

Book review

Creative Design Engineering: Introduction to an interdisciplinary approach, by Toshiharu Taura, Elsevier, London, 2016, £57.99 RRP (ISBN 978-0-12-804226-7).

The origins of creative ideas remain something of a mystery – are they conjured at random, or do they emerge through particular thought processes? Can designers learn to generate and develop creative solutions through a systematic approach, or is design creativity an elusive attribute of the few? Toshiharu Taura takes steps towards answering these questions in the English translation of his latest book, which aims to provide “an academic introduction to the theory and methodology of *innovative creation through design in the broad sense: design to meet the desires of contemporary society*.” Within this scope, Taura sets out to address the fundamental theoretical questions of “why we design” and “why we are able to design,” and to present a “specific methodology for innovative creation” centring on several cognitive methods for concept generation and the basic principles of conceptual engineering design (Taura 2016, xv). The book is intended to convey an interdisciplinary approach to the topic, and indeed integrates much of Taura’s extensive work on concept generation and linguistics with broader engineering design theory, as well as contributions from art and cognitive science (albeit to a limited extent). Whilst the book is presented as useful for designers and design researchers, its intended audience is primarily design students, with the hope that the book may in future accompany undergraduate and postgraduate classes on creative design engineering.

In Chapter 1 the reader is introduced to Taura’s design cycle model, which serves to position the act of designing within a broader societal context and formalises three key phases in the creation and use of products: the *pre-design* phase, where the motive for design (e.g. human needs, personal values, etc.) is translated into product requirements; the *design* phase, where new products are created; and the *post-design* phase, where people interact with products and the motive for new products emerges. As Taura explains in Chapter 1, the book’s contents are organised into four parts addressing various aspects of these different phases: Part 1 discusses the motive of design, Part 2 examines concept generation during the pre-design phase, Part 3 provides an overview and analysis of conceptual design during the design phase, and Part 4 examines the necessary competencies for design, as well as the relationships between products, science and technology, and society in the post-design phase. The book concludes with Taura’s answers to the questions of ‘why we design’ and ‘why we are able to design,’ and a look towards the future of creative design engineering.

A key strength of the book is its broad perspective on engineering design, which considers not only technical aspects and the ‘act of designing’ as it is conducted by engineers, but also the role of design within society and its relationship with science and technology. Design is increasingly positioned as a crucial driver of solutions to grand challenges such as sustainability and environmental change, which require a considerably broader and longer term view on products and artefacts than has conventionally been taught in schools and universities. Taura’s design cycle model clearly outlines and conveys this perspective and could therefore be a useful tool for educating the designers of the future. Another notable strength is the exploration of concept generation in Part 2. Chapters 4–8 gather together findings from many of

Taura's studies on the similarities between linguistic processes and the generation of design concepts, positioning them within a more coherent narrative that hugely increases their meaning and value for design students and practicing designers alike. The work provides a very intuitive account of the various ways in which new concepts may be generated from existing concepts, centring on three methods: mapping between the properties of concepts, akin to the linguistic process of constructing similes and metaphors; combining different properties of concepts, reflecting the blending of mental spaces in linguistics; and the use of thematic relations to infer new situations requiring new products. By formalising what are typically implicit and unconscious cognitive processes and highlighting how they may be harnessed to arrive at more creative concepts, the work potentially provides a means for designers and students to systematically improve their creativity and concept generation processes in both an industrial and educational context.

Ultimately, however, the book does not fully deliver upon its stated aims. In addition to the concept generation methods outlined above, the book also includes what is a rather limited exploration of existing engineering design methodology in Part 3, centring upon a single design process model (Pahl and Beitz 1996) and attempting to identify the basic principles of conceptual design. Whilst all of this is useful to some extent, it does not constitute the "specific methodology for conceptual design" that is promised in the preface. The book also falls short as an introduction to conceptual design theory, focusing largely upon Taura's own work and Yoshikawa's General Design Theory (Yoshikawa 1981). Whilst the significance and value of Taura and Yoshikawa's work should not be understated, the book is missing several important theoretical contributions to conceptual design research from other authors. The lack of discussion of analogical reasoning stands out in particular, especially given the heavy focus on the related linguistic notions of metaphor and simile. These omissions would be less problematic if the book were not intended as a textbook for use by design students, who would surely benefit from a broad treatment of both conceptual design theory and engineering design methodology rather than a narrowly focused examination drawing from a limited range of authors.

Another aspect that could be improved is the book's structure, which is somewhat disjointed and difficult to understand at times. Different parts and chapters tend to start and end rather abruptly, often with little reference to what has gone before and what will be discussed next. For instance, it is rather unclear how the material covered in Parts 2 and 3 (concept generation methods and conceptual design methodology, respectively) relates to the design cycle model, and it is unclear whether the concept generation methods discussed in Part 2 are actually involved in the conceptual design process or a precursor. Each part of the book would benefit from a brief introduction indicating its purpose, explaining how it relates to material covered elsewhere, and clearly contextualising it within the framework of the design cycle model presented in Chapter 1. Addressing these aspects in any future editions would be a significant improvement that would likely make the book much easier to follow for students and researchers alike. Another useful development in future editions may be an expanded version of the design cycle model that more clearly illustrates its relationships with the topics covered in the book.

Overall, the book reads largely as an overview of Taura's work on concept generation integrated with some broader discussion of design theory and methodology and the relationships between design, society, and technology. In its current format, it is therefore likely to be of more value to design academics and researchers than students, although the latter may find practical value in the concept generation methods discussed (along with practicing designers). Its major contribution is the amalgamation of Taura's studies into a more consistent account of concept generation processes in design, and will therefore be helpful for anyone with an interest in this work. The design cycle model is also very useful in positioning engineering design as an activity that both drives and is driven by long term trends in societal and technological development. As noted above, the book would be improved by an expansion in the theoretical and methodological aspects covered and refinements to the structure and flow. Taura notes that the topic of creative design engineering "is still very new, even in academic circles" (Taura 2016, xvi). As such, one would hope that we can expect to see future editions building upon the promising foundation provided by this first edition.

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