critical link has been made between engineering analysis, the science-focused part of the discipline, which is context independent, and engineering design, the human society-focused aspect of the discipline, which is context dependent.

(2) Why must we accept that human needs are context dependent?

Human behavior is overwhelmingly context dependent (Bandura 1986). This makes the formulation of problems and their solutions difficult.

As engineering faculty and technical managers, most of us did not teach engineering design nor did we attempt to manage design thinking because we either did not understand it and/or because it includes unpredictable human behavior within the system boundary. This lack of understanding and perhaps fear of uncertainty and ambiguity often leads to skepticism and even contempt for the human side of engineering — design.

(3) Are we ready and do we know enough to change?

The cumulative work of a global design thinking research community demonstrates our ability to instrument and quantify design behavior. We can measure its impact on corporate team performance. We have started to understand the underlying principles. Though valuable insights have been gained and methods and tools further developed, we are just at the beginning. Biology, too, started as an applied science where scientists such as Darwin gathered knowledge by doing hands-on work. Design is now positioned to follow biology as a foundational science.

However, its application is still, and will always be, the key to a better understanding of design thinking. That's why researchers are striving to gauge and assess its impact. One such an attempt is a recently published study by a project team entitled "Impact by Design Thinking" (Eva Köppen, Holger Rhinow, Jan Schmiedgen, and Christoph Meinel). This study is based on survey results. The researchers not only introduce helpful metrics, but also share their valuable insights derived from years of profound research on design thinking in organizations (Schmiedgen et al. 2015).

The benefits of their work can be seen at *thisisdesignthinking.net*. This website launched by the research team showcases interesting stories from companies working with design thinking and publishes interviews with experts and practitioners. By drawing a colorful picture of the manifold design thinking activities going on today, the website serves the research community as well as coaches, practitioners and students.

Many more projects pave the way for making design a foundational science.

(4) Why is this breakthrough happening now?

While design thinking is practiced universally in varying degrees, it is the unique combination of engineering (especially IT), economics, anthropology, psychology, neuroscience and design-research that is making it foundational (Mabogunje et al. 2015). Breakthroughs at Stanford University cannot be separated from the university's location in Silicon Valley and the community's impact. Breakthroughs at the Hasso Plattner Institute at the University of Potsdam cannot be separated from its inspiring founder and the vibrancy of the Berlin/Brandenburg region.

Both universities, and in particular their schools of design thinking at Stanford and Potsdam, and other pioneering universities around the world attract companies and organizations eager to apply new approaches to their challenges and projects. They need and want to launch change processes and find new inspiration for their work. On the other hand, d.school graduates have an open mind, are full of ideas and enthusiasm for innovation with an appetite for new

solutions that yield better services, products, and even fundamentally better societies. These graduates transport a new spirit to their employers, multiplying it, and implement their own projects that stem from a deep understanding of people's needs.

Frederick Terman, an early Dean of Engineering at Stanford (and widely recognized as the "father of Silicon Valley") re-conceptualized the role of the university as follows:

> "Universities are rapidly developing into more than mere places of learning. They are becoming major economic influences in the nation's industrial life, affecting the location of industry, population growth, and the character of communities. Universities are in brief a natural resource just as are raw materials, transportation, climate, etc."

Universities are now the knowledge creation engines of society, largely replacing industry R&D for radical breakthroughs. They accelerate the creation of new technologies, new ventures, new markets, and new sources and targets for capital formation.

(5) Is it time to professionalize design thinking?

To build on our understanding of innovation and the role of design thinking behavior, including supporting brain research (Donald 1991), we propose to move forward with the professionalization of design thinking. Imagine that in time there will be professional schools of design thinking much as we have schools of engineering, schools of medicine, and schools of business. Imagine too the emergence of pan-disciplinary doctoral programs in design thinking practice.

The first d.school at Stanford started in a garage on the outskirts of the Stanford campus. Hasso Plattner, an early sponsor of the design thinking activities at Stanford, recognized the potential as did the university itself. Ever since, thousands of students of all disciplines have studied and practiced design thinking. It did not take long to transfer the successful concept to the Hasso Plattner Institute in Potsdam – adapting it to the specific context there. Many universities worldwide approach the two institutes in order to implement a similar school following the "d.school" model. Recognizing the value of such a training facility they strive to create the breeding ground for innovation in their own region. In a cooperative effort, schools of design thinking have been established, for example in Paris, Kuala Lumpur, and Beijing, each one with cultural adaptations based on its unique context. More and more governments and universities plan to establish their own schools of design thinking and integrate design thinking into their curriculum. The design-paradigm is worth your attention.

Now that we have the roots of the scientific comprehension of design thinking we can expect to continuously improve our understanding of ourselves. We can additionally discover new practices and disseminate these practices through publications, simulations, and emulations. This understanding, which derives from the study of human-human interaction with IT augmentation is embodied in the nature of language - verbal and gestural. It is foundational.

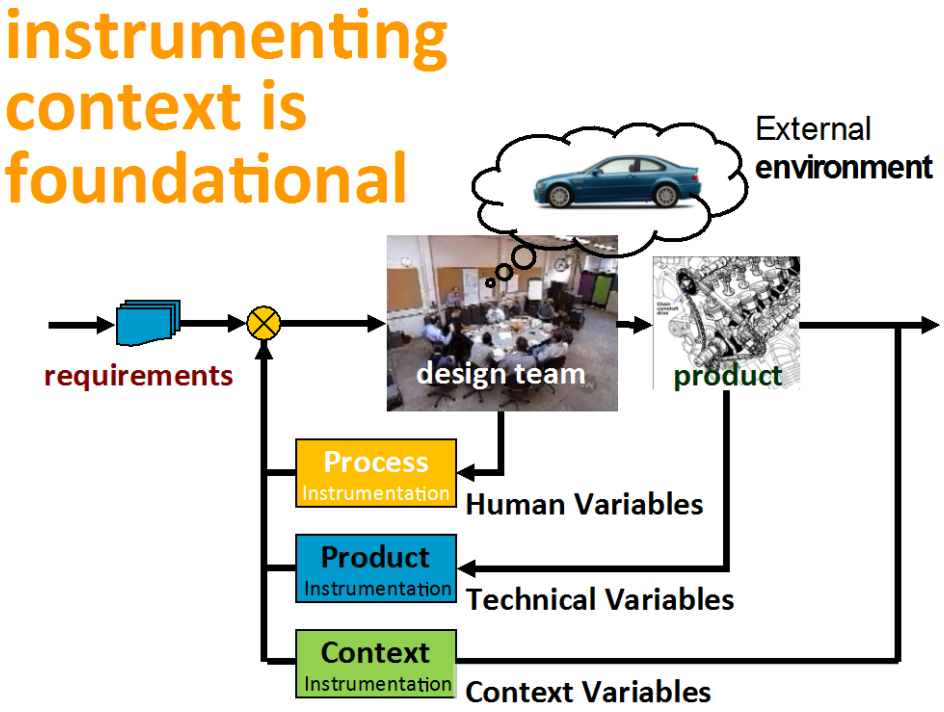

Figure-1: We build upon advances in design behavior research and corresponding brain research. We quantify action and outcomes. We have a mature measure of predictive power. As a profession, **design thinking is foundational** and can be understood scientifically.

References

Bandura A (1986) Social Foundations of thought and action: A social cognitive theory, Prentice Hall, Englewood Cliffs, NJ

Donald M (1991) Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition. Harvard University Press, Cambridge, MA

Mabogunje A, Sonalkar N, Leifer L (2015) Design Thinking: A New Foundational Science for Engineering, to appear in Proceedings of the Mudd Design Workshop, Harvey Mudd College, Claremont, California, 28–30 May 2015

Schmiedgen J, Rhinow H, Köppen E, Meinel C (2015) Parts Without a Whole? - The Current State of Design Thinking Practice in Organizations, Technischer Report. Study Report, Hasso-Plattner-Institute, Potsdam