

A philosophy-based ‘toolbox’ for designing technology: The conceptual power of Dooyeweerdian philosophy

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In this article the conceptual power of Dooyeweerdian philosophy for designing technology is reviewed. It is shown that the philosophical richness of the theory of modal aspects, the theory of individuality structures, and the theory of ground motives has to be disclosed to engineers in order to apply them in their daily practice. The Triple I model has been developed with engineers in a dialogical process. This model takes user practice as a starting point and analyses this practice from three different perspectives: identity or intrinsic values of the user practice; inclusion of the justified interests of stakeholders, and the ideals, dreams and values that co-shape designs. Other philosophical tools are the theories of modal aspects and of individuality structures. All these tools are made concrete for engineering practice by means of schemes, drawings, design questions, moral standards, check-off lists and design heuristics. By adopting this model, it is hoped that these tools can be fruitfully applied in engineering practice.

Filosofiese hulpmiddels vir die ontwerp van tegnologie: Die konsepsuele mag van Dooyeweerdiaanse filosofie. Hierdie artikel ondersoek Dooyeweerdiaanse filosofie se konsepsuele krag vir die ontwerp van tegnologie. Dit blyk dat die filosofiese rykheid van die teorie van modale aspekte, die teorie van individualiteitstrukture en die teorie van grondmotiewe aan ingenieurs ontbloot moet word sodat hulle hierdie teoretiese insigte in hul daaglikse praktyke kan toepas. Die Triple I-model is in ‘n dialogiese proses saam met ingenieurs ontwikkel. Hierdie model neem die gebruikerspraktyk as uitgangspunt en analiseer hierdie praktyk vanuit drie verskillende perspektiewe: identiteit of intrinsieke waarde, insluiting van die geregverdigde belang van belanghebbendes, en die ideale, drome en waardes wat die ontwerp saam vorm gee. Verdere filosofiese hulpmiddels is die teorie van die modale aspekte en die teorie van die individualiteitstrukture. Al hierdie hulpmiddels vir die ingenieurspraktyk kan konkreet gemaak word deur middel van skemas, tekeninge, ontwerpvrae, morele standarde, oorsiglyste en ontwerpmetodes. Die gebruik van die model kan hopelik tot die vrugbare toepassing van hierdie hulpmiddels in die ingenieurspraktyk lei.

Introduction

What is the challenge of Dooyeweerdian philosophy? To answer this question, I would like to go back to the *Fifth International Symposium* (1994) of the *Association for Calvinist Philosophy* (Griffioen & Balk 1995). This symposium was dedicated to the memory of Herman Dooyeweerd, who was born in 1894. The objective was to give an assessment of and to present a perspective for his philosophy. Henk Geertsema (1995:18–19) evaluated the importance of the key concepts of the philosophy for the exact sciences and for science per se. On the one hand, he concluded that ‘his philosophy still supplies an excellent framework for a critical assessment and also for a positive interpretation of the results of scientific research’. Amongst other matters, he referred to the distinction between aspects and entities which resulted in two relevant theories: the theory of modal aspects and the theory of individuality structures. On the other hand, he concluded that the impact of Dooyeweerd’s philosophy is limited:

Dooyeweerd’s philosophy, then, has hardly led to a different way of doing science, to different theories within the disciplines, and so to new scientific discoveries ... Dooyeweerd’s philosophy seems to have produced little for the dialogue with the outside world. (Geertsema 1995:18–19)

Geertsema’s (1995) conclusion has been confirmed by the symposium itself. For example, Stafleu (1995) and Danie Strauss (1995) exchanged words about the meaning of the philosophy for the natural sciences and Schuurman (1995) wrote of its meaning for technology. These contributions are of special importance for the philosophy of the natural sciences and the philosophy of technology but contribute little to the natural and technological sciences. Haaksma (1997) has drawn a comparable conclusion about the work of the engineer and philosopher Van Riessen. He shows that the impact of his work – despite its undoubtedly quality – was limited.

The special issue of this journal shows that the discussion between Stafleu and Strauss has entered a new phase. Strauss (2009:138) states that his 'deepest concern is simply to co-contribute with Stafleu and other scholars' to the 'special scientific implications of this philosophy'. Stafleu (2014), for his part, puts their differences of opinion into perspective and states that their differences are 'nuances' because their 'religious starting point is the same'. However, these discussions have not precipitated a dialogue with natural scientists and technologists.

Since the *Fifth International Symposium*, several Christian philosophers have addressed the question of the meaning of the Dooyeweerdian philosophy - I shall limit myself to the field of technology. Verkerk and Zijlstra (2003) have applied it to industrial organisations. In particular, they use the theory of modal aspects and the theory of individuality structures to understand the structure of these organisations. De Vries (2006) has shown that the theory of modal aspects offers a fruitful perspective to understand the complexity of technological artifacts to raise a broad range of moral questions and to handle ethical problems as 'design problems'. Strijbos and Basden (2006) have edited *In search of an integrative vision of technology*, in which a Dooyeweerdian and systems approach is used to understand and to design information systems. Basden (2008) has elaborated on this work in his *Philosophical frameworks for understanding information systems*. Finally, Verkerk, Hoogland, Van der Stoep and De Vries (2007) have used the Dooyeweerdian perspective in their standard work *Thinking, designing, making: Philosophy of technology*. Amongst other things, in this book the theories of ground motives, of modal aspects and of individuality structures are used to understand the complexity of technology and identify its normative dimensions. These publications clearly show that the Dooyeweerdian philosophy has the conceptual power to develop – to paraphrase Geertsema's (1995) quotation – different ways of designing technology, different theories within the discipline of design, and so to smooth the way towards new technological discoveries.

The objective of this article is to make the basic concepts and theoretical richness of the Dooyeweerdian philosophy available to designers of technology. I show that philosophical concepts have to be 'translated' into concrete tools and I propose a toolbox with schemes, drawings, design questions, moral standards, check-off lists, and design heuristics. This article comprises four sections. After this introduction, section 2 tells stories about Stafleu and Strauss in the context of this special issue. Section 3 presents two stories about the need for philosophy-based tools and the conceptual power of the Dooyeweerdian approach. In section 4 a 'toolbox' for engineers is proposed that is co-based on the ideas and concepts of Christian philosophy. The article closes with some conclusions.

Stories concerning Dooyeweerdian philosophy

I would like to start with one story about Stafleu and another about Strauss. First of all, these stories act as a tribute to

these Christian philosophers. In addition, they reveal micro-mechanisms that contribute to the development of Christian philosophy.

Christian philosophers don't tell stories. Generally, they have a business-like attitude: they go straight to the philosophical point. However, businesspeople know the importance of 'small talk'. Small talk builds relationships and paves the way for doing business. The same holds for philosophy.

In 1989, I published my first philosophical article 'Gödel, Escher, Bach & Dooyeweerd' in *Philosophia Reformata* (Verkerk 1989). In this article I presented a critical analysis of the book *Gödel, Escher, Bach: An eternal golden braid* by Douglas Hofstadter and Daniel Dennet, and showed that Dooyeweerdian philosophy offers key concepts for understanding the relationship between humans, computers and thinking. When I submitted this article to *Philosophia Reformata*, I had two concerns. Firstly, I doubted whether an article of a 'philosophically interested chemist' would meet the requirements of this journal. In addition, the article was not yet fully finalised. At some points I was stuck in the discussion and could not find a way out. The article was reviewed by Dick Stafleu. He wrote a two page letter, typed on a typewriter in a small font, in which he urged me to finalise the article and showed me how to find a way out of the discussion. Looking back, I realise that the importance of this letter goes beyond the mere suggestions of a reviewer to improve an article. He put into practice the idea of a 'community of thinking' that stimulates young thinkers to make themselves familiar with a tradition and to give them confidence to find their own place in this tradition.

In 1994, I met Danie Strauss at the *Fifth International Symposium* in Hoeven, the Netherlands. The conference was held in an old monastery with many cosy corners to meet and have discussions in. I was impressed by his thorough knowledge of both philosophy and the sciences. In particular, I was amazed at his excellent memory, which enabled him to answer questions by citing extensively from the founding fathers of the Christian philosophy, complete with edition and page numbers. In 2011, I was invited by North-West University, Potchefstroom, South Africa to give a guest lecture on the 'Philosophical foundations of business ethics' and was informed that Strauss would be the respondent. To be honest, my first thought was that an exchange of the main speaker and the respondent roles would do more justice to the stature of Strauss. In addition, I foresaw the danger that the keynote lecturer would present a first draft of the philosophical foundations of business ethics but that the real foundations had been laid by the respondent. In the event, however, Strauss highlighted several key themes in Christian philosophy and strengthened the perspective given by the keynote speaker. This story clearly exemplifies the attitude of Dr Strauss: he is fully committed to strengthening the foundations of Christian thinking and to transferring this inheritance to the next generation.

Stories about designing technology

In this section I will tell two stories that show the necessity of philosophy-based tools and the conceptual power of the Dooyeweerdian approach to designing complex systems.

In 2008, I met Dr Paulo Ribeiro, an eminent electrical engineer, at the time a professor at Calvin College, Grand Rapids, United States of America. Ribeiro is familiar with Dooyeweerdian philosophy and he himself is an expert in the work of C.S. Lewis. He has put his wife, family, and friends on a diet of at least one quotation from Lewis a day, which resulted in a happy marriage, lovely kids and a loyal circle of friends.

Ribeiro was familiar with *Responsible technology: A Christian perspective*, a book written by fellows of the Calvin Center for Christian Scholarship (Monsma *et al.* 1986). This book was the result of three basic commitments: (1) 'to write a book for the general reader', (2) the recognition that 'doing technology is not a neutral activity but one that involves valuing of a profound, fundamental nature', and (3) the idea that 'technology, as one form of human cultural activity, must be done under the Lordship of Jesus Christ' (Monsma *et al.* 1986:ix). Ribeiro gave his unqualified assent to these commitments. However, his problem was that this book did not bridge the gap between Christian philosophy and the practice of engineers.

Ribeiro's main research topic is electrical infrastructure of the future. This infrastructure will be more complex than the present one because it will need to integrate traditional and sustainable energy resources, present new distribution systems to customers with quite different consumption and generation patterns, and implement smart control systems. During an extensive discussion, Ribeiro sighed:

It is impossible for an engineer to take the full complexity of these systems into account. I only have reduced models resulting in reduced designs that for their part result in sub-solutions and even wrong designs. (Personal communication)

This complaint resulted in a question: 'Can Christian philosophy support me to understand the complexity of this type of systems [*sic*] and to support me to design better systems?' This question marked an intensive cooperation that resulted in the article 'Planning and designing Smart Grids: Philosophical considerations' in an IEEE journal, *Technology and Society*, in which we presented a toolbox to help understand complex design problems based on Dooyeweerdian philosophy (Ribeiro, Polinder & Verkerk 2012).

The second story is about the thesis *Aging-in-place. The integrated design of housing facilities for people with dementia* by Joost van Hoof (2010). I was one of the members of the committee who had to judge the quality of the thesis. One of the challenges of this research was to develop an integral model to design housing for elderly with dementia. The doctoral student had solved this problem by combining

two existing models: the International Classification of Functioning, Disability and Health (ICF model) and the Model of Integrated Building Design (MIBD model). Essentially, the combination of these two models was already a breakthrough in thinking. However, this combination led to new questions. Firstly, how do we know that the combination of two models leads to an 'integral model'? Secondly, how do we relate the medical concepts of the ICF model to the building concepts of the MIBD model? The discussion about these two questions led to a long-term co-operation that resulted in the article 'Developing an integrated design model incorporating technology philosophy for the design of healthcare environments: A case analysis of facilities for psychogeriatric and psychiatric care in The Netherlands' (Van Hoof & Verkerk 2013).

With both Ribeiro and Van Hoof I started a journey towards exploring ideas and concepts of Dooyeweerdian philosophy and translating them in a 'vocabulary' and 'tools' for engineers. This translation required many dialogues, especially because these engineers were used to thinking in physical and technological categories and were less familiar with thinking in non-physical and non-technological categories. It goes without saying that such translation is a challenge. On the one hand, philosophical richness and strictness has to be maintained as much as possible, whilst, on the other hand, the vocabulary has to be understandable to engineers and the tools have to fit into their way of working.

Both stories have a lot in common. Firstly, they show that technological systems have become so complicated that engineers cannot grasp the complexity of their designs anymore. Secondly, in the engineering practice of these scientists – both were specialists in their fields – philosophy-based tools appeared not to be used. Thirdly, they support the idea that philosophical ideas and concepts have to be 'translated' into schemes, drawings, design questions, moral standards, check-off lists and design heuristics if they are to serve the design practice of engineers. Finally, they suggest that intensive dialogues are required if engineers are to become familiar with non-technological ideas and philosophical concepts.

A toolbox for engineers

Dialogical process

The toolbox for engineers presented in this section is the result of co-operation between one philosopher (MJV) and engineers in different fields: electrical infrastructure of the future (Ribeiro, Polinder), designing long-term homes for the elderly with dementia (De Koning, Van der Plaats, Van Hoof), internet portals in healthcare (De Lange, Van Well), orthopaedics (Holtkamp, Van Hoof, Wouters), and applied gaming for healthcare (Clamoth, Van Diest, Van Well, Wildevuur). This co-operation took the form of a number of workshops in which the engineering practice was taken as a starting point. Firstly, in these workshops the design challenges in the different fields were identified;

in particular (expensive) design failures were discussed to understand 'what goes wrong'. In business terminology, the needs of the customers were investigated. Secondly, in these workshops philosophical concepts and ideas were proposed in order to understand the complexity of the engineering practice and to identify the technological, social and ethical aspects of the design. In business terminology again, philosophical products were offered to the customers. The result was a 'catchball process' between the participants in which information and ideas were thrown and caught back and forth. Through a process of trial and error, philosophy-based tools for engineers were developed. In addition, the results of these workshops were presented to larger groups of engineers. In conclusion, the tools proposed in this section were developed in dialogical processes with engineers and scientists from different disciplines. These dialogical processes will continue in the coming years. Therefore, the status of this toolbox has to be described as being 'under construction'.

User practice and engineering practice

Why technology? Why develop new designs? Verkerk *et al.* (2007:34–36) have defined technology as a search for meaning. They state that technology is 'entirely concerned with the way in which human beings attempt to order and control reality with the purpose of leading a better, more satisfying existence'. The development of technology involves the 'latent possibilities of their surrounding reality and thereby also enable themselves to make life more meaningful'. This means that possibilities are 'opened up' by technology 'which can unfold, develop and give more meaning to our own lives and those of others'.

In the world of design, a distinction is made between user practice and engineering practice. User practice describes the way users make use of technology, and engineering practice describes how engineers develop technology. These considerations show that the design of new technology is about understanding user practice and designing for users. At first glance, this starting point speaks for itself. However, despite all the rhetoric about customer orientation, the engineering perspective has dominated the design process. Since the 1970s, alternative approaches such as *co-operative design*, *participatory design*, and *contextual design* have been proposed. Recently, the ideas of *open design* (Abel, Evers, Klaassen & Troxler 2011) and *users as designers* (Van Dijk *et al.* 2011) have been developed. The toolbox proposed in this article takes the practice of the user as its starting point.

Overview of the toolbox

The toolbox offers engineers the tools for unravelling the complexity of modern technological systems, to understand user practices and to design new products. The main tools in this box are:

1. Triple I model. This model 'seduces' engineers to analyse user practice from different perspectives in order to understand its key characteristics. The perspectives are:

- 1.1. The identity or intrinsic values of user practice.
- 1.2. The inclusion of the justified interests of stakeholders.
- 1.3. The ideals, dreams and values that co-shape designs.
2. The theory of the many aspects. This theory reveals the different aspects of technological designs. It prevents engineers reducing user practice to technological categories and urges them to ask new questions.
3. The theory of individuality structures. This theory supports engineers in understanding the identity and intrinsic values of user practice.
4. Supporting tools. These tools support engineers when investigating specific aspects of user practice, designing new products and evaluating different designs.

Each of these tools is elaborated upon below.

Triple I model

The Triple I model offers engineers a tool for analysing user practice from different perspectives: the nature of this practice, the inclusion of stakeholders, and the influence of ideals, dreams and values (see Figure 1).

The Triple I model is inspired by the idea of a practice as developed by MacIntyre (1981), the analysis of the plurality of society as offered by Mouw & Griffioen (1993), and the practice model developed by Jochemsen, Glas, Hoogland, Verkerk and others (Jochemsen & Glas 1997; Hoogland & Jochemsen 2000; Jochemsen 2006; Verkerk, Hoogland, Van der Stoep & De Vries 2007). The 'I' of 'identity' and 'intrinsic values' is based on both the idea of internal values as developed by MacIntyre (1981) and the idea of the qualifying function of the theory of individuality structures (Dooyeweerd 1969, III). The 'I' of 'inclusion of the justified interests of stakeholders' is based on the theory of stakeholders as developed by Freeman (2001) and the concept of justified interests is based on the idea of the qualifying function of the theory of individuality structures (Dooyeweerd 1969, III). The 'I' of 'ideals, dreams and values' is mainly based on the theory of ground motives (Dooyeweerd 1969, I).

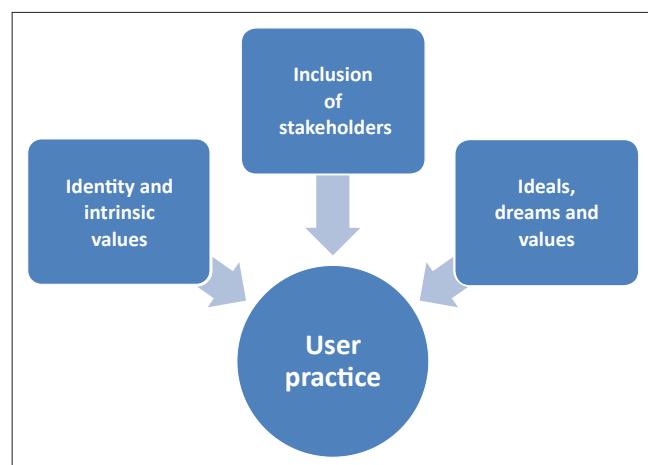


FIGURE 1: Graphical depiction of Triple I model.

The 'I' of 'Identity' or 'Intrinsic values' refers to the nature or character of user practice. It is about the context in which the design will be used. Let's take as an example the development of internet portals. There are any number of quite different portals, for example those with which to buy books, clothes, electronic equipment, and so on. These portals are designed in such a way that (potential) customers are informed as fully as possible about the offered products and are tempted to buy these products. The whole design of these portals can be understood from their economic function: to support purchase decisions.

But there are also portals that support citizens in developing a healthy lifestyle and in managing their (chronic) diseases. These portals are designed in such a way that users are informed about the function of the human body, the nature of the different diseases, and preferred lifestyles. In addition, these portals are 'personalised' so that patients can upload data and receive advice adjusted to their particular personal circumstances. The whole design of these portals can be understood only from the perspective of care, that is, the moral function.¹

In yet another example the user practices of the electrical infrastructure of the future are quite diverse. The practice of an individual household is characterised by the social function and of the industry by the economic function. The idea that user practices can have different 'identities' and 'intrinsic values' is an eye-opener for most engineers. Generally, they do not realise that internet portals for selling products are characterised by economic values and that internet portals for healthcare are underpinned by moral values. On top of that, the idea that one and the same product can have different identities in different contexts is for engineers revolutionary. In other words, the ideas of 'identity' and 'intrinsic values' urge the engineer to think about the nature and character of different user practices. It invites the designer to make the intrinsic values explicit and to 'translate' these values into design specifications (or norms).

The 'I' of 'Inclusion of justified interests of stakeholders' refers to an approach in which the justified interests of the different stakeholders are identified and included in the design process. For example, the most important stakeholders of orthopaedic user practices are: the orthopaedic specialist, orthopaedic designers, orthopaedic producers and insurance companies. Orthopaedic user practice is morally qualified: the patients or customers have to be supported in their daily functioning. All stakeholders of this user practice have justified interests. The justified interest of orthopaedic specialists is to have the technological and medical means to make a suitable diagnosis. The standards for this type of diagnosis have to be set by the community of orthopaedic specialists. The justified interest of the orthopaedic designers is that they have the freedom to choose materials and to

¹In my opinion, the kernel of the meaning of the moral aspect is 'caring for'. Therefore, the qualifying function of healthcare is the moral aspect. See Jochemsen & Glas (1997), Jochemsen (2006), and Verkerk *et al.* (2007).

develop designs that are in agreement with the diagnoses and support patients in their daily activities. The justified interest of producers is the freedom to design the production process to deliver a high-quality product at a competitive price and to make a living. Finally, the justified interest of the insurance company is that the shoes are cost-effective: they have to support social participation and must be characterised by a good price: performance ratio and a low cost of ownership.

In a good design, all the justified interests of the different stakeholders have to be realised simultaneously. In principle, this is possible because they are complementary and not contradictory.

Every user practice has its own stakeholders. This means that for every user practice a separate analysis of the stakeholders and their justified interests has to be done. The idea of 'justified' interests, on the one hand, opens the eyes of engineers to the diversity of stakeholders and their different interests, and, on the other hand, supports them in critically reviewing existing practices. For example, in architecture, the judgements of peers about the design and the beauty of a building is considered to be important. However, from a philosophical point of view, their judgement is not a justified interest.

The 'I' of 'Ideals, dreams and values' expresses basic beliefs about the good life. These beliefs co-shape the technological designs. These ideals, values and dreams are intricately present in every user practice. First, it is about the values underlying the user practice itself. Western culture is shaped by Christian, modern and postmodern values. These values influence the design in one or another way. For example, in present culture the idea of individual freedom is strongly emphasised, resulting in customised designs. In addition, this 'I' also refers to ideals, dreams, and values that are brought in by different stakeholders.

A beautiful example is a promotional film on an internet-based healthcare portal in The Netherlands. Potential customers were enamoured with the potential of this portal to increase their freedom. The film shows laughing patients who are enjoying the benefits of healthcare and practitioners who praise the cost-effectiveness of this portal. Pain, grief, blood and death were removed. The whole promotional film expressed a utopia: a world of happy people who manage their health and chronic diseases and a world without suffering and death (Van Well & Verkerk 2014).

Theory of many aspects

The Triple I model presupposes the theory of modal aspects (Dooyeweerd 1969, II). In communications with engineers the word 'modal' raises too many questions, so the expression 'theory of many aspects' is used instead. This theory is required in order to understand the idea of the many aspects: to prevent engineers from focusing only on the formative aspect and to broaden their outlook towards

all (relevant) aspects of a design. This theory can be used in particular as a 'check-off list' with which to ask questions and address all aspects when drawing up the specifications of a new design (see Figure 2a and Figure 2b).

Theory of individuality structures

The Triple I model also presupposes the theory of individuality structures (Dooyeweerd 1969, III). The theory of the modal aspects describes the different aspects in which things, wholes or concrete structures function. The theory of individuality structures describes the own nature or identity of these structures. Typical social structures in which human beings function and develop themselves are families, schools, employment, politics, entertainment and churches. All these structures have their own identity or individuality, as expressed by the so-called qualifying function: social, formative, economical, juridical, moral or pistical. In all these social structures technology will function adequately only when it is disclosed under the guidance of the quality function of the structure (see

Societal structure	Qualifying aspect
Government	Juridical
Local authority	Juridical
Industry	Economical
Health care	Moral
Households	Social
Church	Pistical
Football club	Social

FIGURE 3: Qualifying aspect of different societal structures.

Figure 3). For example, internet portals in sales have to be disclosed under the guidance of the economic qualifying function, whereas internet portals in healthcare are underpinned by the moral qualifying function. The theory of the individuality structures is required to help engineers understand the nature and character of the context in which technology is used. It is also required to understand that the identity of technology is not determined by technology itself but by the nature of the societal structure in which it functions. (Verkerk *et al.* 2007:118–122).

Theory of many aspects (1)		
Aspects	Electric grid	Smart grid
Arithmetic	Numbers	Measureable quantities: voltage, current and power
Spatial	Use of space	Transmission and distribution network
Kinematic	Moving components	Rotating generators, energy flow
Physical	Materials and properties	Cables, transformers, generators
Biotic	Influence on animals, human bodies, environment	Influence electromagnetic fields and waves on life
Psychic	Feelings of safety	Intermittent renewable sources lead to feelings of uncertainty
Analytical	Distinction between different types of grids	Different types of grids: micro, national, super, smart, ...
Formative	Control	Control of power generation, distribution and consumption, smart meters

FIGURE 2a: Theory of many aspects as analysis tool for engineers to explore the specifications of the design of smart grids.

Theory of many aspects (2)		
Aspects	Electric grid	Smart grid
Lingual	Meaning of terminology	Term 'smart' chosen to promote technology? Should it be Smarter?
Social	Influence on human behavior	Leads to more sustainable human behaviour?
Economic	Cope with scarcity of energy and higher demands	Price differentiation depending on momentary supply and demand
Aesthetic	Aesthetics of buildings and systems	Beautiful V2G connection points?
Juridical	Liability: ownership of networks	Who is liable for a failing smart grid?
Moral	Care for the environment, humans and animals	How do smart grids help in caring for humans?
Pistic	Trust in systems	Some people trust that smart grids will improve life

FIGURE 2b: Theory of many aspects as analysis tool for engineers to explore the specifications of the design of smart grids.

Supporting theories

When designing technology, many different supporting theories have to be considered. For example, User Driven Innovation presents theories and approaches that entail inviting users as co-designers (Abel *et al.* 2011, Van Dijk *et al.* 2011), Social Return on Investment maps the social business case of new innovations (<http://www.socialevaluator.eu>), and the Canvas model supports the development of new business models (Osterwalder & Peignier 2010).

Using the toolbox

The impact of the Triple I model cannot be estimated yet, but the first moves have been made towards 'a different way of doing science, to different theories within the disciplines, and so to new scientific discoveries' (Geertsema 1995:18–19). I would like to give three examples in the field of designing smart grids. Firstly, the Triple I model has been presented at two IEEE conferences about smart grids and has been adopted as a 'philosophical starting point' for a working group about the ethics of smart grids. Secondly, the model has resulted in an article in a refereed IEEE journal with the word 'philosophical' in the title: 'Planning and designing Smart Grids: Philosophical Considerations' (Ribeiro, Polinder & Verkerk 2012). Finally, the enthusiasm of engineers and policy-making officials speaks volumes: Paul Ribeiro has presented this model to a committee of the European Union about smart grids. The leader of this committee complimented Ribeiro with these words: 'Now I understand the complexity of smart grids and now I understand why the design of these grids is such a challenge' (Personal communication).

Conclusions

In this article I have explored the conceptual power of the Dooyeweerdian philosophy for designing technology.

Through a number of projects with engineers and scientists a toolbox has been developed to unravel the complexity of modern technological systems, to understand the user practice in which a specific technology is used, and to develop models and methods to support the design process. The dialogues between philosophers and engineers have to be continued to develop philosophy-based tools for the engineering practice. This is especially true of investigations into qualitatively different user practices, which are required to explore the usability of the present tools and to develop new tools.

From a practitioner's point of view, it is disappointing that there are so many 'nuances' in the interpretation of Dooyeweerd's philosophy – or, perhaps, a lack of conceptual clarity about it. The discussion between Strauss (2009) and Stafleu (2014) illustrates that 'nuances' concerns not only the details of this philosophy, but also the interpretation of its basic concepts and main ideas.

It is promising that both Strauss and Stafleu refer continually to the special sciences. The challenge is to intensify the dialogue between philosophy and the special sciences in order to settle the lack of conceptual clarity. For example, Strauss (2009:93–95) and Stafleu (2014) disagree about the nature and character of the 'historical aspect'. I agree with Stafleu that it will be fruitful to investigate the modal laws from the perspective of subject–subject and subject–object relations. But I agree with Strauss that the meaning–nucleus of the 'cultural–historical' aspect – or, better still, the formative aspect – can be designated as 'formative control' or 'power'. My guess is that special sciences such as technology (design) and organisation science can really contribute to a philosophical understanding of the formative aspect (Verkerk 2004; Verkerk *et al.* 2007).

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Competing interests

The author declares that he has no financial or personal relationship(s) that may have inappropriately influenced him in writing this article.

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