Radical and Gradual

Farewell Address

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By

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To all beloved ones
Radical and Gradual

Mijnheer de Rector Magnificus
Member of the Board of Management
Colleague professors and other members of the academic community
Dear audience,
Ladies and gentleman.

Due to time constraints only the sections with a title in bold will be presented on Nov 30!

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1. **Story from Zeeland** (a province in the southwest of the Netherlands)
The location of the village of Dreischor is six kilometers north of the town of Zierikzee. Started in the Middle Ages by building dikes around three sandbanks in the sea, it has grown in the nineteenth century to a village with 1200 inhabitants. Chief means to make a living are farming and the shipping of crops to the cities of Rotterdam and Antwerp. It is therefore no wonder that the crisis in agriculture of 1866 has hit hard. Also the farming business of Jacob is going badly. Although it is specialized in the cultivation of crops for industrial application it cannot stay out of the general slump.

After the invention of an industrial process to produce aniline in 1862, the growing of the plant rubia collapsed. Red and yellow colorants can be made easier now. After finishing the American Civil War, cotton will retake its leading position from flax. Prices of the latten have collapsed already. Also with linseed, oil and caraway seed earnings have become low.

In the Old Reformed Christian congregation where he is a member, Jacob has run into difficulties too. He has opposed against institutionalization as Church and he has been warned by the elder. Nevertheless he has stuck to his ideas. Now the threat is to be excluded.

Through all these events he decides to execute a strategy about which he has already thought for many years. Sell all your stuff and go. Leave the Netherlands and go to America for a new future. Soon after his decision the following placard appears in the village:
OPENBARE VERKOOPING

VAN

GEBOUWEN,
BOUW-
en
WEILANDEN.

De Notaris Mr. J. J. ERMERINS, residerende te Zierikzee,
met ten verzoek van C. Kip, op dingsdag den 15 April 1866,
snamiddags ten 2 uren, in de herberg van J. van Bloois Cz.
te Dreischor, publick presenteren te verkoopen het navolgende:

En tenzelfden verzoek, op dingsdag den 17 April 1866,
smorgens ten 9 uren, aan de voormalde schuur te Dreischor,
publick presenteren te verkoopen:

1 WELKHOEVEN, 2 VAARZEN, 1 groot VAARSEN, enkele partij BOVY- en MELKGEREEDSCHAPPEN, KLAVER-
en VEEDKOM, ROEGE- en andere STEED, een WERFT, enkele partij WEELHARDE en andere vermelde goederen.

Nadere inlichtingen te bekommen ten kantoren van voornoemden Notaris.

ZEGT HET VOORT!

GELDEN IN C. I. OOST, TE ZIERIKZEE.
But than the stories came and doubts start to appear. About the hot and dry planes of Iowa, about the ships with emigrants which are sunk to get the insurance money. About the preachers of the Dutch Reformed Church in America which are even stricter, about the offences against morality in New York, about sicknesses and about cold winters. In the end Jacob decided to stay and the sale is cancelled. In order to get new sources of income Jacob has realized that in previous years his crops of onions had been successful. The market for sweet and sour onions is growing. He increases the area for these crops substantially. In soil with 60% clay and 40% sand it goes very well. Gradually it is going better and better. In the end he becomes as ‘Jacob the onion farmer’ a wealthy man, at least according to the standards of that time. His problems with his congregation were solved by returning tot the Dutch Protestant Church. Here is room for quite a diversity of opinions. Jacob also bought a musical instrument and became a member of the local brass band. Although this band also played occasionally on Sundays, he was happy to play along.

2. Applied Environmental Design (EcoDesign)
A lot of elements in this story from Zeeland are also applicable if you get involved at Delft university in Applied Environmental Design:
* The content of the field changes rapidly, both through external developments and through your own research. Continuous change is necessary. In twelve years time a lot has happened, later in this speech I will tell more about it.
* What stays is that also here – like elsewhere in science - radical and unconventional thinking is best. After having explored in this way the extremes it is, at least for an applied field as this one, time to return to reality. If this happens in time, it is the most efficient way to find new possibilities and new solutions.
* In the field of Environment and EcoDesign itself but also when issues are at stake about the role of the Faculty or the University you have to stand by your principles and be prepared to accept the consequences. In Delft the good news is that there is a lot of tolerance for professors with deviating opinions and therefore in practice the situation is less dramatic than it sometimes seems to be.
* In the environmental world this is sometimes different. Although it is accepted that there are many avenues to go to Rome, problems occur if you at best want to go to Geneva.

Again, it looks here often that it is all about principles. However, this can be deceitful. It is therefore more important to participate in the field as constructively as possible and work in this community positively, even if you do not agree with the so called principles. In that way it is a lot of fun and that is what I am going to talk about to day. Before that a few other items will be addressed.
3. The development of the field of EcoDesign

3.1 The field, is it a real field?
If I ask this question, you are not surprised by the answer. It is a little bit yes and a little bit no. The answer is definitely yes from its administrative and bureaucratic perspective. It is the only possibility to be put on the university map and to be listed in the plans and strategies. In reality Applied Environmental Design is cross functional and therefore difficult to be put into a single box. It is a mixture of design with physics, materials science, chemistry, mechanical engineering, electrical engineering, business management and marketing. It therefore does not fit well into the traditional Delft university structure. This is not unique. Also universities elsewhere struggle with the problem how to integrate environment into their curricula. The best thing to do is therefore to address this in a pragmatic way. An engineering approach. Just do it, combine science, empirics and intuition. Use metrics and calculations and create some order in the phenomena observed. That is Delft at its best. That is me. Is that a real field? I have my doubts, but is it really bad that there is no holistic approach for Applied EcoDesign? I feel happy without it. Particularly in a new field it is not so important what you do precisely, provided that you really achieve something. If after a certain time it shows that there are consistencies and connections, slowly an engineering science is emerging. In the end, it really becomes a field, may be with a high content of adventure, but it is one.
Whatever may be, one thing is for sure. Applied EcoDesign is not a discipline. There are no fixed rules, no standards which can act as a baseline. Everybody is practicizing in his own way. That is charming but also sometimes confusing. Is it academic? My answer to this is yes, provided that certain quality criteria are fulfilled. Critical analysis do not accept everything. Here we are back at the story of Jacob, scientists are like Calvinists. They do not listen, they read along and have their own thoughts. This is a necessary but not sufficient condition to transform ecobeliefs into science. Maximal proof or at least evidence of high likelihood of truth is necessary.

3.2 From 1993 to 2005
Applied EcoDesign has developed tremendously in twelve years time. The core is still the same as it used to be. It is about energy, materials, packaging and transport, toxic substances and durability/recycling. All these area are not independent of each other; they are linked through the total life cycle of a product. Initially the idea was that improved environmental performance could be achieved mainly through application of “green” design rules. When these were brought together in handbooks and manuals: “green” design would happen automatically. In the first years this turned out to be true; in the 1990-1995 period big successes have been achieved in this way. May be this was due to the rules themselves. Looking back however, it is highly likely that this was simply due to the fact that it had not been considered before.
Soon it appeared that more sophisticated approaches were necessary. In the academic world it was tried to do better through the development of supporting
methodology (“tools”). Most of them were geared to calculate environmental properties of existing products and subsequently trying to conclude what needs to be done from a green perspective.

In industry the opposite happened. Green product attributes were measured and on that basis action agenda’s were formulated keeping physical and business limitations in mind.

As a result the academic and industrial approach of Applied EcoDesign grew more and more apart and still today this contrast between radical and gradual is in place.

In Delft it has always been tried to bridge this gap. This has not always led to praise: for some people what we did was too much compromising, for others still too dogmatic.

This shows that both from a societal or more specifically from a university or an industry perspective, environment is not always a unifying factor. There are conflicts of interest between stakeholders as well. In practice therefore, it is to be realized that environment is a new battlefield where old rivalries and competition can be fought out. Whether you like it or not, as a designer you are confronted with this reality. Good solutions to deal with it are not in place and therefore pragmatic choices have to be made, at least in my opinion.

In short this means; keep on thinking from a radical environmental perspective, keep on doing so as long as possible, but look at feasibility too. Being right is nice, getting (something) right is better. By practicing this, and by having stamina, a lot has been achieved.

The “EcoDesign community” has not appreciated this approach. Many perceived the Delft attitude as not according to the “true beliefs”. Sometimes I got discouraged by hearing so much dogmatic environmental crap by environmentalists but also by policy makers, consultants and even by (self declared) environmental specialists/scientists. However in practice this has mostly strengthened me to fight back, to come with ideas which work in practice and – most of all – to make something useful and pleasant out of it.

3.3 The position of Applied EcoDesign

The position of Applied EcoDesign – in spite differences in approach – in industry and at universities, is not essentially different. Both types of organization are generally speaking no natural talents in green. In both cases, organizational structures are less suitable for cross functionality. Another communality is – even to day – that a lot of employees have prejudices: environment will lead to extra cost, loss of quality of life or both. Inside companies questions about the relation of EcoDesign and money are prominent. What can “eco” contribute to the bottom line? After having eliminated obvious environmental stupidities of the past, an ecodesigner working in industry will be intensively confronted with this question. The answer to it is encouraging at least for electronic products. For material reduction, reduction of packaging and transport volume, simplified product architectures (recyclability) cost reduction and environmental improvement are almost one to one. For energy reduction this is mostly more complicated. Here these is a need for investment first. This means that there will be discussions
about pay back times. There is a value chain issue as well. The beneficiary of the energy reduction (consumers and society in general) is not the same stakeholder as the investor (producer). Combining environmental improvement and cost reduction is an excellent way to improve credibility of EcoDesigners in industrial organizations. Trust in itself is not good enough – only if environment is really integrated in all business processes it will work on a continuity basis. Such processes include a variety of fields ranging from purchasing to marketing and from strategy to execution.

Also in Delft we have been working on this aspect of EcoDesign. The philosophy behind this work is the same. The designer is the core but the business processes have to be known and a green dimension has to be added to it. Again radical thinking about the subject leads to the most creativity, but here even more sense of reality has to been shown. The good news is that environment is solidly on the business map. It is a small territory however. Wanting to rule the whole world from this perspective is a mission impossible. However, both small size and flexibility allow a lot of room to maneuver and offer plenty of opportunities to have a disproportional high impact. This is because most companies have pretty fixed ideas about design, have fixed procedures for product development and have a fixed set of suppliers. Radical environmental thinking asks in fact the question: “Why are things as they are”, not just for an environmental but also for other product aspects. Therefore the value of environmental thinking is so big. It can be applied to a much wider set of issues than just environment. In fact it represents therefore a more general improvement approach. My proposition is therefore that environmental thinking enables to tackle successfully problems which have nothing to do with environment as such.

3.4 After 2005

After the year 2005 there have been contrary developments in the field of Applied EcoDesign. At universities the work on methodologies and tools has developed rather in width than in depth. A huge debate has been started which tool is the best one. Beauty contests do not lead however to unanimity – everybody likes his own baby most. The result of this has been that application of the tools has been neglected – and for this reason there is a feel of crisis in a lot of EcoDesign circles. In spite of this there seems to be little urgency to make a real change of task. In industry, the increasing pressure of legislation leads to a more defensive attitude, compliance is getting a lot of attention – at the cost of productivity. Both developments are as such not necessary at all. In fact the potential of Applied EcoDesign has increased. Particularly this is because it is realized that combining design with mobilization of more technology and better product system organization. The consequence is however that a designer has not to be just creative but also needs to become a ‘design organizer’ to achieve real success.

Radical is the Delft idea that EcoDesign is not about minimizing the environmental impacts over the whole lifecycle. Rather it should aim at maximizing ‘Ecovalue’ (defined as the ratio between costs/environmental load) for the consumer. This Ecovalue concept seems to be very promising to give a
new impetus to EcoDesign. In practice it has not yet applied and in this respect the near future will be very exciting.

The developments in Applied Environmental Design as sketched above can be summarized in the figure below.

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**Fig. 2 The development of Applied EcoDesign over time**

This figure suggests that a substantial gap in approach has developed between academia and industry. Unfortunately there is no reason for that. The essentials of the field still have to be researched as yet. More knowledge and insight could create a stronger common basis. A problem in developing such knowledge is that to day research at universities is strongly dependent on third party financing. This also holds for Delft: in theory it is possible there to start work in this new total point, in practice it is very difficult if not impossible.

### 3.5 What did we do in Delft?

The chair of Applied EcoDesign is the result of a cooperation agreement between the IDE Faculty and Philips Consumer Electronics (PCE). For IDE the advantage has been that these has been direct access to EcoDesign activities in a business environment. Through this channel, Faculty research and teaching has been financially supported as well. PCE has benefited from the creativity of the M.Sc. and PhD students. A university setting also allows to do research digging deeper. This has resulted in important concepts like environmental benchmarking, eco-efficiency and ecovalue. All of them have found a place or will find one in the Philips environmental programs.

Also management systems for “product environmental care” and for recycle systems have been strongly enhanced by Delft Research. Last but not least also
measurement of “green product performance” and of “executive green performance have been developed and tested in practice jointly. The work has not done exclusively for PCE; a lot has been published in conference proceedings and in scientific journals.
The cooperation between IDE and PCE has been mutually beneficial. The essential issue in this is that both parties contribute in terms of content and of financing. For this reason there has been no one way traffic. In view of the very positive experiences I recommend to apply the IDE-PCE model much wider in university-industry cooperation.
In the Applied EcoDesign group, we have followed in the first years traditional approaches. Soon there was discontent; too much dogmatic rules and principles, not enough tailor made solutions. A lot of theoretical number crunching how it could be done or should be done, not enough actions to which a designer really can contribute. As a result a specific Delft, if not a stevelian style, developed. The starting point is: assess the environmental attributes of products and product attributes as they are and try subsequently to improve them. This can be done through design, but also through applying different forms of physics, by using better technology of by product management. In order to penetrate to the nucleus of improvement processes, radical thinking is necessary – everything should be possible, nothing is holy. Considerations in an early stage about money of about feasibility turns out to be killing. These issues have to be postponed to later stages and only as a boundary condition. For electronic products, this approach works very well. There turned out to be a high correlation between environmental improvement and cost reduction. Feasibility often is more related to convincing stakeholders in the internal value chain like purchasing, production, marketing and sales rather than barriers in physics or in financial investments.

3.6 EcoDesign management, what is green?
Contrary to usual ideas, green design does not sell. In our group therefore a lot of attention has been paid to the question how a green design can be managed in such a way to become successful in the market. There turns out to be no general rules how to do this. For each product group of functionality, the optimum is different. Apparently principles are generic, but solutions are to be tailor-made. For the question “what is green” or what is “environmentally friendly” there is no universal answer as well. There is a counter question at best: “if you indicate what the relative importance is of the environmental dimensions like emissions, resources and potential toxicity, I can give you an answer”. Inside the dimension of emissions, this question even digs deeper: what type of emission is most important: CO2, emissions related to biodiversity, emissions related to resources exploitation or emissions related to human health. Who knows has to tell! In any case, real science is not in a position to answer such questions about priority. It would imply that scientists get “dirty hands” and a lot of them do not want to engage in this way. The result is however that politics, the consumers and other stakeholders are left out in the cold. Due to this in a lot of environmental debates, emotions and ideological viewpoints get the upper hand. In the past fifteen years, subsequently toxics, recycling and now CO2 were the number one environmental
subjects to be addressed. The next theme, resources, in particular the shortage of liquid hydrocarbons is already announcing itself. My prediction is that after that toxins will come back on top of the list again. Another consequence is that in the recent past environmental decisions have been taken which are not well thought about. A few examples of this phenomenon are:

* Lead free soldering is mandatory in Europe for electronics, because of the reduction of toxicity. As regards resources and energy/emissions the lead free alternative is however worse for the environment. This has been realized in retrospect only.

* In the Netherlands a lot of natural gas is being used for the generation of electricity. This is because of the lower Co2 emission in comparison of the use of coal and oil. For emissions and toxicity (and the Dutch treasury) this is beneficial. However from the resource perspective it is a first class environmental crime to use such a high quality raw material for such a low grade application.

* Recycling leads to savings of resources, but can also lead in selected cases to a lot of toxic dispersion and high levels of emissions.

* Biodiesel, used lubricating oil and frying oil have today become popular as new sources for liquid hydrocarbons. In all these cases the broader environmental and societal implications of these alternative energy sources are still pretty well unknown.

The question in all cases is to stay: what is really the best? In any case not the fad of the day. It also makes the impression that every disadvantage has its advantage. This soccer wisdom from Johan Cruyff is however not sufficient and more qualified decisions are needed. Real compelling conclusions most likely will never come but on basis of an engineering approach reasonable clear priorities can be set at least on a national level. Delft is ready to contribute!

3.7 The task of the EcoDesigner

With all uncertainty and lack of transparency, the task of the professional EcoDesigner has become more comprehensive and more complex. More and more he or she has become a “design organizer”. The figure on next page shows this.
Fig. 3: EcoDesign processes

This figure shows that Design is still at the centre. In front of it is the functionality analysis.
Also for EcoDesign this analysis is extremely important:
Particularly immaterial and emotional product attributes are relevant for it. The measurement of environmental attributes when a design result has been produced is primarily for environmental validation, but also to set up useful and responsible communication about the environmental merits of the product.
Next to these mainstream activities there are a number of external circumstances which are relevant for the success of the green design. They both refer to the proper use of the opportunities of technology and management and to the markets and the value chains in/through which the products will be sold.
By bringing together all these items in a useful manner in a design, both the environmental and the economical value can be greatly enhanced.
In my opinion the diagram presented above is also valid for design processes in more general. This indicates that design with a specific focus on environmental design is in fact old fashioned. In fifteen years time it has become a part of usual design or should have become like that. Both in environmental and design
communities this is for the time being radical language. In practice – also at IDE - real integration of environment and usual design practices is not yet in place. Gradually the Faculty should work towards integration, particularly in the teaching curriculum. This means that Functionality analysis, Value Chain Management and System Management should get more attention in the program. I have considered to change my chair into one with the content of “Business Management and Design”. It did not materialize, the logic of it – when this was discussed a couple of years ago – has not been understood. Nevertheless I would like to ask the Faculty to change their mind and to establish such a chair.

4. **Doing in practice**

4.1. **Pleasure in empirical philosophy**
The notions about Applied EcoDesign sketched above have been gradually developed over the years. In 1995 the field was chiefly unknown territory and if a world is not known, the best approach is to start to try at a couple of things. Do some measurement, do some experiment and be not distracted by all kinds of stories which are around. That is the way we have started. With help of M.Sc. and PhD students Applied EcoDesign “Delft” style has been built. It went with “falling and standing up again” as we say in Dutch. It was done with confidence in own insights but also with preparedness to learn from other. For going through learning processes with sufficient self criticism a base line is useful but also regularly throwing ideas overboard is necessary. This has been done in a radical fashion in the last twelve years and as a result I have gradually become looking quite differently to Applied EcoDesign compared to 1995 idea’s. This kind of ‘empiric philosophy’ has been a source of a lot of pleasure. In our group we have had passionate debates and – with or without agreement – a lot of original ideas have been generated. Testing radical view points – a great sport! Of most of such ideas little is finally left, but when what is left is being brought in practice, it has an enormous outreach. Anyway, this way of working stirs things up. I learned this some forty years ago at the Philips Labs. It was great to be part of it at that time and it still is.

4.2 **Surprises when considering energy use**
The first example of an empiric approach of EcoDesign refers to the energy use of electronic and electric equipment. Dependent on the product type, 40 up to 98% of the environmental load over the lifecycle consists of energy use in the use phase and therefore it is a first class priority. In the holistic approach of environmental load both electricity generation as well as electricity use are considered and in this way environmental effects are sorted according to type CO2 emission (long term), human ecotoxicity (short term), resources (mid term) and ecotoxicity in general (unknown term) without weighing these effects in order to come to priorities. In scientific language this is called making “ecoprofiles”. This is a kind of complexity which creates a lot of problems; it is not the idea that designers step into the interpretation of what the profiles mean or could mean.
The intent is rather to come to effective action. In the Delft approach therefore simple choices are being made. Only consider items which the designer can really influence – for instance energy use of a piece of equipment. On the flip side is: do not deal with issues which you cannot influence as a designer. Although they are important (like for instance the way electricity is generated in a country). This separation of thought is unusual in the environmental world. However it leads directly to a clear design strategy – try to lower the number of Watts used. This is always OK, irrespective whether CO2 has societal priority or not. But it is particularly relevant because every consumer knows that Watts have to be paid. For a redesign strategy the approach is than directly straightforward. Measure where the Watts going in finally are used. Is it to realize the required functionality or is the energy lost in one way or another? The next step is obvious too: look how the functionality can be realized in a more energy efficient way – or at least how energy losses can be contained.

One of the first products for this has been done was an electrical oven of a German producer. A graduation student came to the following result:

### Example of energy analysis: Electric Oven

<table>
<thead>
<tr>
<th>Energy consumption</th>
<th>Consumption per year kWh Old</th>
<th>Consumption per year kWh New</th>
<th>Action taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock/timer</td>
<td>35</td>
<td>9</td>
<td>Design for clock/timer with low power</td>
</tr>
<tr>
<td>Pre heating elements</td>
<td>10</td>
<td>4</td>
<td>More effective pre heating cycles</td>
</tr>
<tr>
<td>Heating elements</td>
<td>42</td>
<td>34</td>
<td>Change geometry less on/off</td>
</tr>
<tr>
<td>Lamp</td>
<td>3</td>
<td>2</td>
<td>Replace lamp by low watt, better positioning</td>
</tr>
<tr>
<td>Losses</td>
<td>4</td>
<td>2</td>
<td>Better insulation</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>94</strong></td>
<td><strong>51</strong></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 4. Energy use of an electrical oven before and after redesign

In this table can be seen that the clock/timer of the product consumes a lot of energy. By purchasing action this brought drastic improvement. Also by better controlling the preheating process a lot could be gained. For the heating itself the gain is relatively modest. This is because functionality has to be considered as well. The food prepared is required to taste well, not just to be hot or cooked.
This condition makes that the reduction realized is lower than the physical potential. Also for the lamp and the insulation some improvement has been scored – initially the idea of the producer was that here the biggest gain could be achieved! The outcome of this energy analysis was a surprise for everybody. The conclusion was very clear: let the facts speak. Also it was concluded that improvement of green product characteristics can be done through EcoDesign but also through purchasing or by using better technology. But the most important conclusion was: keep a close eye on the real functionality. In the new design this functionality needs to be better or at least equal. Sometimes this is a hot issue.

A well known example are vacuum cleaners. The popular perception is the more Watts the better. However we have shown in Delft, that by optimally balancing the power of the motor and the geometry of the hoses and the attachments the energy use can be halved while keeping the same functionality. Product and marketing mangers did not buy into the concept. Their argument was that this could not be explained to the users. For TV sets it is problematic too. Watching TV seems to be for pleasure and than energy reduction is suspicious. The prejudice is that it will go at the cost of picture quality. Today, many TV’s have a light sensor which adapts luminosity to the light levels of its surroundings. This leads to a lot of savings and creates a platform for other improvements. Finally: fridges are the easiest in this respect: as long as the beer is cold, everything is OK.

The fear of a lot consumers is that environmental improvement leads to a loss of quality is not completely unjustified. Reduction of overkill and quality care are sometimes confused, also by EcoDesigners.

4.3 Playing with material
Eighty percent of the environmental load originates from the early design phase. In theory this is true, in practice this proposition implies a dangerous suggestion. The suggestion is that by appropriate design this eighty percent can be substantially reduced. This is not true. If a certain functionality is to be realized, a certain form of physics has to be applied and this results in environmental loads. For energy this is clear, whether it is a glowing wire in a lamp, a Cathode Ray tube in a TV or a processor in a computer – in all cases the part of the energy use which can be influenced by design is limited. In some cases – if available at least – different physics can be applied through which energy consumption is drastically reduced.

Energy saving lamps and LCD screens are good examples of this. For material use something similar applies. Here the limitation is that functionalities have a minimum size. In cell phones the individual keys have to be touched separately, screens of computer monitors have to be bigger than 15 inch in order not to get tired and in a washing machine or a fridge a certain minimum volume has to fit in. Also the as environmentally friendly promoted services are not as free of
environmental load as they seem. Mostly an infrastructure is needed and it takes literally or metaphorical a lot of energy to keep it going. In Delft we have focused in what EcoDesign can achieve and not in what its limitations are. The design bandwidth for mature products like TV’s and audio equipment is in the material application area still some 20-30%. For products which have just entered the market it can be substantially more. This is a substantial potential also for cost reduction. These numbers also show that designers are often caught in design traditions of the company, or that there is little time available to radically rethink traditional solutions. This can also be observed in a different way. Between electronic products of different brands – having the same functionality – there are big differences in application of different types of materials. This is particularly relevant for plastics application. Here the design bandwidth goes up to 40%. More use of plastics means mostly less use of metals will all the consequences connected to that.

It is not as simple as stated here. Plastics have the lowest environmental impact per kilogram and have a low specific weight, but are often perceived as cheaply material by the consumer. Moreover plastics can contain environmentally unfriendly additives and the recyclability is less than the one of metals. It may be that therefore the physical and economic functionality of plastics are very good but that in the departments of immaterial and emotional functionality the score is low. For buyers interested in this – in Europe that is some 35% of the buying public – material application is an important issue for decision making. If designers only go for the lowest environmental load this could be counterproductive in the market. Interesting are also situations where in one environmental category sacrifices have to be made to realize a big saving elsewhere. A well known example of this is the energy saving lamp. This lamp requires more material than the incandescent lamp, but uses much less energy. More examples are: use of more copper to make transformers more efficient and the use of precious metals to enable miniaturization of electronics. It all shows that the widely promoted design strategy of dematerialization by no means is a universal recipe for environmental improvement. On the contrary: Since materials are recyclable and energy dissipates an environmental investment in materials often is an investment in quality. As a designer, playing with material applications is a way to find out what is the best from a functionality perspective. It is interesting, fun and simultaneously a serious game. Its rules are known by now, but since it is a game there are surprises again and again.

4.4 The changing world of packaging and transport
It all started so decent and so dull. Like reducing the materials of a product also the reduction of its packaging weight has been considered. Here the reduction potential is often some 20% maximum for comparable products. This seems only a little but it still is a lot of environmental load and a lot of money. More challenging was the next issue to be addressed: how big is the percentage of recycled material which is being used in your cardboard boxes. Few designers
know the answer and that means that it is highly unlikely that the maximum percentage is being applied. For boxes to pack electronic products that is 60%. With consistent application of this percentage there is a saving of 45% in environmental load and 15% in money with respect to 100% new material. So simple can it be. But a lot of companies and also designers considers something ordinary as a card box not as their beer. Instead it is seen as a natural given which has to be accepted as it is.

Conservatism also shows when the functionality of the box is considered as well. If it is supposed that the primary function of the box is protection against damage, it is useful to look at the relation between environmental load respectively costs of packaging and transport damage. As far there are data available it can be estimated that these are 3 up to 20 times as high as the damage. Apparently producers are cautious. Or does further thinking stop because insurance is covering the damage?

The large scale shift of production from Europe and de USA to Asia has also far reaching consequences for packaging and transport. Obvious is to shift the design emphasis from weight reduction to volume reduction, since the role of container transport has become so important. Smaller products in containers do not need individual packaging as well. Delft graduation students have made excellent designs of multiple packaging with a very low packaging volume per product. The savings are even such that it pays to repack the products on arrival in the country where these products are sold. In a lot of cases this is not needed anymore. This is because a big part of the trade (60% or more) is ordering on basis of container loads. Supply on basis of numbers ordered is occurring less and less. If container deliveries dominate, this packaging can be much simpler than what we have today.

In Delft we have of course measured as well. An example is the ratio between the volume of packed product and the volume of the product itself. There is a linear relationship between the two parameters with a ratio of 1.78. Only for small products the ratio is higher. Why 1.78? There is no physical reason for that. The only reason I can dream up is that for almost all electronic products there is a standardized drop test. The rule is that buffers around the product should have a thickness which is such that products can drop from a height of 50 cm without being damaged. If styrofoam is being used and it is supposed that products all have the same shock resistance the ratio is indeed 1.78. But the drop test is to a large extent passed by time. Trucks are not loaded by hand, ships roll but do not shock. The conservative design strategy is to reduce all volume ratio’s above 1.78 to that figure, that is already a tremendous improvement. Better is to go to lower ratio’s. Several producers slowly have moved in the last years to 1.75 or 1.74. I would be more radical: 1.6 or even 1.5 could be easily done – also keeping the damage consideration as above in mind.

Also the observation of much higher ratio’s at low product volumes was intriguing. Soon it turned out that this is related to a change of the function of packaging. Apart from the protection functionality issues like drawing attention from consumers and giving information on the boxes have become relevant. A lot of products are sold out of the box today in mass markets.
For such reasons it is relevant to increase the volume of the packaging or at least the area of the visible front of the box. Sales packaging is there for something different as transport packaging. Only few producers realize this and have set up design policies to deal with this. In short, there is a lot to improve in this field. There is even a third kind of packaging which is occurring fast more exclusive products or for products which are often bought as a present. This is the so-called “experience packaging”. This is a kind of packaging which should look nice and pretty, easy to open and should preferably have a kind of surprise effect. In this field there is a big potential as well. Only for the packaging of iPod products of Apple the rule for experience packaging are followed in a consistent way. With all this, EcoDesign of packaging has become an exciting activity. The functionality analysis (transport, sales, and experience) and the analysis of the transport chain have become highly relevant. Irrespective of the current situation there is a huge potential for environmental and financial gains. The reason for this is that so far few designers have systematically dealt with this matter. Again this shows what you have become familiar with by now. Applied EcoDesign starts with environment and it ends right in the hearts of the business.

4.5 Take back and recycling of discarded products, learning by bitter experience?
Separately collecting and treating electronic products is a good idea. For a – on average – low cost per piece this kind of waste is kept away from landfill and incineration. Valuable materials can be recycled; from several mixed fractions at least energy can be recovered and last but not least potential toxic substances can be kept under control. This is a broad societal consensus, the problem is in the high costs. In the Netherlands it is for 100 % collection a bill of 100 million euro, for Europe as a whole it is 2,5 billion. Who will pay for this? The consumers, the producers or the municipalities? A huge debate in which designers or at least the design philosophers among them have sent society into the wrong direction. Their idea has been – to say it in short – to let the producers pay. If they have to do this, the designs of the products will be changed in such a way hat the recycling costs become zero, or if they do very well, can turn into a profit. If the consumer pays for the product which have not been adapted (the historic waste) than everything will be automatically become OK. This kind of ideas has been taken as a starting point for legislation in Europe and therefore in the Netherlands as well. And there we have the problems. Legislation based on design as magic. This had not been shown before but once in your life it is the first time. It is even worse: in the present European Directives for recycling the goal is not clearly defined. Is it to foster recycling or is it to control toxic substances, and of course politicians would like to have both. But from a technical point of view the two goals lead to different treatment avenues. This has been overlooked because the law has an implicit preference for manual disassembly and than this is not much of a problem. In the Directives there is little attention for collection too and no attention at all for the fate of the secondary streams after treatment.
This is all too bad and unfortunately it is a good example as well where dogmatism and politicizing of environmental issues can lead to. As a group we have been intensively addressing these issues and also tried to support better qualified decisions. The way of making is already known: look whether the dogma’s and propositions are not only true in theory but also in practice. Do environmental measurements, think in terms of money. Make priorities, have criticism, but simultaneously propose alternatives. To come to relevant judgements the whole chain of discarded products has been mapped as regards environmental and financial aspects. This has been done per product category.

This type of work has been done for TV’s, other consumer electronic products, monitors, fridges and freezer, washing machines IT and communication equipment. Mutually there turn out to be big differences in ecoefficiency of recycling among these groups.

More important is however an important set of clear common conclusions:

- it is better to base collection and recycle targets on environmental relevance than on weight.
- most electronic products (more than 90 %) have a cost deficit on treatment. This cannot be remediated by better design.
- The eco-efficiency of take back systems is best served by economy of scale. Applying latest treatment technology ranks in second place. Better design ranks a third place only.
- The environmental effectiveness is best served by more collection, high level reapplication of secondary streams ranks second, better treatment is on spot 3.

Such conclusions are for many years now the “inconvenient truths” from Delft. This holds for a lot of stakeholders: in particular for politics, the governments and sometimes also industry. Gradually the scene is changing. The Delft knowledge about take-back systems is currently being used for review of the European Directive on electronics recycling and also sensible member states use it as well.

4.6 Disassembly, a blessing in disguise

Disassembly has been for many years the core doctrine of the recycle beliefs. Through this, a product is taken apart in a very detailed way and through this the most pure material fractions are obtained. If disassembly is really disassembly into very small parts, it takes a lot of time and therefore money. This will lead to very big recycling deficits.

Once I have calculated how much material has to be disassembled in one minute to be cost neutral (including the upgrading costs of the secondary material). For the hourly tariffs in the Netherlands there are frightfully high amounts which are somewhere between 500 g. and 1 kg/minute (excluding precious metals). This indicates that it is uneconomical to disassemble almost any electronic product with a weight below 5 kg; only when there are too much toxics, this is warranted, but than the reason is an environmental rather than an efficiency one.
Fortunately, the separation characteristics of the so called mechanical treatment technology has vastly improved in the last ten years. Also the insights how mixed fractions can be upgraded has increased vastly. In both cases the group recycling technology of our TU has contributed a lot.

All this does not mean that disassembly is over and out. Also from other perspectives it remains a very interesting subject. One of my first graduate students made a table of so-called standard disassembly times for all kind of fixtures, just by measuring in practice, with help of a stopwatch. Irrespective whether this is for screws or glue joints or for anything else, nearly constant figures are found for this type. First we did not believe this ourselves. We found however at a University in Texas somebody who had calculated these times based on an ergonomic theory. These figures agreed wonderfully well.

This was an important result. From now on – without having a prototype available – disassembly times could be calculated. In this way all kinds of design proposals can be rapidly analysed.

In this way it could be established for instance that radical design of audio products – usually products with a very long disassembly time – still could not be made cost neutral on treatment after discarding.

However when it turned out that the standard time had also predictive value for assembly times, the calculations gained in popularity. When Philips Consumer Electronics still had a lot of factories I was always received well. This was not because I was valued as an environmental specialist, but because I had invented a trick to estimate assembly costs quickly.

The calculation of disassembly times in comparison with those of competitors products has – also for this reason – become part of the so called Environmental Benchmark procedure.

The standard times have also been used with a lot of enthusiasm in the “disassembly sessions” which are part of my class in Applied Eco Design. It is always a big success and in spite of all chats and disorder it is serious – a lot of learning is connected to it.

Disassembly also plays a big role in controlling potential toxic substances. With all drives to maximize recycling this is something forgotten. There are even products - as for instance LCD TV’s and energy saving lamps - where this is the most important aspect on treatment. In the European recycling regulation toxic substances of electronics are only addressed in an Annex-without defining however what the requirement of “removal of hazardous substances” really means.

For products brought to the market after 2006 there are clear rules for potential toxic substances. There are however exceptions because such substances are necessary to make physics work ecoeffcient.

Therefore for some product categories the toxicity issues stay in place. For such cases special rules will be necessary, both at the collection side (return premiums) as well for the outgoing material streams. So called integral treatment
can sometimes be a way out – but in the end – in spite of all better technology – in some cases disassembly and design for disassembly is there to stay.

5. Eco Design and Business

5.1 Green Marketing

Of all subjects in the field of environmental management where our group has done research, today I will only discuss the subject of “green marketing”. This is because this subject is most related with design, and therefore fits the best in the Faculty.

“Green” as such does not sell. In the Netherlands more than 80% of the respondents says to seriously consider “green” products. In practice the behaviour is different; only 25% to 30% really buy. From in-depth interviews it turns again that consumers are more selfish than anticipated from the superficial ones. Environment turns out to be a collective rather than an individual item. For electronic products the attitude of potential buyers with respect to green products has been researched. From the table below it appears that here are seven archetypes of environmental behaviour.

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage of total</th>
<th>Buying of Green Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmentally engaged</td>
<td>15</td>
<td>Often, not from multinationals</td>
</tr>
<tr>
<td>Rational pro-environment</td>
<td>15</td>
<td>Yes, if all people do it, it will work</td>
</tr>
<tr>
<td>Emotional pro-environment</td>
<td>13</td>
<td>Occasionally, prejudice about price</td>
</tr>
<tr>
<td>Environment is too difficult</td>
<td>15</td>
<td>Seldom, may be it is a trick of producers and the government</td>
</tr>
<tr>
<td>Environmental pessimists</td>
<td>15</td>
<td>No, it does not help on global scale</td>
</tr>
<tr>
<td>Proponents of economic growth</td>
<td>10</td>
<td>No, all this environmentalalism hampers growth</td>
</tr>
<tr>
<td>Enjoy life</td>
<td>17</td>
<td>No, I do not want to hear all these troublesome stories</td>
</tr>
</tbody>
</table>

Table 1: Environmental attitudes of consumers

From this table it is evident that electronic products which are promoted just because of being “green” there is only limited interest. A “green” TV which is being advertised against the background of a meadow full of flowers and little lambs does not sell. This means that such a product in order to be really attractive for a broad public has to offer other benefits as well. These benefits can be in different functionality fields. A very strong combination is environment and money (for instance: lower electricity cost). Environment and health combine
very well, but this is for electronics less relevant as for food. A combination of environment and design, that is design with a quality or even exclusivity flavour or original design, scores well. From research on audio products it turns out that green in this category associates with smaller volume. Natural look, simplicity, round forms and pastel colours score well. Square products, dull black or outspoken colours and pronounced design are generally felt as negative. From the in-depth interviews it also turned out that women are much more environment friendly than men. In the last ten years participation of women in buying decisions has increased greatly. A combination of “green” design and “feminine” design works well in the market. This conclusion was also drawn in a research project in which products promoted in the market as being green were investigated. Most of them get negative ratings, both as regards quality impression and as regards formgiving. Women turned out to be significantly more negative than men.

5.2 **Ecovalue**
For the discussion below Ecovalue is defined as the ratio between cost of ownership of a product and the environmental load over the total life cycle. This is in two ways a radical departure from the traditional approach of Eco Design. First of all Ecovalue looks from the demand side (consumers) rather than from the supply side (producers). Moreover environmental load is related to real money. In an economy where a consumer is in the drivers seat this is both relevant. Also because money – at constant income – can only be spent once. If products become cheaper because of Eco Design (and this is often the case) more goods can be bought which undoes (part of) the environmental gains through design, this is called the rebound effect. Designing for higher Ecovalue is not hampered by a rebound effect.

In order to implement an Ecovalue strategy in practice the buyer needs to be prepared to pay more than for a standard product. This will be the case for products with a better immaterial and emotional functionality. Particularly in countries with a high in come per capita, products catering to this are an important segment in the market. In Western Europe this is 30 – 35 %. Also new products have a higher Ecovalue than mature ones, this is another 30 – 35 % of the market. Price buyers form in Western-Europe only 30 – 35 %; for them the Ecovalue concept is not applicable. These market data show that the Ecovalue concept is highly interesting. There are several green design strategies conceivable to tap the Ecovalue market. Next to traditional decrease of the environmental load this can be more convenience, safety, quality or originality or combinations of those.

A radical Ecovalue strategy is one in which products are designed in order to get a significant higher price than the standard product while accepting a little increase in environmental load. In the end this is better for the environment because this is basically aiming at a “reverse rebound effect”.

In the field of electronics examples of such a strategy are Ambilight TV’s and audio products with superior form giving.
So far, producers have only implicitly tried out Ecovalue strategies. In fact it is a form of product differentiation. Such strategies are already in place; only an environmental dimension is added: environmental quality. Unfortunately, this is still seen as a technical item – even if traditional Eco Design avenues are abandoned. A good example of this is the pursuit of an ecoefficiency concept in design in Japan. In this it is clearly recognized that lowering of the environmental load has physical limits. The only way out is increasing the functionality. In my opinion this is only effective if the functionality increases are rewarded by the consumers by paying more for the product. However, Ecovalue thinking does not occur in the ecoefficiency as put into practice in Japan. It remains therefore a supply side approach.

5.3 Steak and beans
Ecovalue leads to more recommendations which seems to be contradictory. One is that in order to fulfil the need of the human body for proteins it is better – for those who can afford – to eat steak instead of beans. The environmental load per unit of protein is high with respect to the one for beans but the price of steak is disproportionally high. For this reason the Ecovalue of steak is better. Moreover although taste is beyond debate, most people like steak more.

This paradox has been presented in class for many years to the students. A reward has been in the form of a nice bottle of wine or liquor. For the person who could undo this Ecovalue paradox. I promised as well to buy the bottle biking to the nearest shop instead of going by car to the superstore more far away. In spite of all this encouragement no one has come up so far with a valid argument, so I make now the same offer to you. For the time being the mystery remains in place. One lead I can imagine is that when pushed to the limits, the way of reasoning is not true. Very rare species of fish having a lot of protein would have a very high Ecovalue. To consume these because of the Ecovalue concept would not be a good idea. The only other way out could be to suppose that the environmental load in the Ecovalue ratio has been defined in the wrong way, for instance by undervaluing bio diversity greatly. In this way we are back again to the discussion about what is (really) “green”.

6. The role of the government
6.1 Environment is liberal conservative
From the previous paragraphs it can be concluded that through a combination of functionality and market analysis, Eco Designs use of greener technology, appropriate system organization and sensible marketing a lot can be achieved. Gradually the environment will improve, also for electronic products. It will not go fast, the changes will not be radical.

Also governments can be of help. On one hand this can be done by setting boundary conditions with respect to environment to industrial and other activities on the other hand through stimulating greener behaviour of consumers. This is still relatively simple. It is more difficult to be a referee between conflicts of interest between stakeholders in the value chain about environment.
It is clear that just market forces do not automatically deliver environmental friendliness. Investments in infrastructures in which good green designs can flourish are mostly not profitable. The same holds for investments in a lot of green technologies.

This is particularly relevant for the energy sector. At electricity generating companies, investing in alternative energy is called investing in "bricks" (which are a load for the balance sheet). Coal firing has been said to be excellent to keep a competitive advantage. The nuclear energy debate is an example of deadlock among stakeholders for a non-financial reason.

The upfront cost of energy lamps is higher, many consumers still perceive that such extra cost will not be earned back.

If there is somebody who can take a balanced position in such debate it is – whether it is liked or not – the government.

Most likely you will be surprised that somebody with a liberal conservative view on society makes this kind of statements.

For me there is however a strong logic. The liberal conservative principle says that people should have maximum freedom to do what they want to do, provided that others (including the environment) are not harmed. These others are mostly fellow citizens who can stand up for their own interest – environment as such is not in a position to do so.

What is even more important is that also future generations cannot stand up for their (environmental) interest. If the liberal conservative principle is also applied here, the conclusions is that liberal conservatives should have the highest environmental requirements and should be prepared to invest most in green.

Applied to the political landscape in the Netherlands however, either my way of reasoning is wrong or in this country there are no real liberal conservative parties. I am afraid that the last statement is true.

6.2 Measurement of sustainability

It is striking that in a lot of environmental policies of today there is no clear goal. A partial excuse for this is that “green” has several dimensions (emissions, resources, potential toxicity) and therefore has a high degree of complexity. My general impression is however that these policies are too much a reaction to incidents and are too much based on the fad of the day.

A structural goal, which could be a baseline for the evaluation of all kind of proposals and agenda’s could be the consistent lowering of the environmental load per unit of national consumption. This is a better yardstick than the national production (the GDP).

Because in the latter imports and exports are not included. This leads to false statistics; there is for instance seeming an improvement of CO2 emissions in the Netherlands, but this is because today a lot of electricity is being imported from neighbouring countries and a lot of production has been moved abroad.

What is striking too is lack of priority setting. In trade a normal question would be how much sustainability do I get for how much money. When it comes down to policies and programs this is mostly unheard of. There is a lot of talking about (absolute) environmental loads (and the reduction thereof) but in environmental
circles it is still a bit indelicate to talk about money as well. Reality is however that budgets have – also for environment and sustainability - in practice an upper limit. The intellectualization of this lack of priority setting is that sustainability effects are difficult to measure. The concepts developed in Delft for ecoefficiency and Ecovalue do show however that it is very well possible to set priorities. Such systems do not have a 100 % accuracy but in practice show very well the avenues to go.

I would like to spend more time in this address to the subject of measurement of sustainability. It is a typical Delft subject which can have a big societal outreach. It also fits in the mission of DUT which says that the institution wants to be engaged in important societal and techno-scientific problems and challenges. Also finding solutions is a clear ambition. DUT wants to be appealed to for this and this is what I do here: if an institution as this one is getting 35 million euros from the Dutch taxpayer, sustainability should be one of the big spearhead programs.

6.3 Fear, action and money
The film “An inconvenient truth” has moved a lot. A lot of awareness has been created; the environment has clearly moved up on the political agenda. Unfortunately the film also fosters fear. This is a kind of technique which is being used by a lot of environmental proponents. Fear is however a bad advisor. Although the technique of personal pledges is contra productive in this it can lead to a lot of hypocrisy. Even the members of the current Dutch Government shied away from it.

What can contribute more is to find through practice what can contribute best. The present program of the Dutch Government called "Clean and Frugal" scores in my opinion well in this respect. It is a breakaway from the past. Of course there can be simultaneously a lot of criticism and there are alternatives as well – minister Cramer has been informed about my views in this respect. Nevertheless the plan is a good achievement of a cabinet for which I have otherwise no sympathy at all. "Clean and Frugal" is appealing because unlike on many environmental issues in this country there is less talking and researching and more action. In cases where the direction to go is clear and where the technology is in place it is all about "just do it". Alternative ways of generating energy including through nuclear energy, more efficient public lighting, more insulation of buildings, more energy efficient computer and communication networks, it is all a matter of organization. Maybe public – private partnerships are the best way to do this. In the in-depth research about environmental attitudes, mentioned earlier it has also turned out that information about environment intensifies feelings but does lead in only a few cases to real different environmental behaviour. A well known example of this is that almost everybody knows the environmental effects of car driving and has the opinion that something should be done. Few draw the individual conclusions: Less driving or do not buy a car at all. In the society in which we live forbidding cars is no option. Dictatorship in the name of
environment is not feasible. What can be done is making car driving expensive. This means that its Ecovalue – although artificially – is being increased. Next to increasing Ecovalue through design (see above) also increasing Ecovalue through taxes is in my opinion an important tool in situations in which EcoDesign cannot deliver.

An example is energy: today it has a very low Ecovalue. For materials the Ecovalue is better. For products there is a broad distribution of figures, but on average the eco value is higher than of materials. The highest Ecovalue score are in services. If this kind of thinking is continued, a tax on lack of added value (LAV) replacing the current Value Added Tax (VAT) is in sight. Even more radical is to increase the percentages of LAV and to abolish income tax in the end. The justification for this is that from a pure environmental perspective income is irrelevant; environmental loads start to occur when money is being spent! Most likely LAV will really green consumption. Indirectly it will support EcoDesign in a powerful way.

Particularly in the Netherlands a lot of people will say directly that such radical idea’s will not work. This is not anything special. Similar sounds are heard about all kinds of other sensible environmental actions like the replacement of incandescent lamps by energy saving lamps. There has been immediately focus on all the drawbacks of this (and there are some of them) and on basis of this there are a lot of negative comments. The transition problems and the final goal were confused. This is a typical example of being smart in the Dutch way. Lack to all the problems first, go for the opportunities later. Be better in explaining all the negative sides than the positive ones. A lot of our students are excellent in this field. We have to look at ourselves first however, because most likely a lot of the students have copied this kind of behaviour from somebody, may be even they have been trained in this at the university.

Although it looks often different, most transitions are gradual and not all of a sudden. It takes a lot of effort to make it happen. A “green” tax system, energy saving lamps, solar and nuclear energy, abolishing subsidies for environmentally unfriendly activities, introduction of green management in companies and institutions all have to overcome natural conservatism of people. All the items addressed are little pieces which together can bring big changes; none of them is one of the big concepts which solve all environmental problems in one big stroke.

7. The University
7.1 Awesome in spite of all approval culture.
With the MSc students, the PhD students and most staff members I had a great time. Working with them was challenging, inspiring and it was a lot of fun. Through the radical approach a lot of knowledge and insight has been acquired. With help of this and a lot of hard work excellent results have been obtained. I am “proud” on the “club” which has achieved this. In the Applied EcoDesign group and at Design for Sustainability there is a big diversity in characters and in societal ideas. This is a big strength and it makes it very fascinating.

With the institutional side of the Faculty and the university I have often felt unhappy. This is not unique for IDE or DUT. Also elsewhere the so called
"professionalizing" of the universities is making progress. This shows in new layers of management, a big number of directives and procedures, all invented to support a new approval culture. "Output" is a holy thing, efficiency important. The balance between usefulness ("the market") and the essentials of the "university" (academic education) seems to be broken. Also the cultural function of the university is too much neglected. It should be the place where interesting, seeming useless, trailblazing, crazy, special and funny items can be addressed. An example of this was my Ph.D. research forty years ago. Today its content would not have survived a first evaluation round. This untimely death would have saved it from a rejection when applying for external financing. Also the supervisor would not come away unscathed. He would have turned out to be incapable to write a research and coaching plan which satisfies current standards. This would be one of the reasons to rate him as unsatisfactory in the current result and development appraisal procedures. Nevertheless he is for me an excellent research professor. My recommendation is that the current management power at universities should be directed more to content and less to money and to procedures.

Today is a festive day, and therefore I will say not much more about this subject. The multitude of positive experiences is much more important. Nevertheless there are two subjects which I feel very strongly about.

**7.2 The students**

Students are the essential reason for the existence of universities, although it seems today sometimes to be different. The core business is to train them in a certain discipline and to teach them abilities in research and in design. For an academic level intellectual capabilities like reflection, reasoning and judgement are required. Also the capability to cooperate with others to communicate and to put science and engineering in a temporal and societal contest is required. In order to offer a really good curriculum therefore a lot is needed from the Faculty. Reversely, students need to have talent too. This is for me the essential effort to be made by DUT: to develop the talents of young people in such a way that in the end an academic level of engineering capabilities will be reached.

If the level of current potential graduates is being concerned, this is a kind of scaring issue. In the period of twelve years which I can overlook, the average level of the students has been dropped. Also there are students which are successful in "seeping through the system" and reach the stage of the graduation project although they have not the right level to be a candidate for a diploma. It is clear that forty years of levelling in Dutch education is taking its toll. Unwillingness or incapability to recognize special talent leads in combination with lack of decisiveness to deal with unfit students, leads to much more mediocrity. Another observation is that in spite of all extra coaching and all financial threats, the percentage of successful students has not increased significantly in the last fifty years. A lot of students freedom has been sacrificed but there has been little in return.
Colleague de Ruwe has investigated in our faculty a couple of years ago, the reasons why students did make it for their P-exam in two years (this is the exam after the first year). This group is about 30% of the yearly influx. One third of this group (10% of the total) turned out to lack talent, one third had given in to distraction (ranging from computer games to too much sports or taking a job) and one third raised personal problems (like sickness decease of parents, relation problems).
Irrespective the outcome of the debate about entrance exams - I have the view there that everybody with a high school diploma should get a chance – the findings above lead to the conclusion that it is every respect sound to give maximum 20% of the students the binding advice to quit.
I have the opinion that students should be offered more freedom and more facilities but also have to realize that they are responsible for themselves. It is up to them to take their fate in their own hands. There is a big societal interest in this too. Also from that perspective it is desirable that students do not keep on struggling. This often occurs because of lack of alternatives – but in the end delaying decisions is often a loss of time - there is still no or just a marginal result.

7.3 The professors
Next to students also the professors are the mainstays and carriers of the university. Professors “stand for” their discipline. They are the ones which are responsible for content level, capacity and financing. They are the figureheads for the scientific and societal output. Cooperation with others is being generated, both inside and outside the university. They are also supposed to have a broad vision and to be capable to look beyond their own field.
In most cases they live up to these standards, but in view of the fact that more and more forms of institutionalized distrust are creeping into the procedures of the University, it looks whether there are increasing doubts about the quality of the average professor. Also he should therefore be managed and a wild array of directors and coordinators is meddling in his tasks. When becoming a professor was ten years ago an adventure of which the start was known but is was completely unclear where to end up – now the path is trodden and the signposts have to be followed. Controllers have been put in place to check whether there is a match with the strategy and in some cases even the ideology of the institution. Like for students it is completely right that competences and achievements of professors are being monitored. This should in my opinion serve grasping more opportunities, rather than lead to restrictions. For instance professors who in view of their achievements, reputation, credibility and authority generate money should also be allowed to spend it themselves. Success attracts more money, reversely money does not guarantee success. When the performance of professors is insufficient it should also be possible to terminate the appointment. Like in the situation with the students, Dutch universities have much more difficulties in dealing with success. Being smart in the Dutch way as sketched before seems to be dominant in this case as well. In this address I would plead too to keep honouring the office of professor or to restore it where necessary.
8. Adventures in EcoDesign of Electronic Products
In this farewell address I have to restrict myself in view of time. There is much more to tell about the field. This is one of the reasons I have written a book about it with the title as above.

It describes in much detail Applied EcoDesign, the relation between environmental and business, environmental value chains and all kind of measurement methods. Also recycling and reuse are being addressed as well as the role of governments and of environmental legislation. Also teaching EcoDesign is considered. A special chapter is devoted to China.

Next to this there are five special subjects addressed in seventy five short sketches. These include
- Personalities from whom I learned a lot or are important for me as a practitioner in EcoDesign.
- Cities or events in cities which had a big impact.
- Rituals and habits. This tells how I work with students or how others deal with you.
- “Tidbits”, funny or crazy things which have happened.
- Highlights of the year. What subject was important in EcoDesign in the year of consideration.

The book is also a walking guide; there are fifteen city walks, fifteen country walks and fifteen walks linked in a special way to the personalities described.

Finally there are the addresses of favourite restaurants and pubs. Here some guidance is needed. None of the places will offer a gastronomic delight, but if you value the atmosphere there as much as I do it is worth to try.

The book will be distributed for free. After the reception this afternoon, you can take a copy home. If you are a reader only of this address and you are interested to get a book or a CD of the book, please contact the DfS secretariat, tel. +31152782738.

9. A word of thanks
I have done my office of a professor with passion and sometimes with emotion.

Of all the fields I have been working in my professional life (six) and of all the jobs I had (twelve in total) this is the one which gives me most satisfaction. I owe a lot to all of you. This is because you have become dear to me or because of your friendship, the pleasant cooperation, your interest, your understanding or your tolerance.

The Board of Management has approved the founding of my chair in which I have been reappointed again and again.

The Management of Philips Consumer Electronics has consistently supported me even on moments that university dialects could not be understood.

I am grateful to the Management of the Faculty IDE “new style” because sustainability and EcoDesign rank high on their agenda. I have had many discussions, particularly with the Dean how to implement an appropriate strategy for this purpose. Often we did not agree. Thank you for your tolerance for dissenters.
Special words of thanks are for the PhD students (they have seen me as a sparring partner and have challenged me a lot), the graduation students (with their sometimes awkward creativity, it has moved me a lot) and the students in class with their spontaneous reactions. Our disassembly sessions were the best of it all! Together these groups are the core of my university life. They allowed me to love it intensely. Yet family is the most important. Thanking them in public I feel as inappropriate so I will not do it. Instead of this I would like to stress the importance of family values.

**10. Last words**

Gaudeamus igitur, iuvenes dum sumus
Pereat Tristitia, pereat osores
Vivat nostra civitas, Maecenatum caritas
Vivat Academia, vivat professors

(Let us be cheerful in our young years
Away with all sadness, done with who hates us
Long live our community, long live the sponsors of our art
Long live Academia, long live the professors)

Vivat, crescat, floreat
(May it live, grow and flourish).

Ik heb gezegd!