

Comparing frame creation and TRIZ : from model to methodology

Citation for published version (APA):

Dorst, C. H., & Kokotovic, V. (2015). *Comparing frame creation and TRIZ : from model to methodology*. 598-608. Paper presented at 2015 IASDR International Design Research Conference, Brisbane, Australia.

Document status and date:

Published: 01/01/2015

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

Comparing Frame Creation and TRIZ: from model to methodology

Kees Dorst, University of Technology Sydney, Australia & Eindhoven University of Technology, The Netherlands, Kees.Dorst@UTS.edu.au

Vasilije Kokotovich, University of Technology Sydney, Australia, V@uts.edu.au

Abstract

In this paper we discuss a core quality of expert design practice, the ability to create new approaches to problems. If design can be seen as connecting Humanity to Technology, then the Frame Creation model we will introduce here focuses on the Human side of the problem, while an Engineering Design methodology like Theory of Inventive Problem Solving [TRIZ] does the same for the technical side of the equation. We will first illustrate such a complex Frame Creation project, using an example to establish an informal proof-of-concept. This raises the question how may we move from such a proof-of-concept to critically develop and validate a complete methodology. To answer this question we will draw parallels between the evolution of the well-developed and accepted TRIZ in Engineering Design, and the continuing evolutionary trajectory of “Frame Creation”.

frame creation; problem solving methodology; design thinking

The broad fields of Design and Engineering possess a peculiar capacity to create new approaches to problems, through a redefinition of the problem situation. In her book ‘Ethics in Engineering Practice and Research’ Caroline Whitbeck remarks that

“... The initial assumption (within moral philosophy) that a conflict is irresolvable is misguided, because it defeats any attempt to do what design engineers often do so well, namely, to satisfy potentially conflicting considerations simultaneously” (Whitbeck 1998, p. 56).

Other fields, suffering under the burden of too many unsolvable problems are beginning to recognize that some of the problem solving approaches from Design and Engineering, in particular the reframing of problem situations, might be useful in their domains as well [Dorst,2015].

While research into framing may be found in different research domains [i.e. Artificial Intelligence [AI], Social Sciences, Philosophy, Politics etc...] the common threads running through this research relates to notions of ‘making sense of the world’ and how this

understanding feeds into decision making processes. Goffman (1974) argued ‘Frames’ are ‘Schema interpretation’ which allows both individuals and/or groups to “locate, perceive, identify and label” events and occurrences, thereby portraying meaning, structuring experiences and determining actions/decisions. Moreover, according to Dennett (1978, p. 125) a central question focuses on how “a cognitive creature... with many beliefs about the world” is able to update those beliefs when acting in it so as to remain “roughly faithful to the world”. This notion of finding a groundedness and consistency in shifting perspectives is very relevant to design, as designers must adapt their individual perspectives and heuristics when moving through the design process.

In the domains of research indicated above, generally the research focuses directly on the mental process / activity of an individual and the perceptions and meanings they attribute to words and phrases. In recent times research relating to “Frame Theory” has been evolving within the domain of design itself (Schon, 1984 a). This research focuses on how we may intentionally develop frames, and has used empirical data on expert design behavior to gain insight into this hitherto quite mysterious process that lies at the core of design originality and ingenuity. Over the last 25 years, this research has developed to the point where models of how we may shift our frames of reference have been trialed and developed in the context of “real world problems”.

In this paper we discuss this core quality of expert design practice, the ability to create new approaches to problems (‘Frame Creation’). While we demonstrate how this works and how a Frame Creation model has been successfully implemented, the question remains: How may we move from such models and experimental projects (demonstrating a credible ‘proof-of-concept’) to critically develop a complete methodology that can be used across professional domains? To answer this question we will draw parallels between the evolution of the well-developed and accepted Theory of Inventive Problem Solving [TRIZ] in Engineering Design [i.e. Orloff (2006)], and the continuing evolutionary trajectory of “Frame Creation” in Design.

The problem with the problem (paradoxes and contradictions)

To understand the merits of this typical designerly approach to problem solving we need to step back and realize that many issues that we encounter in our daily lives and professional practices never make it to the status of ‘a problem’ - a ‘problem’ only occurs when something stops us from the normal flow of dealing with the issues in life. This ‘something’, the counterforce that keeps us from progressing, is bound to have its own background and rationale – this clash of rationalities creates the paradox that this is at the core of a problem. The word ‘paradox’ is used here in the sense of a complex statement that consists of two or more conflicting statements. All the statements that make up the paradox are (possibly) true or valid in their own right, but they cannot be combined for logical or pragmatic reasons. There are three ways forward from this. The first one is to choose in favor of one of the sides of the paradox and let that have its way. Then there is the option of compromise, where

negotiation might lead to a decision that sits somewhere around the half-way point between opposing needs. The third way is demonstrated in the Whitbeck quote above: to somehow rejig the problem situation so that the paradox does not exist anymore.

The complexity of design problems can be quite extreme because of the difference in *value systems* of the stakeholders involved in the project – stakeholders that all have to be satisfied for the solution to be a good one. In TRIZ terms these are predominantly *tradeoff contradictions*. It is the conflict between stakeholder demands that sparks the paradox, so the designer has to construct a design that transcends or connects the different value systems of the stakeholders, or the problem situation itself needs to be developed into a better alignment before a solution can be created. Either way, the designer has to step out of the ways of thinking embodied in these original value systems and frame the design situation in a new way, pushing it away from the manner it was initially phrased and presented.

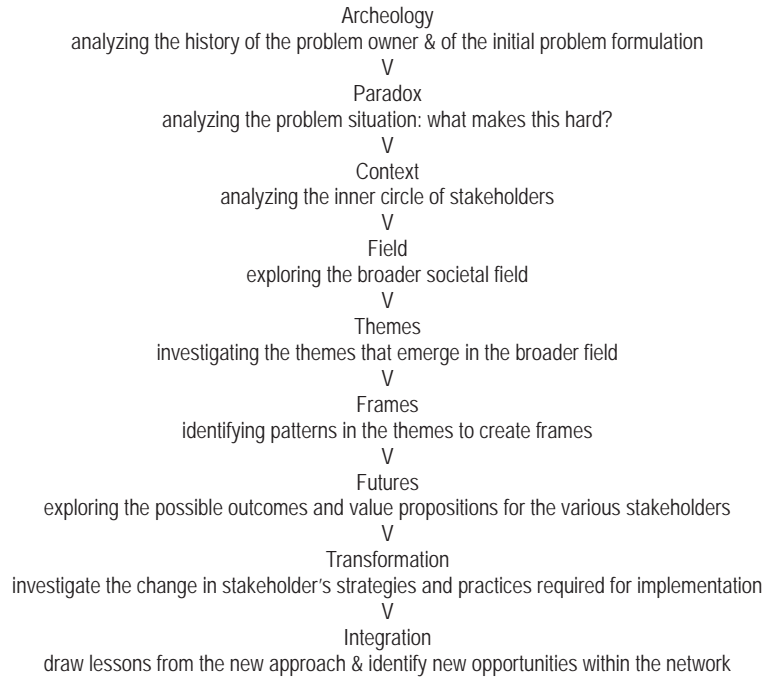
Principles and Process of Frame Creation

The key principle of frame creation lies in its deliberate approach to changing a problem situation. Expert designers have shown us that problems often cannot be solved directly, at least not in the terms in which they are presented. The problem and its formulation have their roots in a specific context, and this context needs to be critically appraised and then altered before the problem itself can be attacked. Frame Creation circles the history and assumptions behind the rationalities that have led to the original problem formulation. In a sense this may be considered a form of “mental scotoma”.

Given the above, this begs the question, how does one open up new avenues of thought, and critically analyze & challenge assumptions mired in historical precedent. We assert it is the fixedness of frames of persons within organisations that cause the perception of being stalled within the entrenched normative frames of reference.

In order to shift entrenched frames of reference, expert designer use nine steps [see: (Dorst, 2015) for an extensive description of this Frame Creation model].

At the core of the frame creation process is a complex movement of zooming out and zooming in: first from considering the problem itself to the immediate context, and then on to the wider context of the other players that could be involved in the problem situation. From a TRIZ perspective this relates to the need for developing an understanding of where and how the problem is situated within both larger systems and associated sub-systems. As in TRIZ, in “Frame Creation” it is argued we must expand our horizon to the broader field (in Engineering terms: changing the system border). Then we establish common Themes, and from these we create new Frames for the problem situation, which then lead to proposed actions (‘Futures’) that can be appraised critically. Mapping out the required transformations in the stakeholder organizations help to judge the proposed approaches on their realism.



The Designing Out Crime initiatives in Sydney and Eindhoven provided initial real-world platforms for performing crucial experiments in the development of a the Frame Creation model. To illustrate its workings we turn to a project that was executed some years ago for the Sydney Opera House. The Sydney Opera House Trust was seeking a new solution to prevent people - protesters and trespassers - from climbing up the sides of the building.

Archeology – In the Opera House problem situation focused on the problem of people (mainly protesters) climbing the ‘sails’ (the white shells) of the Sydney Opera House to unroll a banner or paint a slogan. The Sydney Opera House, as an iconic building - it is a Unesco world heritage site - and a highly symbolic place for the city of Sydney, is politically vulnerable. After an incident years ago, the ‘podium’ space that gives access to the white shells of the Opera House has been completely blocked off from public access by a fence, and security has been increased. The ‘temporary’ fence has been around for 8 years now, rendering this beautiful area unavailable to the public.

Paradox - The lead question is: what makes this problem hard to solve? We need to identify both the tradeoff contradictions and the inherent contradictions:

Tradeoff Contradiction

BECAUSE the Sydney Opera House is such an iconic building [Value laden], it attracts protesters that seek attention [Value laden]

Inherent Contradictions

BECAUSE protestors [specific individuals] are prevented access, the podium section is closed off for everybody [two opposite properties].

BECAUSE the podium is closed, the Sydney Opera House cannot be fully experienced as a special place

Once the core contradictions / paradoxes were highlighted there is a need to shape/reshape the context of the contradictions, not unlike within the TRIZ methodology.

Context – It is important to shift the problem situation by first studying the core group of stakeholders that is very close to the problem situation and will inevitably figure in the solution scenario and consider the values & approaches they might bring to the process. The physical and conceptual space for change is determined by the ‘Utzon design principles’ - a set of design principles and guidelines for modernization of the opera house, provided by the original architect. The inner ring of stakeholders around this problem situation includes within this context: the Sydney Opera House trust, Commonwealth Heritage, the food & beverage providers at the site, New South Wales police, New South Wales tourism board, the Sydney foreshore authority, the Opera House maintenance people, the counter terrorism police, etc....

Field – Anybody who might be connected to the problem or the solution – or who might exude and influence. In mapping the field of players we concentrate on their ‘currency’, interests, values and the frames they bring that could push the problem in a new direction. Some deeper patterns began to emerge, where shared underlying values can lead to new solutions. This move to identify emergent patterns/issues in the system, has a direct counterpart in the TRIZ methodology. In this case we should include the broader social field for the opera house, with about 8.2 million people visiting the building each year. There is the Aboriginal heritage of the site, the patrons that go to the music concerts and opera performances, the numerous artists and performers themselves, art organizations, etc. A major player in the field is the opera house itself, as a physical reality as well as an ‘iconic’ image that has become a symbol for Sydney and for Australia. Its design seeks to be universal, beyond any specific culture and to symbolize freedom, youth and hope. The podium space between the concert hall and the opera hall is the only place where one can be surrounded by the building, looking at the wonderful detailing of the shells, see the glow of the light, look at the sky and enjoy the breathtaking view over Sydney harbor. It is also quite an isolated space, with views that are framed by the architecture.

Themes - Once the field is widened identifying and mapping emergent patterns/issues in that wider field allows resonant themes to be made evident, which hitherto have not been considered as part of the “Problem Space”. An understanding of such common Themes will underpin the solution that can be supported by all parties and give a strength and resilience to the collaboration needed for implementation. In this case one theme is the conundrum of the opera house as it has developed into a cultural cliché: it is iconic as a picture, but the millions of near-identical photographs that are taken of the side view of the opera house across the water do not do justice to its intentions and complex reality. The steps up to the platform were meant as a spiritual, meaningful journey of leaving the city and everyday life to a hallowed place where one can experience great art. This original intent, with its sense

of intimacy and subtlety, is blown out completely by the sheer number of people around the building at any moment of the day. The deeper sense of a special place has gone, as well as (for most people) its connection to the arts. These values and intentions are overwhelmed by the strength of the building as an architectural sculpture. But that sculptural quality is largely visual and static, the building has become a museum piece in its own right – the theme that emerges is one of a place where life needs to be restored to the Opera House, on a subtle and human level in line with its original intent. The podium is the space where the spiritual intent of the opera house can be most clearly experienced. There is also a sense of refuge, escape from the business of the city. The visitor experience could be one of the culmination of a journey, coming to a stop and wonder about being there, in Australia, in Sydney. But Sydney locals avoid the headland where the opera house sits. While the Sydney Opera House is known as ‘The House’, it clearly is not a home to them. This begs the question of how may we “Frame” these core themes.

Frames - With the emergence of these themes the original paradox starts to shift. Themes that are shared among many different players in the field are particularly interesting, as they could be the basis for a new network of partners.

Based on the above themes, ‘liveliness/rejuvenation’, ‘spiritual uplift’ and ‘the sense of place/home’ many frames have been created and explored. One simple example in relation to the theme, ‘liveliness/rejuvenation’ serves to illustrate such a shift in thinking in relation to the Opera House podium:

Example.

IF the problem situation of the opera house podium is approached

AS IF it is a problem of liveliness/rejuvenation, THEN the podium should be...

To bring life to what is a public space outside the city centre, and make it function as a city square for the Sydney people, there should be a reason for them to come there, again and again – the space needs to be programmed to attract the right slice of the population.

Attracting local young people is especially important, as they bring a lively culture and could connect to the backpackers visiting the site. They are also a missing audience category for the opera house itself. Attracting these young people could be done through temporary exhibitions which may or may not be curated in a typical manner [i.e. pop-up events, light art, etc..].

Futures - The proposed frame is matched to the opened problem situation, and reshaped in a process of co-evolution.

A sample of the futures one might imagine by taking these frames as a starting point, and combining them where possible: one could envisage the podium space as a 24-hour curated space with different uses during the morning (yoga?) day (sense of space through a soundscape/ storytelling/ background information?) and late afternoon/evening (pop-up events, little concerts) to late evening (more meditative: moonlight/stargazing) combined

with slower changing events like sculpture exhibitions, soundscapes based on the concerts inside the opera house, interactive installations and projections. Similar projections on the floor inside (in the foyer) and outside (on the podium) could be used to blur the boundary, visually create the sense of lightness the architect envisaged in the original drawings. The programming would of course shift with the changing possibilities of the seasons. Thus the podium could be an ever-changing landscape, that tourists and (young) locals return to all the time to drink in the new experience.

Returning to the initial problem of the climbing protesters: the fuller use of the space around the clock will make it much harder for people to climb up without attracting attention. The infrastructure that is needed for the new curated use of the space can double up as a security measure: the interactive floor could register if somebody is loitering suspiciously at one of the possible climb-up spots, and alert security before a climb is attempted.

Transformation - The next step is a critical evaluation of what frames and solution directions would be feasible, through an exploration of what changes are needed in the practices of the participating organizations to make this all come together. This step results in a 'business plan' accompanied by a transformation agenda and strategy for achieving results.

While the ideas suggested in the previous section are attractive, and will certainly work to make the space a vibrant one and create a safer environment through natural surveillance, their implementation will require quite a transformation in the ways the key stakeholders have been dealing with their 'House'. The present stakeholders do not have experience in taking on the curation of such a space, for so many different audiences, on an almost 24h basis. Organisations from the city should be invited to organise and curate these events. While this would link the opera house with the city, it would mean that the Sydney Opera House Trust would have to relinquish some control over what exactly is going to happen on these hallowed grounds.

Integration - On a deeper level, the learning from the themes can be integrated into the organization. Once the program, the idea of inviting the city to express itself on the podium is underway, this opens up a myriad of possibilities. The Opera House podium could become a dynamic international attraction on its own. On an intellectual level, this unique exercise in giving new meaning to a landmark can be applied to many public spaces worldwide. This is suggestive of possible integration beyond the original problem frame and indeed context.

The above was merely one real-world example of how it is possible to move through the different steps of the Frame Creation model. Over the last six years, we have gathered more than a hundred of such examples. This raises question of how we may move beyond case studies and towards a more comprehensive frame creation methodology.

The story of TRIZ

The early development of TRIZ is attributed to Genrich Altshuller who in the late 1940's began its development and is based on the realisation (sparked when he was working at a

patent office) that successful solutions to problems resulted from the resolution of contradictions. From here he further developed the TRIZ model noting that most problems are complex and systemic in nature. He noted the initial problem [problem as given] could be related to larger systems, and also be broken down and related to sub-systems, and sub-sub systems. In a real sense the problem-as-given is part of a complex network of issues. Additionally, he was of the view that despite the existence of contradictions one should strive for an ideal solution [despite the fact one may never get there]. In terms of product development the product should: cost nothing, be made from nothing, use no energy, use no resources, not cause any harm, takes up no space, require no assembly, take no time to make etc.... These basic core precepts as discussed in Altshuller (1997) formed the foundations of ARIZ, the precursor to TRIZ.

As discussed in Rantanen and Domb (2002), over time ARIZ evolved to TRIZ, which at its core moves through 5 basic phase states: 1.) *understanding the problem* – 2.) *identification of the contradictions* – 3.) *identification of appropriate resources for the ideal final solution* – 4.) *identify and draw upon evolutionary patterns that may inform the ideal final solution* - 5.) *Propose an “IDEAL” final Result that either eliminates or resolves the contradictions.* In order to evolve TRIZ theories over time, extensive modeling, trials and tests were necessary in order to move towards a fully evolved methodology.

Conclusion: parallels and differences

In “Frame Creation”, as in TRIZ, we must first understand the problem to reveal the contradictions and paradoxes. In advancing more nuanced notions of conflicting considerations / paradoxes, the TRIZ literature holds there are different typologies of contradictions. It posits the idea that there are inherent contradictions and tradeoff contradictions. Firstly, a tradeoff contradiction means that if something good happens something bad happens [these are usually *value laden* based on human perceptions], and secondly an inherent contradiction means that the one thing has two opposite properties inherent within it.

Thus the Frame Creation model with its nine phases is clearly evolving along a trajectory which is not unlike the trajectory of TRIZ with its 5 phase model. Just as TRIZ has moved through the phased development trajectory of, Theory building, - Model building, - Model testing, to Tool development, the work within the Designing Out Crime initiatives in Sydney and Eindhoven has provided an initial breeding ground for the frame creation process model. (Lulham et. al. 2012).

TRIZ is focused on technical problems and more closely aligned with Engineering in its approach. Engineering method: First principles and analyse your way to a new way of looking. Using catalogues of solutions for the creative jump (the selection of this particular solution out of a catalogue and integrating it into the design is the creative act). Cataloguing

solutions in a way that makes them easily accessible to the engineering professional must have come naturally for Altshuller, with his background at the patent office.

If design can be seen as connecting Humanity to Technology, then Frame Creation focuses on the Human side of the problem, especially geared to bureaucratic or technocratic organisations that have lost sight of the users or citizens they are or could potentially be serving (see the Opera House example). The model is just the backbone that outlines the conceptual steps that need to be made as part of the Frame Creation process. Much more important than this mere progression are the methods and techniques within the steps, supporting the professional in frame creation through design techniques for all the nine steps. Very varied repertoire of techniques that have proven to be useful in the practice of the Designing Out Crime research centers has been pulled together in Method Cards (Dorst, Watson and Kaldor, 2015).

The development of frame creation from the level of a ‘proof of concept’ on a core process model to a true design-based methodology for application in organisations is a daunting task, as it deals with the Human side of the design equation, which is much less structured than the technical domain. The complexity and fundamental situatedness of the human side of design means that Frame Creation will always be positioned somewhere between practice and academia. Thus the Frame Creation model and (eventual) methodology should be assessed on criteria that range from internal coherence and integration, to external validity (for the proposed application area) but at the same time it should also be practical. ‘Practicality’ means that the methodology should be actionable and work within the constraints of practice, be applicable with relative ease, be effective (do what it promises) and efficient (deliver this in a timely and resource-lean manner). It should not only be internally consistent (free of inner contradictions) on a theoretical level but also not lead to absurdities or morally unacceptable outcomes in the real world. For the uptake of a methodology in practice it is important that it is perceived to be useful relative to contemporary challenges and seen as a valid way of approaching these challenges. In a close parallel to the body of work around TRIZ, it could be that we need to build up a typology of projects (however open-ended) and a treasury of themes - both valuable from the standpoint of wanting to support Frame Creation practice. This then is a balancing act with the academic standards, which require a methodology to have a novelty relative to the academic discussion - it should further the discussion in the field of research and spawn new, fruitful avenues of research. To deliver on the academic criteria requires its assumptions, goal and scope to be explicit and clear, and for the nature and scope of its contribution to the field to be carefully articulated. In a mature academic field like design research we expect a methodology to be both theoretically and empirically grounded. We note and accept the inherent size constraints of this paper restrict a more fully evolved discussion here. In time we will consider, explore, and indeed verify concrete results in relation to this model. Moreover, as a reference a more fully developed comparison between the historic changes in

the TRIZ model and the Frame Concept model is envisaged. It is our intent to move beyond the ideas presented here.

References

- Altshuller, G. (1997). 40 Principles – TRIZ Keys to Technical Innovation. Technical Innovation Center. Worcester, MA.
- Dennett, D., (1978). Brainstorms. Cambridge, MA: MIT Press.
- Dorst, K., Watson, R., Kaldor, L., (eds) (2015) Design for the common good. Amsterdam: BIS Publishers (forthcoming)
- Dorst, K., Tomkin, D., (2011-II). Themes as bridges between problem and solution, In: Roozenburg, N., Chen, L-L, Stappers, P.J., (Eds) Diversity and Unity – proceedings of IASDR2011
- Dorst, K., (2011). The core of ‘Design Thinking’ and its application, Design Studies. vol. 32, pp. 521-532.
- Dorst K, (2004).The problem of design problems – problem solving and design expertise, Journal of design research. vol 4, issue 2.
- Dorst, K., (1997). Describing Design - A Comparison of Paradigms, Published thesis TUDelft, The Netherlands.
- Dorst, K., (2015). Frame Innovation - Create New Thinking by Design. The MIT Press. Cambridge. MA.
- Goffman, E., (1974). Frame Analysis: An Essay on the Organization of Experience. Harper Row. London.
- Orloff, M., (2006). Inventive Thinking Through TRIZ: A Practical Guide. Springer-Verlag, Berlin.
- Lawson, B., & Dorst, K., (2009). Design Expertise, Architectural Press (Elsevier), Oxford, UK.
- Lulham, R., Camacho Duarte, O., Dorst, K., Kaldor, L. (2012). Designing a counter-terrorism bin, In: P. Ekblom (Ed) From Research to Realisation: Designing out crime from products. Crime Prevention [Vol 27]. Lynne Rienner, Boulder, Col.
- Rantanen, K. and Domb, E. (2002). Simplified TRIZ- New Problem Solving Applications for Engineers, and Manufacturing Professionals. S. Lucie Press, NY.
- Schön D., (1983). The Reflective Practitioner: How professionals think in action. Temple Smith, London.
- Schön, D., (1984 a), ‘Problems, Frames and Perspectives on Designing’, Design Studies, vol.5, no.3 (July 1984), pp.132-136
- Whitbeck, C., (1998). Ethics in Engineering Practice and Research, Cambridge University Press, Cambridge UK.

Author Biographies

Kees Dorst

Kees Dorst (PhD) was trained as an Industrial Design Engineer at Delft University of Technology, and studied some philosophy at the Erasmus University Rotterdam. He has worked as a product designer for various design firms and as a researcher, he has studied the

ways in which designers work. Currently, he is Professor of Design Innovation at the University of Technology Sydney and at Eindhoven University of Technology. He has published numerous articles and five books – most recently the books ‘Understanding Design – 175 reflections on being a designer’ (2006), ‘Design Expertise’ (2009) with Bryan Lawson and ‘Frame Innovation’ (2015) for MIT Press.

Vasilije Kokotovich

Vasilije Kokotovich (PhD) is currently a Research fellow within the new Design Innovation Research Centre [DI:rc] at the University of Technology Sydney. He has worked extensively as an industrial designer and design engineer in both the United States and Australia, much of it in parallel to his many years of teaching experience at a tertiary level. His areas of specialisation and current research relate to design thinking, design creativity/innovation, and design systemics. His latest research aims to develop creative thinking strategies/tools/methods that assist in the creative resolution of design problems. Says Vasilije: “It is argued that if we can develop and teach these creative thinking strategies, we will increase the creative capital of the cultures that use them”.