# THE VALUE (DRIVEN) WEB

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## Abstract

This paper presents a vision on the importance of values and ethical aspects in web science. We create(d) the Internet, but now the Internet (technology) is shaping our world increasingly: the way we experience, interact, transact, conduct business et cetera. The Internet is ubiquitous and vital to many aspects of our society; it is substituting some of our existing infrastructures and its traffic becomes a reflection of our society. The complexity of the Internet grows fast and might at some point transcend that of ourselves. At the same time the Internet escapes our normative, ethical control. Though it is value-laden, the process of embedding values in internet technology is mostly implicit and obscured by both the strong technological focus and distributive nature of internet technology and services. This distributive nature reflects amongst other things the result of an increased institutionalization of functionally decomposed economical and societal products and services in all the sectors that contribute to the GDP. This trend of decomposition clashes with the desires of all "prosumers" using the Internet and require integrated, composed products and services that they can identify and associate with in a human way. User values and expectations must be met by the products and services. This is a potential tipping point where supply and demand, producers and consumers, political society and technology may be drifting apart. Thus, web science is confronted with a crucial challenge and a huge responsibility. We argue that in order for the Internet to evolve and mature into a long term sustainable organic extension of our society, we must explicitly recognize the importance of values. This is a first step towards embedding the values that society recognizes as important. Values concerned do not solely deal with privacy, but also with security, transparency, trust, user autonomy et cetera. The challenge for all involved in the development of the Internet and in the provision of services is to define the values that matter and to bring them to bear upon technology, software architecture, standards, code et cetera. In this paper, we set out to identify some of the vital values and norms that will enable us to mould the Internet according to societal ideals. Working within the approach of value sensitive design, we sketch how we can capture, formalize and embed a balanced set of values in internet technology as non-functional requirements.

Key words: Values, Value Sensitive Design, Holons, Trans-sector Innovation, Functional Decomposition, Internet, Ethics, Trust

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## 1 Introduction and historical perspectives

Roughly 11.000 years ago, a major transition took place for humankind and its evolution. Nomadic families started to settle down during the aftermath of the last ice-age and became colonists. Before colonization, nomadic tribes were entirely self-responsible, holistic, autonomous economic and social cohesive clusters, sustainably performing all necessary tasks in order to survive as a group in balance with their environment. One may consider such a tribe to have a collective *nerve system* guarding and controlling the prosperity and well-being of this relatively small human physical 'network'. The transition marked the end the Hunter-Gatherer period that lasted roughly 2.5 $10^5$ years and the beginning of the Agricultural Phase, a period of roughly $10^4$ years. The first villages emerged. People commenced, for sake of efficiency, to divide tasks among each other. They learned to specialise in a branch or 'sector' of emerging specific new 'functions', such as farming, construction, mining, warfare et cetera, requiring each a rather unique set of knowledge, skills and tools (Baken et al, 2006).

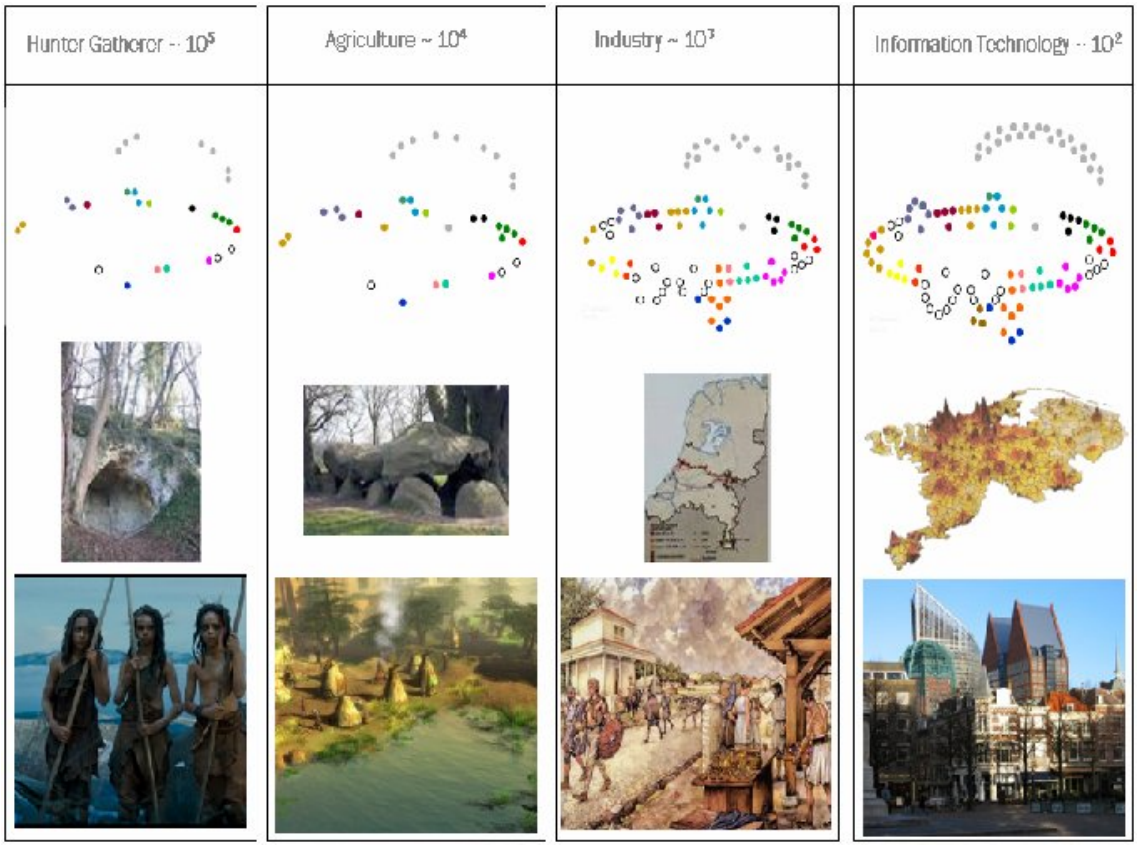


Figure 1: The four phases of human kind

The outsourcing of tasks is heavily based on the value of ***trust*** and supported by transactions (Mesgarzadeh, Baken, 2008 and Ferguson, 2008). People allowed other people to take over vital tasks

they used to perform themselves. Depending on the value and importance of what was outsourced, the *moral risk* for the outsourcing party increased[3] due to asymmetric information flows. Thus, this transition initialized an important trend: progressing *functional decomposition* in economic and societal tasks. Indeed, this enlarged the efficiency and thereby the scale of economy and society, growing from local all the way to global, but also seems to entail a drawback: the holistic character of the clusters "evaporated". Could this vital feature return in the nearby future by a value sensitive design of the Internet forming a value sensitive trans-sector nerve system across and stretching over all sectors?

Direct consequence of the initial functional decomposition is a clearly increasing complexity of economic and societal processes. Together with the discovery of counting, abstract numbers provided the basis for the skill of writing. The 'progress' naturally invoked a third and fourth wave, i.e. the Industrial and later Information Technology revolution culminating in the emergence of a revolutionary phenomenon: the Internet. A constant factor in all latter three waves is (the diverging movement of) the accelerating functional decomposition and emergence of new functions and sectors, enlarging the "network" of economical and societal sectors. This decomposition increased exponentially from the third and fourth wave onward. Further increasing complexity was accompanied by, amongst others, a strong growth of specialization and the vocabulary[4] of our languages. However, there is a price that comes with this evolution.

First, the quality of the relations in lengthening chains of production weakened. Second, the increasing scales bring new complex trans-sector economic, societal and environmental challenges. The latter is because the evolution of the 'network' with each successive evolutionary wave seems not designed to cope with the trans-sector phenomena it evokes. A gap seems to grow between the sectorally organized supply side and the integral and value laden needs on the demand side, culminating in an increasingly dehumanized society. A change in the stovepipe design, especially on the supply side, is required: a transition to a cohesive and value laden sector network.

[3] Later, with the outsourcing and institution of the function "saving money", Banking and Finance emerged as a sector. The proper working of this sector obviously relies heavily on trust.

[4] The English vocabulary now roughly counts 500.000 words and 1.000.000 if we include scientific words, see e.g. *Number of Words un the English Language*, The Physics Factbook, edited by Glen Elert. In the time of Shakespeare (1564-1616), this was less than one third!

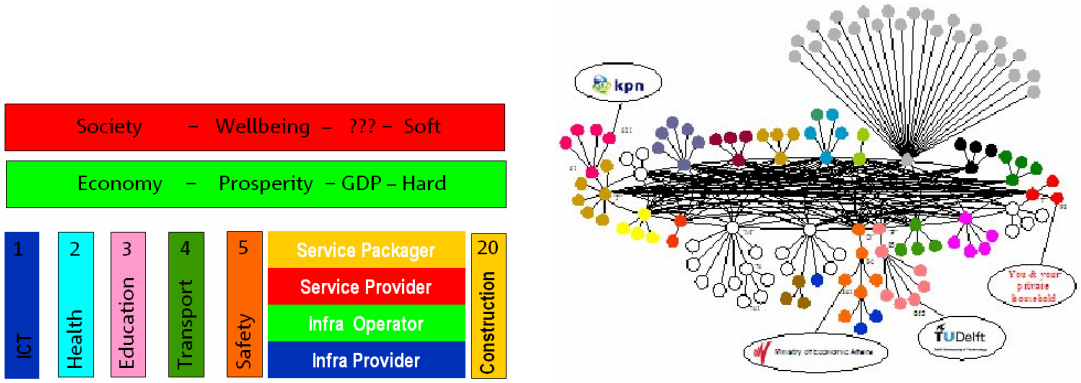


Figure 2: Transition from sector stovepipes to a sector network

This network slowly emerges encompassing a set of some 20, often internationally organized sectors. It appears that (the coherence of) the new network, which is obviously influenced by the number and quality of connections (links) for tangible physical and intangible value streams, also needs to be optimized in its overall performance within the boundary condition of the finite resources that are available to the network. A value sensitive design is required to deal with the global economic, social and environmental challenges that we face. However, today, the network rather resembles a collection of loosely, opportunistically and sub-optimally interacting sectors. These sectors and their companies, dominantly pursue their intra-sector, short term targets and their own rationale for survival. This is reflected in its electronic IT-counterpart, the Internet. What can we do to improve this situation? Could the ICT sector emerge as a central hub in the sector network serving a double function, first as a sector on its own and second as the prime designer of the Internet, taking into account both the functional and value sensitive non-functional requirements?

We believe that indeed the ICT sector can take initiatives in this matter in close co-operation with the other sectors with a special place for science and scientific research. This requires empathic dialogues that may result in the transfer of successful features of the current Internet to other sectors (Crawcroft, 2010) and in the understanding of design rules for the future sector network and its electronic equivalent, the Internet.

The knowledge of the ICT sector and their very complex services, networks and processes, can be of immediate use; it is captured among others in the eTom-model, see the world leading Telecom Management Forum (www.tmforum.org). However, the eTom model also needs its non-functional, value counterpart. Nevertheless, one could start directly translating and transferring the model to other sectors. We summarize the huge challenges:

1. the tilting of the sector stovepipes, transforming them into
2. a value sensitive trans-sector network
3. projecting this physical network on its electronic counterpart, the value sensitive Internet

This paper cannot cope with the complete roadmap of the transition. Instead, we will focus on the methodology to embark on the concept that makes a first step to distinguish, define and make some of the relevant values quantitative so that they can be incorporated into the design of the future Internet. Working from this approach of a value sensitive design, we sketch how we can capture, formalize and embed a balanced set of values in internet technology as non-functional requirements.

## 2 Framework to integrate values into ICT

### *2.1 Introduction Value Sensitive Design*

Value sensitive design (VSD) (Friedman and Kahn, 2003) is an approach that aims at integrating human values, ethical concerns in the heart of the engineering practices. In the words of Friedman "Value-Sensitive Design is primarily concerned with values that center on human well being, human dignity, justice, welfare, and human rights. Value-Sensitive Design connects the people who design systems and interfaces with the people who think about and understand the values of the stakeholders who are affected by the systems. Ultimately, Value-Sensitive Design requires that we broaden the goals and criteria for judging the quality of technological systems to include those that advance human flourishing."[5] What stands out in VSD is the assertion that in addition to functional and technical requirements value statements need to be incorporated in the set of requirements. In the preceding sections we have argued this point in relation to the web and internet technology.

In this section we introduce a method called moral QFD (Wiegel and Simons 2008) and in the next we demonstrate how it can be used to integrate values into the design of internet technology and applications.

### *2.2 Moral Quality Function Deployment*[6]

Wiegel and Simons (2008) adapted the traditional Quality Function Deployment (QFD) process as proposed by Akao (1990). The traditional QFD method is changed and extended to facilitate the capture of deep, moral values. They introduce the term Citizen to indicate that the person(s) that will be using the product is not just a consumer, a patient, an user, an employee, a government officials, etcetera, but many of these. The method is based on Kansei engineering (Nagamichi, 1990), QFD for service industry (Ohfuji, 1990) and the Lifestyle QFD (Mazur, 2005). There are some important differences with traditional uses of QFD. Moral and cultural values have different sources: primarily the users, but also the company that produces the product and the people involved in the design and

[5] Batya Friedman is one of the founding researchers of the VSD approach. Quote from the VSD project website http://depts.washington.edu/vsdesign/index.shtml

[6] This section is summary with adaptations of section 3 from an extensive paper on Moral QFD (Wiegel and Simons, 2008).

production. With moral values ‘not everything goes’, nor is it simply a counting of the voices. Values are also subject to stricter requirements of consistency.

Moral QFD consists of the following process steps:

1. Determine goals
2. Define citizen segments
3. Visit the gemba (actual place): understanding the customer, user, citizen
4. Draw the citizen value table
5. Draw the affinity diagram
6. Construct the hierarchy diagram
7. Establish priorities
8. Construct the maximum value table
9. Execute citizen and technical competitive analysis
10. Construct (rooms 1 to 3 of) the QFD house of quality
11. Deploy findings in product design and construction

Step 1: Determine the goals. This first step is as obvious as it is difficult. Determining what goals a technology should serve in a meaningful way appears often to be difficult. This includes the definition of a vision in which the technology serves as a means towards the goals. Ultimately, these goals must be formulated as concrete as possible. Saying that a technology should, for example, ‘promote emancipation of minorities’, is a starting point but leaves open too many questions to be useful as a proper foundation. Philosophy, sub-disciplines of legal studies, theology have long traditions in conceptual analysis of value-laden concepts. As these concepts are mostly interconnected, employing several concepts in the formulation of goals requires a close check on consistency.

Step 2: Define citizen segments. Who are the (groups of) citizens who will be using, be influencing, be affected by the technology. Identifying the different segments of citizens is like creating a patchwork. It is important because each group will provide a different view on the technology. Groups will be impacted in different ways, participate and use products in different ways. There are two complicating factors: 1) groups will might hold different values and pursue different goals (step 1), and 2) citizens might belong to different segments at the same time. The difference with the more usual analysis is that this recognises that the differences go beyond different interactions with technology based on age, sex, or income. Here again, defining segments is in itself already a value laden activity. Investigating consistency and identifying contradictions between and within segments is the main aims of this step.

Step 3: gemba visit. The gemba is a word that refers to the 'real' place, meaning the situation in which people actually perform their activities as opposed to a conference room or office. It means to say that designers should go to the shopfloor, Internet cafes, public spaces to observe how people actually interact with the technology they design. The purpose of this step is to fully understand the citizen. This involves a wider range of cultural and moral values than just using the web. The citizen valuation is informed by her wider social and cultural context. This step must also include the culture and moral values of the organization where the technology is developed. Many companies have a wider understanding of their mission than just making money. The values expressed in the mission statement must be incorporated in the analysis. The same applies to the company's employees. An important reason to include the company's values is that if the company would produce goods that clearly are at odds with the company's values it will lose credibility, itself an important value, and pollute its brand.

Finally, this step must include an overview of shared values and taboos that govern the lives of the citizen group(s) one is interested in. These can include supra-national, national and local customs, mores, taboos, etc. All these express the values that the citizen-annex-customers share, that restrict their behaviour and inform their decisions. Interviews of citizen-annex-customers might include questions like the following.

Table 1 *Value Interview*

| |
|---|
| What are the social, moral issues that you care about strongly? |
| How do you feel about global warming and your own role in this regard? |
| To what extent are your product choices influenced by your views on these issues? |
| What are your religious convictions? And how do these influence the products and services you buy? |
| Do you (not) easily leave information on the Internet for others to see? |
| Do you care about what the retailer does with the information gathered via the shopper loyalty card? |

The response and observations from the gemba are reworked into a Citizen value table, step 4: drawing the value table.

I [*moral, cultural type*] strongly believe in [*moral, cultural value*] which means that I want to [*what to achieve*] ; in order to do so I will [*act, refrain from*] using [*products, services*] that are [*product or service attribute*]

The moral values are embedded within a wider range of shared moral and cultural values within the society. Examples of these values are the *obligation to use scarce resources prudently*, the e*qual care for all*, etc. These values act as taboo, restricting the individual customer-annex-citizen, and/or as a general guideline. Values act as a filter for the next step, the construction of the moral affinity diagram. Values, moral labels that are in conflict with these values or taboos are filtered out. This is not as trivial as it may sound. Many values are held without being generally enforced. Not everything that we hold morally undesirable is in fact forbidden. Nor is everything that we hold morally desirable obligatory. It is within this range of values that organizations operate and develop new technology.

I, *urban engineer*, believe in *the power of technology to improve life* which means that I want to *try new technological developments*; in order to do so I will *deploy techniques* that *benefit my quality of life*.

These statements are summarized in a citizen value table.

Table 2 *Citizen value table*

| Who | Belief / value | Life guiding goals | Actions | Reasons / justification to act | Affected techniques, products, services | Product attribute |
|---|---|---|---|---|---|---|
| | | | | | | |

Step 5: draw the affinity diagram. Though it is best to let customers construct the affinity diagram the QFD team should be at hand to clarify some moral notions that might create confusion. In the moral discourse there are three main bearers of the value: 1) the act and compliance with norms, 2) the outcome of the act, and 3) the actor[7]. For some people the accordance of an act with the norm, the nature of the act is the basis for moral evaluation. E.g. 'thou shall not lie' is a norm to which we should always adhere. Other people hold that the overall situation should be better even if that means that the action through which it is achieved is not desirable. E.g. a lie is permissible if greater harm is avoided. Finally, people themselves can be judged based on the virtues they posses. E.g. 'she is a courageous woman' expresses a virtue which is morally commendable.

In constructing the affinity diagrams one must be careful to distinguish between these positions, in particular, as they might be referred to by the same concept. We advocate using the different ethical

[7] This distinction corresponds with the three main branches in normative ethics: deontological ethics, teleological/consequentialist ethics and virtue ethics.

theories as different perspectives on the same subject-matter (see also Van de Poel 2007). This also helps to overcome the fuzzy nature of moral and cultural values. What amounts to honesty or trustworthiness is not clear cut and differs from person to person, from group to group, etc. This again is one of the main drivers to include the values explicitly in the QFD process.

This can be illustrated as follows. For physicians, being a good physician means amongst many other things, to be trustworthy. This in turn means safeguarding the patient's privacy. Values can be conflicting, which is when moral dilemmas arise. A physician has also a duty to look after the patient's health, and perhaps to foster medical research. The patient's health, in an emergency situation, might require disclosing patient data to other persons without the patient's prior consent (thus potentially breaching the patient's privacy).

Table 3 *Affinity diagram*

| I Physician-Patient relationship based on trust | II Proper and timely care |
|---|---|
| 1. "I know I can trust my physician to safeguard my privacy"<br>2. "I have an enduring relationship with my patients based on their trust in my good intentions for them"<br>3. "I know my physician will use information about me to my best interest"<br>4. "I know my relatives cannot access my medical data" | 1. "I can prescribe medicines that do not trigger allergic reactions"<br>2. "In case of an emergency they paramedical staff knows what medicine I need" |
| III Efficient use of scarce resources | IV Fostering scientific research |
| 1. "I do not want to provide the same information time and again"<br>2. "I want to be able to assess the situation as fast as possible and run as few medical tests as possible" | 1. "I want to help scientific research without giving up confidential information"<br>2. "I want to provide feedback to research teams on the effects of the medicine so they can develop better medicine"<br>3. "The effects of a treatment can be assessed over a longer period of time and a large patient base" |

These quotes from the gemba show different attitudes towards values. In table 3, statements I.1 and I.4 express, in different degrees, restrictions on the use of patient data per se, that is irrespective of the consequences. This is in clear contrast to I.3, a consequentialist position, which gives the physician considerable more room for decision-making. It will be clear that these will make different demands on the product design. Moreover, they are not just comparable because they express different aspects (action versus outcome). Using various scenario's, and feeding the possible design options back into the process (see the description of steps 7 and 8-11 below) is required to reach a shared view. This process is referred to as the ethical cycle (Van de Poel, 2007) or wide reflective equilibrium (Van den Hoven, 1997)

Step 6: construct the value hierarchy diagram, is probably one of the more complicated steps of moral QFD. Since moral concepts can be fuzzy or highly abstract it is difficult to turn them into physical attributes and product specifications.

In moral and cultural context, concepts often have a very rich meaning: so called 'thick' concepts. The concept of trust varies from culture to culture. In some culture the personal identity is strongly connected to the group to which one belongs. This means that the value of a personal sphere to which no one has access is much greater (lower) than in cultures where identity is strongly linked to the individual person (the group). This is illustrated by the notion of trust of which there exist various interpretations. Camp (2003) proposes a definition in which privacy, security and reliability of a service or a party are constitutive elements. These notions in turn are linked to authority and integrity. Before a trustworthy service can be designed a thorough cultural and philosophical analysis is required.

Existing formal tooling can express the value specifications for product properties: deontic logic. Deontic logic is a branch of modal logic that is used to express obligatory, permissible, gratuitous, forbidden and optional actions or properties (Wiegel 2005). If a physician has permission to access to the electronic file record the specification can be formulated as follows:

$Physician(i) \wedge PatientOf(ij) \rightarrow P([i\ STIT\ \Phi j])$

If *i* is a physician, and *j* is a patient of *i* than it is permissible that *i* has access to file $\Phi$ of patient *j*. *STIT* is another operator from modal logic and stands for *See To It That*. It is used to express actions. The point here is not to discuss modal logic but just to point out that for the fuzzy concepts of values one can ultimately derive very precise definitions of the specifications.

Table 4 *Value hierarchy diagram*

| Moral domain | | | | | Physical domain | | | |
|---|---|---|---|---|---|---|---|---|
| Level 0 | Level 1 | Level 2 | Level N | Value | Product component | Element | Quality characteristic | Specifications |
| | | Actions explained ex-post | | Trans-perency | | | | |
| | | Secure | | | | | | |
| | | Protects privacy | | Integrity | | Perso-nal data | | |
| | Trust worthy | Reliable | Let patient decide whenever possible | Autonomy | Data storage | Eco-nomic data | Data integrity | Consistency; completeness |
| | | Knows patient intentions and their priorities | Ensure staying healthy | Health | | Health data | | |
| | | | Assesses values at stake | Indepen-dence | Authori-zation module | Roles | Relevant to application domain | Conforms professional definitions |
| | | | Observes codes of conduct | | Patient goals | | | |
| Trust-worthy elec-tronic health record | | Restricted access | Discriminates between various types of personal information | | | | | Scenario analysis with patient to learn intentions |
| | Intel-ligent access | | | | Decision-making | Actions | Speed of execution; Preference consistency | Ask patient in case of doubt |

NB This case is imaginary though there are several products that display similar features this approach was not used as far as the authors know. To the contrary it inspired us to formulate the approach and promote the inclusion of moral and cultural values in the design of products and services in a structural way.

Step 7: Establish priorities, takes the outcome of step 6 as its starting point. In the above value hierarchy the more fuzzy notions are coupled with physical or logical properties of the product/service in question. These qualitative relationships need to be turned into quantified relationships between values and properties that allow the designers to establish the most important value-property relationships for the targeted customer group.

Mostly moral values are category data, having either nominal or ordinal scales. Some actions are forbidden or allowed, good or bad. Other actions or state of affairs can be ranked on an ordinal scale, or they can be labelled in grades of moral or cultural valuation ranging from morally very good (supererogatory), to good, to acceptable, to negligent, to bad. What is possible in terms of data types and analysis depends also on the ethical theory that is used in defining the values. Utilitarianism, for example, uses utility as the measure of the good. And some strands allow for cardinality of the utility meaning that interval scales are used.

Consider our example of the electronic patient record. If trust is lost because the privacy has been violated, one does not trust the service a little less. The trust is completely gone. So this is an instance of a categorical variable on a nominal scale. The overall moral evaluation of the service might, for example, be indicated on a scale of five ranging from good to bad.

Table 5 *Semantic differential survey structure*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Good | ☐ | ☐ | ☐ | ☐ | ☐ | Bad |

This scale allows for different interpretations like the one presented above: very good (supererogatory), to good, to acceptable, to negligent, to bad. Each of these terms has a moral or cultural connotation. Although there is a ranking order in these labels one can not assert that the interval between each is constant. In this case one might consider treating them as nominal data. This, of course, has implications for the statistical methods that can be applied. The information thus gathered can be processed using the semantic differential method to link properties of products and services to various values.

The one important addition here is the feedback to the customer value table (step 4). As described before moral and cultural values are seldom clear-cut. Through a process called the wide reflective equilibrium (Van den Hoven, 1997) or ethical cycle (Van de Poel, 2006) values and options are developed, explored and adjusted. This is an empathically iterative process. In this process various

ethical and cultural positions are adopted to explore the customer situation and the options. Seeing the consequences of one's initial moral and cultural values, and their weighing in the form of a product or service properties might well lead to a reconsideration of the values and their relative weights, as well as to other values (see section 5, figure 1 for a graphical depiction). In the latter case it is not as if the values that appear are new but rather they were not articulated or considered relevant at first sight.

Steps 8 construct the maximum value table. The maximum value table connects the citizen values that have been decomposed in the value hierarchy to the design features op the product. The outcome of the maximum value table and the available options are matched to investigate moral admissibility of the options. This means that there is a feedback loop from step 7 to step 4.

Step 9 (execute citizen and technical competitive analysis) and 10 (Construct (rooms 1 to 3 of) the QFD house of quality) are technical steps that are not discussed here as they do not alter the value component.

From step 11, when the design options become clear, the available designs (rather than the properties in step 7) are fed back into the steps 4 and 7. These steps express the value and connect the values to product and service specifications respectively. Based on the designs customers might come to new insights on the values they hold, their relative weighs as well as uncovering until not expressed values.

## 3 Moral QFD and the web

There are many value-laden notions associated with the use of the web. People use it to find or extend friendships, to express themselves, to do business, etc. These and other activities make reference, either implicitly or explicitly, to values that the people active on the web hold dear. When we do business we trust the other party to deliver according to the terms agreed; we trust that the goods described and displayed are described honestly and realistically; we trust the people we befriend on the web to be who and what they claim; we trust the governments to publish all relevant information, completely, even-handedly, etc. We take the notion of trust because it is an important one that figures in many different contexts on the web. But of course there are many, many more of those value-laden concepts. We argued above that for the Internet to fulfil a role as integrating factor it is necessary to identify and explore all these value-laden concepts and take them into account when designing new technologies and web applications. This section, however, is limited to an illustration of how moral QFD can be used to analyse and incorporate values into design of technologies.

Step 1 Determine the goals. One of the goals could be described as 'providing a virtual environment in which transactions can be executed with a warranted trust by the citizen'. This goal can be embedded

in a wider visionary statement on the importance of interaction between citizens, between enterprises and consumers, between governments and citizens.

The aim of this step is clarify the goal(s). Various important concepts figure in the apparently simple goal statement: transaction, warranted, trust, citizen. Wiegel and Van den Berg (2008) provide an example of an analysis of the concept of trust showing its many facetted nature.

> "Trust is an act or an attitude of the one (truster) who is trusting someone or something else. Trustworthiness is a property of the one, or the thing that is being trusted, the trustee. Trusting something else means accepting a (moral) risk of not getting what one was expecting the trustee to accomplish. This failure is not just due to an ability to deliver but also to some form of betrayal. When a machine that is used to accomplish something does not work one can feel disappointed (one relied on the machine) but not betrayed. […] Another element in trust is the expectancy of competency. For trust to be warranted there must be a reasonable expectation that the trustee is capable of executing the task that it is being delegated. The expectation might be in part based on the information provided regarding earlier performances. If this information is misleading there is again reason to feel betrayed. Yet another element of trust, and a more controversial one, is the intention of the trustee to act in accordance with the expectations and to the good of the truster. This might not be necessary. A truster that is motivated by a contract or self-interest can properly execute the delegated task."

One of the four key concepts is broken down again in several other concepts: truster, trustee, track-record/ information provision, expectations, competency, intention. The trustee in the context of the web can be hardware, software, a person, an organisation. When I turn to municipal website to obtain a building permit I trust both the provider of the service (the city council) and implicitly the provider of the Internet access.

Step 2 Define citizen segments. This step extends the previous step by exploring who exactly is involved, and in our case who is the trusting citizen. It can be citizens turning to the municipal website to obtain information on building permits. They will trust the city council to provide the information, the information to be correct, complete and easily understandable. There are various groups of citizens involved: home owners, employees of construction companies, architects, etc. They live in specific states with specific values and ideals, in high density urban areas or country sites, etc.

Step 3 Visit the gemba: understanding the customer, user, citizen. As part of this step the citizens are observed whilst active. Home owners might be observed to have trouble reading complicated, burocratic jargon, and being annoyed when small print is 'hidden' 6 mouse-clicks away from the main page. Both aspects will not engender trust in the provider of the information and service. The city

council may be interested in providing information more efficiently through the web and making the process more transparent. Construction companies might be interested to use the web to get to the information faster and to cut some red-tape. Both home-owners and construction companies might want to ensure that some of the information provided is treated carefully, i.e. not accessible by 3rd parties, revealing only some information (like the proposed change) whilst hiding other information (like price). What information should be treated as private and which not is value-laden question.

Step 4 Draw the citizen value table. For each of the citizen segments statements are captured, that represent their attitudes, values, actions, et cetera. For each group there will be many such statements. These statements are in fact a rephrasing of the ad verbum reports of interviews held during the gemba visits.

I, *small local farmer*, proud of my home, believe in *abiding to the law and freedom to determine one's own life* which means that I *feel that the government should not, or as little as possible, interfere in the way we build our homes*; in order to achieve this I see *eGovernment as a means to abide to the law with as little obtrusion as possible*.

I, *urban home owner*, believe in *my home as a private, quiet place away from the intrusion of neighbours* which means that I *want to ensure that my neighbours home activities do not intrude on my peace and quiet at home*; in order to achieve this I see *eGovernment as a means to monitor plans that might compromise my peace at home*.

Table 6 *Citizen value table*

| Who | Belief / value | Life guiding goals | Actions | Reasons / justification to act | Affected techniques, products, services | Product attribute |
|---|---|---|---|---|---|---|
| Small local farmer | Law abidance<br>Small government | Determine my own life and way of living | Acquire building through eGovernment | Least impact and still abide law | Building permit from city council through web | Little information asked, little effort, unobtrusive |

Step 5 Draw the affinity diagram. From the multitude of statements with the values expressed in them we must come to a smaller manageable set of attitudes and values that can be dealt with in the design process. This is achieved by grouping the statements under shared headers. This is best done with the people that were interviewed at the gemba.

Step 6 Construct the hierarchy diagram. The information gathered in the previous steps is brought together in the value hierarchy which displays all concepts in their relationships on the left-hand side of the diagram. Subsequently during the process the right-hand side is filled with aspects of the product or service as it is being designed. The results of the detailing are fed back into the design loop to check whether the values are being covered and that they are consistent.

Table 7 *Value hierarchy diagram*

| Moral domain | | | | | Product/service domain | | | |
|---|---|---|---|---|---|---|---|---|
| Level 0 | Level 1 | Level 2 | Level N | Value | Product component | Element | Quality characteristic | Specs |
| | | | Complete | Honesty | | | | |
| | | Reliable information provision | | Transparency | Information report | Info (Is) on services (S) | For every service there is documentation | ˛Is, s□S |
| | Warranted trust | | Proven track-record | Honesty / Non-betrayal | | Info on conditions | Easily located | 2 mouse-clicks |
| Trustworthy web service | | Competent trustee | Service offering | | | | | |
| | | | Warranted expectations | | | | | |
| | Reliable infrastructure | | | | | | | |

Steps 8 through 11 are the usual technical design steps. With the input from the preceding steps the design process can proceed as usual. Therefore these steps are not discussed here. The one important addition is the feedback loop in which the design is matched with the results from step 4, the customer value table, and step 6 the value hierarchy diagram, to ensure that the values are properly mapped and accounted for.

## 4 Conclusions and next steps

Moral, cultural values and ethical aspects in web science are of great importance. We need to translate the vision of a value driven web into an executable roadmap that will bring us closer to that vision. The first step is derived from a grand design how to migrate from a in stovepipes fragmented low trust society towards a trans-sector networked cohesive high trust society. We introduce a methodology that allows us to make a first step to distinguish, define and make some of the relevant values quantitative so that they can be incorporated into the design of the future Internet. Working from this approach of value sensitive design, we sketch how we can capture, formalize and embed a balanced set of values in internet technology as non-functional requirements. We started concretely with the value concept of trust.

The next step will be to work out the complete roadmap of the transition towards a value sensitive design of the Internet. An important aspect will be the composition of the teams that work on the roadmap and the individual elements. We think this will require varied teams of not only technology experts but also economists, biologists, philosophers.

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