Chapter 4.

A FRAMEWORK FOR UNDERSTANDING HUMAN USE OF COMPUTERS

"I know how to use it, and it's easy to use -- but what the heck do I use it for?" These words, uttered by the manager cited in Vignette 2 in the Preface, epitomises the difference between ease of use and usefulness and, in doing so, can serve to begin opening up the issue of the human use of computers. This chapter seeks to open it up further and explore how Dooyeweerd's philosophy can be used to understand usage by exposing some of the challenges and issues therein and enable us to formulate a framework for understand human use of computers (HUC). The framework developed aims to be sensitive to everyday issues as they present themselves to us as users in both research and practice.

After drawing out some issues from a few example cases, Dooyeweerd's notion of multi-aspectual human functioning is employed to ensure a broad, integrated focus on the everyday life of HUC. This reveals a number of such multi-aspectual functionings, three of which are distinguished:

- human-computer interaction (HCI),
- engagement with represented content (ERC), and
- human living with computers (HLC).

The structure of each is explored with the aid of Dooyeweerd's non-Cartesian notion of subject-object relation (§2.4.5) with qualifying aspects (§3.2.5). The normativity of each is explored by reference to the innate normativity of the aspects and, for HLC especially, this suggests a new way of understanding its complexity. Finally, a number of practical devices suggested by a Dooyeweerdian approach are presented and the chapter ends by showing briefly how the Dooyeweerdian approach can engage with, underpin and enrich other frameworks for understanding usage.

4.1 TOWARDS AN EVERYDAY UNDERSTANDING OF IS USAGE

4.1.1 A Major IS Failure

Mitev [1996], [2001] discussed the failure that was the early SNCF Socrate rail ticketing system. The following paragraph from [2001] summarises her findings succinctly:

> "Technical malfunctions, political pressure, poor management, unions and user resistance led to an inadequate and to some extent chaotic implementation. Staff training was inadequate and did not prepare salespeople to face tariff inconsistencies and ticketing problems. The user interface was designed using the airlines logic and was not user-friendly. The new ticket proved

> unacceptable to customers. Public relations failed to prepare the public to such a dramatic change. The inadequate database information on timetable and routes of trains, inaccurate fare information, and unavailability of ticket exchange capabilities caused major problems for the SNCF sales force and customers alike. Impossible reservations on some trains, inappropriate prices and wrong train connections led to large queues of irate customers in all major stations. Booked tickets were for non-existent trains whilst other trains ran empty, railway unions went on strike, and passengers' associations sued SNCF." [Mitev's referencing removed]

Though brief, this analysis shows clearly the diversity of impacts an IS can have when in use -- not just managerial or technical, but social and legal. The impacts were not just on the formal aspects of SNCF such as efficiency but on the everyday life of people -- who were many and of wide diversity. This suggests that any framework for understanding HUC must provide a basis for understanding diversity of impacts and of types of people involved or affected (for whom the usual word in the usage community, 'stakeholder' will be used).

A strong normativity is clearly evident here, by which certain things (all, as it happens) are deemed negative and to be avoided while others are deemed positive and to be sought. More from the tone of her writing rather than from any explicit statements, it is clear that this normativity is to be treated, not as mere subjectively-experienced discomfort, but as something about which action should be taken. This suggests that a framework should provide a basis for understanding normativity without reducing it to mere description.

4.1.2 Unexpected Impacts

Eriksson [2006] discusses the case of a stock control system installed in a Swedish vegetable wholesaler in the hope of enhancing profitability via IT-assisted business process re-engineering. Specifically, a middle-man between wholesaler and retailer was replaced by a computer ordering system in the hope of increasing both flexibility and profits. To their dismay, the wholesaler found their profits falling rather than rising. Under the original regime, the middleman would offer not just a friendly contact for the retailer but also nuanced advice about the quality of the day's stock and, based on a sympathetic awareness of the retailer's situation, proactively suggest alternatives. All this disappeared under the new regime.

Walsham [2001] shows unexpected impacts even more clearly. He discusses the problems of the EPS (electronic placing system, used in insurance market trading) (described later). Degree of use of the system was still low several years after its launch. The study found a number of reasons for this, but a key one was that "the EPS system .. undermined the Lloyd's rule of Utmost Good Faith. This rule essentially states that a broker must display all known relevant information about the client and the insurance risk to underwriters upon presentation of the risk to them." [p.155] But the system did not allow this and went against one of the fundamental factors on which the tasks of market trading were based. "Trust comes out as a crucial element that must be successfully created and maintained throughout the negotiation process in the insurance chain." [p.158]

Use of the system hindered the building of such trust, so its use remained low. In this case, the unexpected repercussion was that while the original objectives may have been met, those objectives themselves did not adequately reflect the vital aspect of trust and good faith.

These examples suggest that a framework should provide a basis for thinking about such complex issues as unexpected, indirect impacts of use as well as those we might anticipate.

4.1.3 The Case of Elsie: A Small Success?

These three examples show failure. Perhaps because failures are more newsworthy than successes, good, penetrating discussion of successes is rare in the literature. Moreover, authors might filter out of their published papers that which was not deemed relevant to their message. The fourth example is one of success and one in which the author was intimately involved, and, though some of its aspects have been published, the following account includes some of the 'everyday' details that might not normally be published.

The Elsie knowledge based system [Brandon, Basden, Hamilton and Stockley, 1988], was developed to assist quantity surveyors in giving advice to their clients who were at an early (pre-architect) stage in considering the construction of new office developments. Many hundreds of copies were sold to surveyors in the U.K. and came into use. Its use was studied by Castell, Basden, Erdos, Barrows and Brandon [1992]. Of its four modules, the budget module was the most widely used, which would help the surveyor in setting an appropriate budget for a client who wished to consider building office space.

Elsie was a typical expert system (or knowledge based system, KBS), which operated by asking the user a sequence of questions about the proposed office development (such as the number of staff, whether it was a head office or a regional administrative office, or characteristics of the site). From the answers received, it made expert inferences (about size, number of floors, number of lifts, quality of materials and fittings, type of foundations needed, and so on), and on the basis of these it would calculate what the building might cost to construct.

The user (usually a quantity surveyor) would read questions off the screen and gave answers via the keyboard. At any time they could obtain explanation of questions and an indication of how the session was proceeding. To some questions a degree of uncertainty could be accepted in the user's answers. The budget module would ask around three dozen questions, but their number and order varied from session to session because the next question to put is always dynamically selected by the backward chaining [see Brandon, et. al., 1988] that is characteristic of KBS technology. This results in redundant or unnecessary questions being suppressed. Forward chaining, by which each answer is immediately propagated throughout the network of inferences to see if any inference goals have now been satisfied, give the KBS a responsive feel. Such

technical features made Elsie feel very friendly (even though it was driven via keyboard).

At the end, the budget module would present its estimate of what the building might cost to construct, and invite the user to explore and even critique this result. The user could request a breakdown of costs per major element of building (walls, foundations, services, fittings, etc.). If any element-cost was deemed excessive, the reason for this could be explored to ascertain on which information it depended, and this could then be varied to see what difference it made to the cost. The user could even override Elsie's reasoning, for example, if the cost of bricks available differed from that assumed by Elsie, or the aesthetic-amenity quality factor needed to be raised or lowered. In the survey of use [Castell, et. al., 1992] it was found that features valued most by the users were not the more technical ones like the reasoning algorithms employed, but were such things as the perceived accuracy of the system, its flexibility (for example, though designed for commercial buildings it was used also for magistrate courts, hospitals, etc.), and the rather mundane feature that projects could be archived for later recall.

Every project a surveyor meets is unique, leading to a wide variety of types of situations in which Elsie was used. By employing these features, the specification of the building was gradually refined to suit the client's needs, step by step, and at each step Elsie provided information to help the user make quite nuanced decisions about the specification of the building and the quality of materials. The following quotations are taken from Castell, et. al. [1992].

> "To make valid estimates requires a clear picture of the customer's requirements, but it is often the case that such requirements are not clearly known in the initial stages. Customers often change their requirements when they see the implications in terms of costs or building specification."

Elsie also changed what had been a single-stage process (of supplying the client with a detailed estimate taking about a week) to a two stage process, in which an initial rough estimate was supplied immediately, then

> "Following the initial stage, the customer and surveyor meet to revise, update and clarify elements of the original estimate, and a new negotiation cycle, based on the outcome, is started. During such cycles, assumptions are revealed and changes in requirements and their consequences are quickly analysed, with the customer present. This stage is supported directly by Elsie in that it is employed at the time of discussion and provides a powerful medium for expressing new decisions and clarifying assumptions."

Such features led to a number of benefits for the users' tasks, including reduced cognitive load, speed in obtaining the first estimate, enhanced communication with client and flexibility in responding to unanticipated change. As a result:

> "not only is the process of generating a budget estimate significantly shortened ... but the process enhances the clarity of the customer's requirements. It should be noted, however, that this increases rather than decreases the chances of the customer changing requirements, but such changes can be readily accommodated."

Elsie not only made extant tasks more efficient (which had been anticipated), but even changed the very tasks themselves, which had not been anticipated but proved to be where the real benefit lay. This, in turn, "led to significant changes in the relationship between the quantity surveyor and customer, and a change in the role of each" which had two components:

> "... several factors combine to increase the customer's commitment to the project. ... direct involvement in the second (revision) stage of the process has meant that the customer has felt more in control of the whole process. Being encouraged to actively engage in the process by providing information and suggestions to be input directly into the system, and assessing the consequences of such new information in a variety of ways opens up the process and engages the client in a much more direct way. The system thus becomes a tool supporting interaction at the level of social relationships as well as that of tasks."

and

> "The relationship between surveyor and customer has traditionally been one of expert versus novice ... With the kind of shared problem solving behaviour described above, the participants in the negotiation cycle are now likely to be working towards a better articulated, shared goal."

As a result,

> "Thus the interaction with the computer becomes less differentiated in terms of expert versus novice and more co-operative in terms of reaching the common goal of an acceptable budget estimate and building specification. The change in relationship is towards empowerment of the customer ..."

It is interesting, however, that the surveyors welcomed rather than resisted this apparent shift of power away from themselves because "they see themselves as able to provide a better and more attractive service to their customers."

It is also interesting to note that, in terms of meeting its original objective -- to make high-level surveying expertise available to less senior surveyors so they could share some of the workload and undertake budgeting tasks more cost-effectively -- Elsie would be evaluated as a failure, yet it was judged a success (and became the second most widely sold expert system of its time), because of the kinds of benefits discussed above. The latter -- and especially the change in role -- were completely unexpected repercussions.

This account not only exhibits diversity, normativity and unexpected impacts found in the other three cases, but clearly displays the network of interrelated factors in the use of such software in professional situations of decision making and advice giving, and the complexity that plagues our attempts to understand such usage. The direct relationship with the computer (HCI) enters the picture as various types of user-friendliness and ease and transparency of use, followed by the ability of lay people to use it, the importance of technically mundane features, the changes in user tasks and processes, especially those brought about by the users themselves, changes in roles and social structures, and the difference between formal and

actual criteria for judging success.

4.2 COMPUTER USE AS MULTI-ASPECTUAL HUMAN FUNCTIONING

Chapter 2 showed that Dooyeweerd's philosophy addresses issues of diversity and normativity in a human-centred way orientated to everyday experience. So it is no surprise that the author discovered that it provides excellent understanding of such everyday issues of usage as are mentioned above. The argument that follows will gradually develop the author's framework for understanding HUC. It is not necessarily the only framework that could be developed, or even the best, but it seems to be a reasonable one, so the validity of the framework is merely explained and illustrated, rather than proved. This is done by means of aspectual analyses of the cases employing Dooyeweerd's suite of aspects, which fulfil a dual purpose. One is to expose the reader to the practical device of aspectual analysis in various guises. The other is to introduce new ideas, one by one, that are important components of the framework for understanding being developed.

Dooyeweerd invites us to see use of computers as multi-aspectual human functioning. Many existing frameworks for understanding computer use elevate a single aspect thereof and largely ignore the others; for example, usage seen from the viewpoint of psychology elevates the psychic aspect and usage seen from the viewpoint of business elevates the economic aspect. But in a Dooyeweerdian understanding of usage, all aspects are given due recognition and respect, yielding a framework that enables us to address the diversity that is usage when viewed from a lifeworld perspective.

4.2.1 Aspectual Analysis of Computer Use

We can find almost every aspect in the accounts above. But what philosophical roles or characteristics of aspects are important here? Aspectual analysis in general relies on aspects being ways in which things may be meaningful (§3.1.5), the 'things' in this case being situations of use. And, since computer use involves us doing things which result in impacts, aspectual analysis of computer use recognises that aspects enable both functioning and repercussions of that functioning (§3.1.5).

One type of aspectual analysis is to interpret an extant text. The main aspectual meaning of each phrase is identified, and perhaps tabulated as exemplified in Table 4.2.1.1, which present a quick analysis of Mitev's report.

Aspectual interpretation of extant texts, as with Socrate, can indicate to what extent the writer is focusing on certain aspects at the expense of others. Mitev's text contains every aspect, hereby showing her analysis to have been sensitive to the lifeworld.

Table 4.2.1.1 Aspects of Socrate Use

Aspect	Phrases from Socrate report
Pistic	unions and user resistance
Ethical	Surveyors happy to sacrifice power as experts, A 'generous' UI that gives more than strictly necessary
Juridical	political pressure, inadequate implementation, The user interface was designed using the airlines logic, inappropriate prices, Booked tickets, passengers' associations sued SNCF
Aesthetic	chaotic implementation, prepare the public to such a dramatic change
Economic	poor management, unavailability of ticket exchange capabilities, non-existent trains, trains ran empty, railway unions went on strike
Social	Cultural meaning of the questions, Enhance relationship with client., Circulation space
Lingual	inaccurate fare information, Staff training, Public relations failed
Formative	Technical malfunctions, prepare salespeople, Impossible reservations
Analytic	inadequate database information
Psychic	not user-friendly, unacceptable to customers, irate
Biotic	Muscle exerts force; ligh activates retinal cellst, Fresh air: opening windows
Physical	Ground loadbearing capacity, Force on key
Kinematic	timetable and routes of trains, wrong train connections
Spatial	queues
Quant'ive	Large, all

A more thoughtful aspectual analysis involves reflection on the situation of use as such rather than on texts, and can uncover a wider diversity of issues. A small reflective aspectual analysis ('brainstorm') of Elsie (which draws in factors from the author's memory as well as those mentioned above) is shown in Table 4.2.1.2.

Such aspectual analyses, especially directly of situations, can be very successful in surfacing issues that might be overlooked. They begin to reveal the diversity of factors that constitute human usage of computers, and which contribute to its success or otherwise.

But we face two problems. One is that, in undertaking this kind of analysis, are we merely 'filling slots', forcing an account into arbitrarily-chosen categories? This possibility is discussed in chapter 9.

Table 4.2.1.2. Aspects of Elsie

Aspect	Usage of Elsie
Quant'ive	Number of questions, Number of floors, Magnitude of cost.
Spatial	Shape, size of building, Determine whether building fits site.
Kinematic	Lifts, stairs.
Physical	Ground loadbearing capacity, Finger force on keyboard.
Biotic	Muscle exerts force; ligh activates retinal cellst, Opening windows for fresh air:
Psychic	Users feel good about Elsie.
Analytic	Clarify client requirements, Separated building elements, Shapes on screen as significant, e.g. as letters, digits
Formative	Flexibility of layout, functional quality, Developing specification for the building, User formulates answer with computer.
Lingual	Communicate with client, Explanations of questions, User understand the questions and give answers,
Social	Cultural meaning of the questions, Enhance relationship with client., Circulation space.
Economic	Work out how to reduce costs, Final cost, Resources of the UI, e.g. screen area, time waited for computation.
Aesthetic	Aesthetic-amenity quality, Harmony between surveyor and client., Style of UI.
Juridical	Knowledge of local byelaws, building regs, Does the UI do justice to info, users?, Do justice to client's real needs.
Ethical	Surveyors happy to sacrifice power as experts, A 'generous' UI that gives more than strictly necessary.
Pistic	Role change to partners with shared goal.

4.2.2 Interwoven Multi-aspectual Functionings

The second problem is that Table 4.2.1.2 feels rather heterogeneous. Many of the factors feel of a different sort from others, for example the number of questions presented to the user and the number of floors of the building are both quantitative but seem to be meaningful in different ways. We may also discern two physical aspects -- force on the keys by the user's fingers, and the load-bearing capability of the foundations of the proposed building being analysed -- and several lingual aspects -- the questions on screen, and communication between surveyor and client. Likewise, in Mitev's account we detect a similar difference between two formative aspects: technical malfunctions and impossible reservations. These are self-evidently different.

Any given aspect manifests itself in different ways in several different multi-aspectual functionings that constitute the whole that is usage. This can lead to confusion if we are not careful to distinguish the different ways in which we experience computers when using them. Taking the formative aspect, for example, we find:

The user functions in the formative aspect insofar as s/he forms what they see on screen (or hear via the speakers) into a structured conceptual whole, and one that is related to what

they already know, and as they plan their next answer.

In engaging with the content represented in Elsie, the user experiences the formative aspect in the degree of flexibility of the building, the quality of its functional fittings, and so on.

Formative human living with Elsie might include using it to help the client develop a specification of the building that will be submitted to the architect.

What is the basis for such differences within an aspect? If we take an unashamed Meaning-orientation and ask in what ways is computer usage meaningful, at least three such ways may be readily distinguished:

Human-computer interaction (HCI) -- aspects of the interaction between the user and computer via the user interface (UI),

Engaging with represented content (ERC) -- aspects whose meaning is represented in the IS,

Human living with computers (HLC), employing the computer in everyday living -- aspects of living that might somehow be affected by, or affect, the use of the computer beneficially or detrimentally.

Each of these is a different type of multi-aspectual human functioning, exhibiting most of the aspects. Together they constitute human usage of computers, but cannot be seen as parts of a whole. Rather, they may be seen as bound together by enkaptic relationships (§3.2.6.2).

Early research recognised only HCI. HLC has also now been recognised for some time; for example Davis' [1986] Technology Acceptance Model speaks of ease of use and usefulness. But even today few recognise ERC.

ERC is particularly important to understanding virtual reality (VR). The VR community has, for many years, talked about the experience of immersion, but recently has begun to differentiate 'presence' from immersion. Immersion, an experience of the hardware and style of the UI, may be seen as HCI, while presence, with its quality criteria of 'plausibility' and 'believability', refers to ERC.

In mechanical technologies, such as a hedge cutter, only the (equivalent of) the first and third are necessary. The equivalent of HCI comprises holding the cutter aright and pressing the correct buttons. The equivalent of HLC comprises the neatness of the hedge (aesthetic aspect), cutting it so as to stimulate sprouting (biotic), trying to get it done before it rains (economic), pride in being a good gardener (pistic) and so on. But in information technology, ERC is indispensable and inescapable because information technology

involves, as its name suggests, representation of some meaning of the domain of application.

4.2.3 Aspectual Analysis of HCI, ERC, HLC

A separate aspectual analysis of each of these three types of multi-aspectual functioning can reveal even more clearly the structure of the complexity that is HUC; the results for Elsie are shown in Table 4.2.3. Such tables, in which entries are distributed into different columns, can be useful to separate out issues.

Table 4.2.3. Aspects of HCI, ERC and HLC in Elsie

Aspect	HCI of Elsie	ERC in Elsie	Elsie HLC
Quant'ive	Number of questions	Number of floors.	Find out cost of building.
Spatial	Spatial layout of the keys.	Shape, size of building.	Determine whether building fits site.
Kinematic	Movement of fingers to press keys.	Lifts, stairs.	-
Physical	Force on key; light emitted by screen phosphor on retina; elecl-chem activity in brain.	Ground loadbearing capacity.	-
Biotic / Organic	Muscle protoplasm exerts force; retinal cells activate	Fresh air: opening windows.	-
Psychic / Sensitive	Nerve signals from retina/cochlea to brain, to fingers, within brain to recognise and remember	-	Users feel good about Elsie
Analytic	I distinguish shapes on screen as significant, e.g. as letters, digits, conceptualising and	Separated building elements.	Clarify client requirements.
Formative	User forms letters into words, questions, makes inferences, formulates answers.	Flexibility of layout, functional quality.	Develop specification for the building.
Lingual	I understand thequestions and give answers.	Explanations of questions.	Communicate with client.
Social	Cultural meaning of the questions;	Circulation space.	Enhance relationship with client.
Economic	Resources of the UI, e.g. screen area, time waited	Final cost.	Work out how to reduce costs.
Aesthetic	Style of UI.	Aesthetic-amenity quality.	Harmony between surveyor and client.
Juridical	Does the UI do justice to info, users?	Knowledge of local byelaws, building regs.	Do justice to client's real needs.
Ethical	A 'generous' UI that gives more than	-	Surveyors happy to sacrifice power as
Pistic	My vision of who I am as I interact: controller of	-	Role change to partners with shared goal.

- The HCI column refers to what the user experiences at the user interface of Elsie as a technical device or artefact.
- The ERC column shows content explicitly represented within the Elsie knowledge base with which the user engages via the UI. In this column are aspects of the model of the building

held in the knowledge base, which might be deemed a virtual world; as far as the author recalls, nothing of the ethical or pistic aspect was explicitly represented.

The HLC column shows some aspectual reasons a user might be using Elsie -- aspects of the life of the surveyor.

As a practical device, this type of aspectual analysis is usually more fruitful than the previous two, where issues within each aspect were all mixed together. The previous two might be used for initial brain-storming, but an aspectual analysis of HCI, ERC and HLC, side by side, not only separates out different issues more clearly but also helps to stimulate a more holistic style of thinking so that issues are not overlooked.

4.2.4 The Nature of HCI, ERC, HLC

But using such analysis of Elsie here serves to reveal the nature of HCI, ERC and HLC more generally.

The HCI column contains aspectual functions of the human activity of interacting with a computer via a user interface, without regard to what type of software is being used or the specific reason it is being used. Functions like these might be relevant to sending an email, entering data into a database, playing a computer game, composing computer music, monitoring process control software, and so on. The main difference will be in the type of medium used (mouse rather than keyboard, loudspeakers as well as screen, tactile feedback, microphone input, and so on).

The ERC column contains aspectual functions, properties, beings, etc. that are represented in the software. They are represented in the computer program, in its data structures and its algorithms that make calculations or undertake some activity. In Elsie, most aspects have been represented explicitly. This should be so for good knowledge based systems or knowledge management systems, especially those built for ill-structured applications, because what is represented should relate to the everyday lifeworld in the domain to which they have been applied. But for computer systems that have a very specific application it is often the case that only a few aspects are represented; for example a calculator might explicitly represent only meaning of the quantitative aspect.

The HLC column contains aspectual functions from the life of the user as they use Elsie for various purposes. Those mentioned here are ones that have been mentioned by surveyors or that, in the author's experience, are reasonable. Some of the purposes might be overtly stated, others might be covert. In principle, any software might be used for a wide range of purposes; for example though normally we might play a computer game for fun (aesthetic aspect), we might sometimes play it as a social activity, sometimes to boost our image of ourselves (pistic), and so on.

But, we might ask, even when using Elsie to clarify client's requirements (for example), are we not functioning biotically by breathing, sensitively as we smell someone's tobacco smoke coming

in through the window, and so on, filling up the gaps in the HLC column? The answer is that we have omitted from this column the aspects of our general life functioning. Only those that pertain to our using of Elsie are included here, and such things as breathing and feeling the keys or seeing the keyboard are found in the HCI column.

4.2.5 Qualifying Aspects

On what philosophical basis may HCI, ERC and HLC be differentiated in the general case? And on what basis may it be decided whether there are other multi-aspectual functionings that, with these three, constitute HUC?

Dooyeweerd's answer is that, when seeking to differentiate one type of thing from another on anything other than a subjective basis, it is often helpful to identify the qualifying aspect (§3.2.5), because this is the main meaning of the thing, in the sense of its purpose or destination, to which all the others aspects contribute. Each of the three multi-aspectual functionings are led by a different qualifying aspect. Table 4.2.5 lists these for Elsie.

Table 4.2.5 Qualifying aspects for HCI, ERC, HLC of Elsie

	HCI of Elsie	**ERC in Elsie**	**Elsie HLC**
Qualifying aspect	Lingual	1. Economic 2. Analytic	Any

The qualifying aspect of HCI is usually the lingual for all information systems. This is because, regardless of application, the main thing we experience is symbols on the screen or heard from speakers that signify something, or in the actions we make that signify what we want the computer to do. This is clearly so in the question-answer style of HCI dialogue found in Elsie, but it is also so in graphical UIs, and whether the sensory channel is visual, aural or tactile-haptic.

It may be noticed that most of the aspects serve the lingual function of understanding what is presented via the UI and responding; this is because the qualifying aspect of HCI is usually the lingual as we discuss below. The importance of the social aspect of HCI is not so much in actual social intercourse when driving the computer. Whatever social intercourse occurs around a computer is usually centred on ERC or HLC -- e.g. a group of children playing a

computer game. Rather, it is concerned with whether the user understands the cultural connotations of, or assumptions behind, what is shown on the screen or heard through the speakers, and with the standardization of things like user interface style. The economic aspect is important because the user's time and the screen area are both limited resources that must be managed frugally. The aesthetic aspect of HCI concerns the harmony and artistic style of the UI. The juridical aspect concerns whether the UI does justice to either the users or the represented content, and so on.

(Occasionally it could be argued, however, that in certain highly proximal software, the qualifying aspect is pre-lingual. For example, if we are using a photographic editing package to subtly change the shading of the sky to make it a deeper blue, not by means of commands or menus, but by sweeping it with the mouse, then this involves very little other than motor control of mouse combined with visual feedback. It could be argued that this interaction between computer and user is qualified by the psychic-sensitive aspect. But others might still maintain the lingual qualification by suggesting that the very movements may be seen as symbolic signification of psychically-qualified purpose -- but would be a little awkward to do so. Here we will leave these possibilities open and focus mainly on lingual qualification.)

The qualifying aspect of ERC is that of the represented content with which the user engages. This is the qualifying aspect of the purpose for which the IS was developed -- its main meaning or destination as a piece of software. In the case of a calculator it is the quantitative, in the case of a word processor, the lingual, in the case of a game, the aesthetic. Whereas the qualifying aspect of HCI is usually the lingual, that of ERC can be any aspect, reflecting the reason for which the IS came into being and continues to be used. In most software this qualifying aspect is usually fixed, regardless of how it is used. But in Elsie's case it changed once. It was originally to set a budget (economic) but this changed when it began to be used, to the analytic function of clarifying understanding and the lingual function of communicating the understanding between surveyor and client. This echoes Dooyeweerd's discussion of the change in qualifying aspect of historical things like antique shawls that become wall hangings [Dooyeweerd, 1984,III,p.143].

The qualifying aspect of HLC is that of the purpose(s) for which the IS is being used by an individual user. For example, for one surveyor, Elsie could be used to give good service to a client beyond the call of duty (led by ethical aspect), to another, to fulfil a contractual obligation (juridical), to a third, to reduce costs (economic), to yet another, to maintain good relations with the client (social) and so on. In general, HLC has a variable qualifying aspect, because any IS in which some flexibility has been designed, may be used in a concrete situation for a variety of purposes. Playing a computer game (aesthetically qualified ERC) might be for educational purposes (lingual) in HLC.

4.2.5.1 On identifying qualifying aspects

The assignment of a qualifying aspect to a thing is not given a priori, but must be chosen by a process of reflection on the thing as it presents itself to us in its everyday (pre-theoretical, naïve) lifeworld context. The author has found three principles useful:

- # The qualifying aspect must reflect the thing itself rather than our variable, subjective use of it.
- # The qualifying aspect is what primarily differentiates this type of thing from another type.
- # For all other aspects, it should be clear and natural to see

how they serve the needs of the qualifying aspect.

Preferably the thing should be given time for its relationships with its context to mature and for reflective discourse to develop about the nature of the thing. Such discourse should be taken into account but should not be allowed to overly dominate all.

For example, reflection on HCI during the 1960s would have revealed little more than control of a machine (formative aspect) or calculation (quantitative). Today, the vast majority of HCI takes the form of the human understanding the meaning of symbols presented, and presenting other symbols in return; hence the lingual aspect is what qualifies HCI. In HCI the formative aspect serves the lingual by enabling a structured interaction, the social serves it insofar as cultural intersubjective meaning of terms helps the user understand. Note: it may also seem that the lingual serves the social, as in email, but that is HLC or ERC rather than HCI.

4.2.6 Benefits of Understanding Types of Multi-aspectual Functioning

Being able to distinguish HCI, ERC, HLC as three types of multi-aspectual functioning in this way has several benefits. It can help us separate out different issues in usage, but more specifically:

- # It explains why something that is easy to use or technically advanced might still fail to bring benefits in use, and why supposedly old-fashioned software like legacy systems can bring real benefits.
- # Recognition of ERC separate from HCI, HLC clarifies how to deal with virtuality. In particular this approach gives us a framework by which to understand the paradox of virtual objects like powerful spells from MUD (multi-user dungeon) games being bought and sold on eBay. Both ERC and HLC are real multi-aspectual functioning.
- # We have a clear basis for differentiating what the software is intended for from what we actually use it for each time.
- # It can be useful in helping us tease apart the issues that emerge in changes in use of software.
- # It can be useful in practice in helping to guide IS development, and enriching it by employing aspectual analysis of all three of HCI, ERC and HLC.
- # It can be useful in the formulation of useful research questions and even whole research programmes, in that it urges us to consider all three, even though we might focus on one, lest our research becomes confused. It warns us that attempting to understand HCI in relative isolation from ERC and HLC might result in flawed, or at least narrowed, research that generates unsustainable results.

That the qualifying aspect of HCI is fixed, mainly, on the lingual provides a link with the area of research and practice that is the nature of computers, discussed in chapter 5. The qualifying aspect of ERC, which may be any aspect that expresses the purpose of the IS and thus links with the task of creating the IS in knowledge elicitation in ISD

(chapter 6). The notion of qualifying aspect is to be preferred to that of functionalistic purpose because much IS use cannot be seen in functionalistic ways (e.g. computer games designed for enjoyment). That the qualifying aspect of HLC is highly variable provides a way of understanding cases in which IS are used creatively for reasons outwith their normal purpose, without giving either too much or too little attention to intended purpose. This links with the task of anticipating usage in ISD (chapter 6).

HCI, ERC and HLC will now be explored in more depth, first the structure of each of the three and then their normative direction. An alternative rendering, of discussing structure and normativity of HCI, then of ERC, then of HLC, was rejected because it would weaken the sense that they are all part of the same activity that is human use of computers.

4.3 THE STRUCTURE OF HUMAN-COMPUTER RELATIONSHIPS

Dooyeweerd was interested in the structure of things as well as how they function. Here we consider the structure of the three relationships between human and computer in HCI, ERC and HLC. Because the HCI relation is the most direct, it will receive the longest discussion.

4.3.1 Structure of HCI: Law-Subject-Object and Gegenstand Relations

To understand the relationship between the human user and the computer, it is necessary to understand Dooyeweerd's notion of subject and object clearly. In place of Descartes' subject-object relationship, as an undifferentiated human ego observing or operating on a (more or less) non-human other, Dooyeweerd offers a diverse law-subject-object relationship in which both humans and other entities all play a part as subject and object in many different ways (§2.4.4).

In computer use, there is a subject-subject relation between the human and computer in the physical aspect because both are subject to the laws of that aspect; it is this S-S relation that enables true interaction. However, we cannot reduce HCI to the physical aspect, since, as HCI, it gains its real meaning from later aspects, usually the lingual. It is the psychic to lingual aspects that are most meaningful in HCI. For example, when moving and clicking the mouse I do not think primarily of 'exerting sideways and downwards forces on the mouse' (description according to physical aspect) but in terms of 'moving, clicking, dragging the mouse' (psychic aspect), 'selecting' (analytic), 'moving, forming' (formative) or 'expressing' (lingual).

4.3.1.1 Aspectual Subject-Object Relations

The physical is the latest aspect in which it can function as subject. So in all post-physical aspects, the relationship cannot be subject-

subject. If the use is proximal, in which the user is hardly aware of the computer, giving it little attention, then the relationship in all these is subject-object, as depicted in Table 4.3.1. (We do not show the pre-physical aspects since their meaning here is completely bound up with the physical.)

Table 4.3.1. Aspects of user and computer

Aspect of HCI	of user (input; output)	Rel	of computer (output; input)
Physical	Physico-chemical energy, fields and forces	S-S	Physico-chemical energy, fields and forces
Organic	Muscle cells active; Retinal, ear, nerve cells stimulated	S-O	Currents from mouse; Voltages that control screen
Psychic	Make mouse gestures; See shapes, colours, spatial arrangements (esp. vert, horiz,topological), Hear sounds, etc.	S-O	Receiving mouse gestures; Displaying shapes, fonts, colours at various positions
Analytic	Choose what to ask computer to do; Differentiate parts of visual-aural field that carry information from backgnd	S-O	Recognising tokens of command; Displaying pieces of data
Formative	Structure commands to computer, plans for finding understanding content; Intelligently respond to displayed structure (e.g. following appropriate links)	S-O	Recognising command structure, taking appropriate action (e.g. click on link to page); Displaying structure (e.g. hyperlinks as blue underlines)
Lingual	Finding and understanding content from the web pages	S-O	Displaying content; obeying user's UI commands
Social	Understanding the humour and cultural connotations on the page	S-O	Providing explanation and help to assist user's cultural understanding.
Economic	The web page makes frugal use of screen area, and downloads rapidly	S-O	-
Aesthetic	Appreciate the colours, balance, etc. of the web page	S-O	-

Gives meaning to physical functioning

The two sides of the relation are described differently, except for the subject-subject physical relation. In the subject-object relationships the functioning of the user is that of agent (subject) while that of the computer is of meaning in each aspect ascribed as the computer's physical functioning.

Later aspects are dependent foundationally on earlier. So, for example, if we describe the computer as receiving gestures from the mouse and displaying shapes on the screen, this is shorthand in the psychic aspect for saying that the computer functions in a certain way physically, which we (users and others) interpret as receiving mouse gestures and displaying shapes. If we describe the computer as

"giving us the latest profit figures", this lingual shorthand for the computer's physical functioning, which we interpret as:

displaying shapes, which happen to be standard ones that are ...
... letters and digits rendered in a certain font, which we take to be words and number, which ...
... form a structure (e.g. word 'profits' followed by '=' followed by a number), which is interpreted as ...
... the latest profits.

And we might add

... which are seen as bad or good, depending on cultural knowledge of the sector in which the firm is engaged.

We then make use of this information in our lives (HLC).

Some of the benefits of viewing HCI in this way are to our discourse about the nature of computers in chapter 5. It throws fresh light on why it is that the computer seems intelligent but why its behaviour is determined, and it makes it valid to speak of the computer 'displaying', 'recognising' and even 'working out' or 'thinking' without either implying subject-agency on one hand or metaphor or anthropomorphism in the description on the other. This means that arguments and deductions made about what the computer is doing are sound (in contrast to those based on metaphor).

The benefit for viewing HCI in this way here is that it can clarify a number of issues. One is that it gives a place for all aspects in HCI, especially the later ones which are often overlooked. Another is that it highlights the debt we owe the physical aspect. Being a determinative aspect that is the latest in which the computer functions as subject, this view explains why we can rely on the computer's calculations and searches. But the main one is that it provides a basis for evaluating and designing HCI in which confusion between the various issues is minimised.

4.3.1.2 Distal and proximal

Polanyi [1967] discussed how use of a tool is 'distal' when we are unfamiliar with it but becomes 'proximal' once it becomes second-nature to us. In a proximal relationship with a tool our attention is not on it but rather on the task for which we are using it, but in a distal relationship, some of our attention is distracted to attend to the tool as such. The tool is now at a distance from us mentally.

This view has been applied to understanding two types of HCI [Basden, Brown, Tetlow and Hibberd, 1996]. In the first couple of decades the HCI relation was assumed to be distal, with a common metaphor for understanding it being dialogue between two agents (human and computer). For example, nearly one third of Downton [1991] is devoted to 'Human-computer dialog design'. But this distal relationship is problematic; Norman [1990] said:

> "The real problem with the interface is that it is an interface. Interfaces get in the way. I don't want to focus my energies on an interface. I want to focus on the job."

Laurel [1986] called for 'direct engagement' and Shneiderman [1982] pioneered 'direct manipulation'. As a result, proximal HCI became the norm (for example in using word processors).

Attempts were made to understand this philosophically. Winograd and Flores [1986] (discussed later) contended that the harmful distal relationship came about because computer scientists assumed a Cartesian subject-object relation, and urged us to design according to Heidegger's notion of 'at-hand' to achieve proximality. The distal experience is explained by them in terms of Heidegger's notion of 'breakdown'. But this has been criticised (see later).

But Dooyeweerd's subject-object relation is one of intimate, proximal engagement, not of distance. Dooyeweerd does have a distance relation, Gegenstand, in which we 'stand over against' aspects of the thing with which we are engaged. For example, if, in reading the profits statement above we find trouble, then we must give attention to user interface and work out what it means before we can use it in our lives. To do this, our aspectual functioning is not engaging with the IS as such, but, for a time, with a load of coloured lights shining out from the plate of glass in front of us (pixels of the screen), that is with the various aspects of the HCI from physical up to lingual.

This account of both proximal and distal HCI is more nuanced than that by Winograd and Flores, because the various aspects of the relationship can be differentiated to analyse more precisely what the problem is. For example, if the trouble we have is because we do not understand English well, then it is a Gegenstand related to the lingual aspect, but if it is because the characters are rendered against a confusing background, it is related to the psychic aspect. But it need not be. Ben Shneiderman once told of his surprise when, assuming direct manipulation is always graphical, one of his students, who was using the text-based editor, VI, contended "With the cursor over a word, I hit 'dw' to delete it; what could be more direct than that?" The view here can explain why the student was correct (lingual directness) and why Shneiderman expected otherwise (psychic aspect). Proximal engagement can occur even in a text-based interface.

4.3.2 The Structure of ERC: Aspectual Reaching-out

The relationship the user has with the computer in ERC is with the represented content. While in HCI the relationship is with the symbols of the user interface as such, here it is with what they represent -- but ERC goes beyond what is mediated via HCI.

In the case of Elsie, for example, HCI-mediated content includes amounts like gross floor area, number of floors, cost per unit area, various non-numeric data like type of office, the questions put, explanations given and so on. It also includes dynamic meaning such

as the order in which questions are asked and other behaviour of Elsie. In the case of a computer game, it includes some characteristics of the player, the items carried, the spatially extended territory of the game, and, of greater importance than in Elsie, the action.

These are usually mediated via the HCI, but the user also engages with represented content they know (or believe) to be inside the computer. In Elsie this included the costs database, the inter-variable inference relationships and the weights of the latter, and so on. In a computer game, in includes things not presently visible such as the whole territory, other players, non-player characters. (This is the issue of 'innards' discussed in chapter 5.)

Represented content with which the user engages can also include the contents of documentation, information passed on from others about what is in the computer, and so on.

Engagement with represented content is multi-aspectual functioning. In these the engagement with represented content means, not response to what is mediated via HCI, but multi-aspectual functioning that is affected by what the user believes to be inside the computer etc. In most of this it is still the lingual aspect which reaches out to all aspects of the domain meaning, but sometimes it might be, for example, the formative aspect because what the user engages with is imagined (perhaps with deduction) rather than seen, read or heard about.

All these, and perhaps more, must be included for the framework for understanding represented content with which the user engages to be sensitive to everyday experience.

All represented content is ultimately mediated via the user's lingual functioning, whether this be HCI itself, communication with those who know the IS, such as the writers of documentation or trainers. (This communication is, perhaps, a fourth multi-aspectual functioning alongside HCI, ERC and HLC, which should be explored for a full picture of HUC.)

But it cannot be reduced to these lingual functionings, nor seen as merely part of it, but is rather enkaptically bound to them. What makes this binding possible is that the lingual aspect 'reaches out' to all other aspects, as mentioned in §3.1.4.

Meaning relevant to the application is represented as content and this could be of any or all aspects . If the representation is of what purports to be the real world (such as we might expect in a database, or in Elsie), then what is represented need to be true to that reality. But in virtual reality, the representation need not be true to that reality but can be a product of the imagination. Dooyeweerd's aspects could, in virtual reality, be seen as different ways in which things can be realistic in the virtual world. In most virtual worlds it is usually the entity side which differs markedly from the real world (with the appearance of fictional entities like hobbits, magic weapons, etc.) while the law side stays largely intact, with a few changes at the

edges to, for example, incorporate magic.

In the public domain game, ZAngband, for example, we find nearly all the aspects represented, as shown in Table 4.3.2. (This table will be referred to later to illustrate aspects of virtual worlds.)

Table 4.3.2. Aspects represented in ZAngband virtual world

Aspect	Content represented in ZAngband virtual world (game)
Quant'ive	Number of items of equipment carried; amount of gold.
Spatial	The maze of rooms and corridors laid out on screen
Kinematic	My 'speed' rating determines how fast I flee enemies.
Physical	Weight of armour. I can fall through trapdoors.
Biotic	I must look for food. Killing creatures or being killed
Psychic	I cannot see far in darkened rooms, but can smell monsters.
Analytic	I must identify types of objects, weapons, armour, creatures, etc.
Formative	Creatures attack me, 'intelligent' enough to find their way, so I must avoid them. ZAngband gives me quests.
Lingual	Creatures speak to me; I gather rumours.
Social	Creatures may be friendly / aggressive; I try not to annoy the friendly ones
Economic	I use my funds to buy, sell equipment. Limit on equipment carried.
Aesthetic	What creatures say to me is sometimes quite humorous.
Juridical	Some creatures are guilty of crimes, so I receive a reward for killing them.
Ethical	I meet beggars - but have no means of giving them money
Pistic	Players assigned a deity, which affects how we play

All such things are represented by symbols in the IS (the technical artefact of which might be a program, database, web page, etc.), which might be program variables, fields in a database, content of a web page, etc., but they can also be activity of the program. How representation comes about will be discussed in chapter 6, and the technological resources for it, in chapter 7.

It is not enough to represent an aspect thinly; it must be represented in the richness with which we encounter it in the real world. For example, under the analytic aspect of distinction, we classify and identify objects, and in everyday life we have several degrees to which we can do this. So when the player of ZAngband finds an object they must be able to detect its general type immediately (two-handed sword, soft leather shoes, gold ring, etc.), but they must also be able to identify the object's quality -- such as how effective the sword is in being wielded and doing damage -- and in ZAngband this requires the player to zap a Rod of Perception or read a Scroll of Identify. There is also a third, special or secret degree of identification. These degrees of identification are

programmed into the software as variables, data structures and algorithms. But while playing, the user is not aware that these are variables but takes them as they present themselves: fictitious things. The most effective ERC is proximal rather than distal.

In all aspects, even the physical, the relationship the represented content has with the user is subject-object, never subject-subject.

4.3.3 The Structure of HLC: Aspectual Repercussions

In HLC the computer system becomes almost invisible, being completely subsumed into, and being an object in, the human user's

subject-functioning. In HLC we are primarily concerned with how human beings function in the aspects (that is, respond to the laws of those aspects) and thereby incur repercussions, which are of a different type for each aspect, as depicted in Fig. 4.3.3.

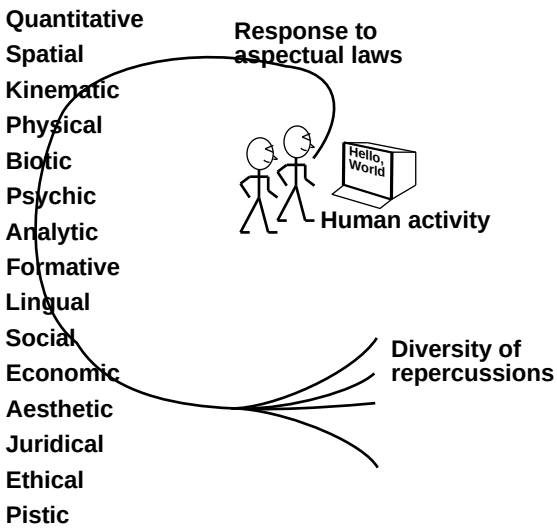

Fig. 4.3.3. Aspectual Functioning and Repercussions

But repercussions are not fixed, as Walsham [2001,p.45] also emphasises: "the merits and demerits of a computerized information system remain open to debate on a continuous basis". But this variability is not arbitrary but occurs within what he calls (drawing on Social Construction of Technology concepts) 'technological frames' that "lead to particular attribution of meanings" -- this sounds remarkably like aspects.

4.3.3.1 Diversity of repercussions

Each aspect indicates a distinct type of repercussion (see §3.1.5), so we can expect many types of repercussion of computer use. None may be reduced to nor explained in terms of others. If we consider Mitev's [2001] account cited above, of the failure of the SNCF Socrate system, we can identify the following aspectual repercussions easily:

"led to an inadequate and to some extent chaotic implementation." -- juridical + aesthetic
"Staff training was inadequate and did not prepare salespeople to face tariff inconsistencies and ticketing problems." -- formative
"The new ticket proved unacceptable to customers." -- formative (historical)
"Public relations failed to prepare the public to such a dramatic change." -- formative
"caused major problems for the SNCF sales force and customers alike." -- formative
"led to large queues of irate customers in all major stations." -- social + sensitive
"Booked tickets were for non-existent trains" -- economic
"other trains ran empty" -- economic
"railway unions went on strike" -- economic
"passengers' associations sued SNCF." -- juridical

All such repercussions (all negative as it happens) contributed to, and constituted, the failure of the system.

Aspectual analysis can be carried out, exploring the functioning and repercussions in each aspect, either prospectively in prediction and design or retrospectively in evaluation. The aspect-tree device introduced later is useful here. This can ensure that the moral and political issues (ethical, juridical aspects) are not overlooked, a criticism that Walsham [2001,p.49] reports was made of Social Construction of Technology.

HLC impacts not only the user but many people or other stakeholders (e.g. animals). Stakeholders are seen as those that have some subject- and/or object-functioning in the multi-aspectual network of activity that surrounds the computer system. Notice the wide range of stakeholders in the SNCF case. Jones and Basden [2004] shows how aspectual analysis can be useful in identifying a wide range of stakeholders, including those often overlooked, such as non-human ones.

4.3.3.2 Unexpected, unanticipated impacts

As illustrated in the cases discussed by Eriksson [2006] and Walsham [2001], many important impacts are unexpected. The reason for unexpected repercussion, Eriksson argues, is because a number of important human aspects had been overlooked (e.g. the social relationship by which informal advice about the quality of vegetables was offered). Though Walsham does not speak of aspects in the same way, it is clear the same reason applies in his case of the insurance system: the entire pistic aspect of its use was overlooked: Utmost Good Faith. The pistic aspect was also overlooked in the case of Elsie (changed view of one's role), but here it brought unexpected success.

The most serious unexpected impacts occur not because of lack of detailed knowledge but because aspects are overlooked during design, development or use. Philosophically, the reason why unexpected repercussions occur is because the laws of aspects still pertain, transcending us, even when overlooked (see §3.1.4). If, as subjectivism holds, there are no transcending laws, it is difficult to

account adequately for unexpected impacts.

This suggests that identifying which aspects have been overlooked during design or use can help us identify the broad areas in which the most serious unintended impacts are likely to occur, and that, if we then take account of (our best knowledge of) the laws of these aspects, we can often gain an indication of what the unintended impacts are likely to be, and over what timescale. This is important in IS development (chapter 6). The author has found in practice that this is an intuitive, rather than rational, process, probably because the kernel meanings of aspects are grasped by intuition rather than by reason (§3.1.4), but it is possible some structured method could be devised for it.

4.3.3.3 Indirect, long-term impacts

The most direct repercussions can be expected in the aspects in which the functioning occurs. In lingual functioning we would expect lingual repercussions; for example, if the text of the question the computer puts to the user is poorly worded, then we can expect the user to misunderstand the question. This misunderstanding could then be passed on to others, affecting them. Ulrich [1994] calls such people 'affecteds' and Eason [1988] and Friedman and Cornford [1989] called these 'secondary users'. Ferneley and Light [2006] suggest the notion has still not received adequate attention in the IS literature.

In particular, the indirect impact is more diverse. The repercussions of lingual functioning are not only lingual but can occur in any aspect due to what might be called aspectual crossover in the human user. The ego or self functions in all aspects, even when stimulated by one. For example, in response to a poorly worded question, the user might get annoyed (a psychic repercussion) and rude to others (social), and be unwilling to exert themselves in the service of others (ethical), as shown in Fig. 4.3.3.3.

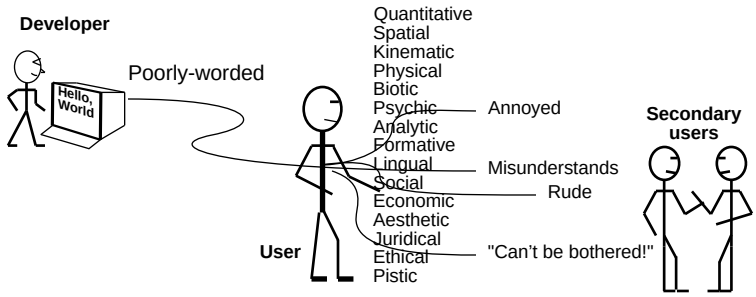

Figure 4.3.3.3 Repercussions of IS Usage

We can perhaps see this in the SNCF case cited earlier, where the social and psychic repercussions "large queues of irate customers" resulted from "Impossible reservations on some trains, inappropriate prices and wrong train connections", which are analytic and juridical dysfunctions.

There is no mechanical link between the two that people will become 'irate' in such circumstances (though they often will). Because all the later aspects, at least from the analytic onwards, are normative rather than determinative, there can be no mechanical link between functioning and repercussion. This precludes any attempt to find a mechanistic methodology for predicting the impacts of information system usage. But this Dooyeweerdian framework can at least help us analyse and discuss it.

Most indirect repercussions involve social functioning, so they can be understood as expanding ripples of aspectual repercussions, some within the same aspect and others by aspectual crossover. As a stakeholder receives some repercussion of aspectual functioning, they respond by changing their own functioning in a number of aspects, and so, in turn, the latter functioning generates yet more repercussions. Many aspectual repercussions in post-social aspects occur because the aspectual functioning spreads throughout society and may thus take some time to materialize fully. As Table 3.3.9 showed, the latest aspects like the pistic can give rise to particularly long-term repercussions, often of an ecological nature.

4.3.3.4 Overview

This view of HLC as multi-aspectual human functioning in which the computer system is an object provides a basis on which we can at least begin to analyse and discuss the various components of the complexity of HLC. Table 4.3.3.4 summarises how each component may be addressed by a specific portion of Dooyeweerd's thought.

Table 4.3.3.4 Addressing complex HLC issues with Dooyeweerd

HLC Issue	**Addressed by ...**
Diversity of impacts	Multi-aspectual human functioning
Diversity of stakeholders	Multi-aspectual social functioning
Unexpected impacts	Aspectual law pertains
Indirect impacts	Aspectual crossover Social respect
Long-term impacts	Long reaction times of post-social aspects

4.4 THE NORMATIVITY OF COMPUTER USE

In discussing the SNCF case above, we referred to 'dysfunction'. But on what basis may we call this 'dysfunction'? Sometimes, for example, it might be good, in the longer term, to get passengers used to a different way of buying tickets. The framework for understanding HUC must enable us to distinguish success from failure, benefit from detriment or harm, positive from negative, and not only as immediate experience but also over the long term.

On what basis may we understand the complex normativity of each of HCI, ERC and HLC, so as to research, plan, design, evaluate or just live with it? The answers explored here is that the aspects, especially the later ones, are normative and define different kinds of good and evil, because they are spheres of law (see §3.1.3).

4.4.1 Normativity of HCI: Usability

Usability, or ease of use, was, for long, assumed to be the overriding norm for computer use as a whole and still is the norm for HCI. But it is now acknowledged to cover many factors, which can be understood multi-aspectually. For example, in their A Practical Guide to Usability Testing, Dumas and Redish [1999,p.4] define usability as:

> "Usability means that the people who use the product can do so quickly and easily to accomplish their own tasks. This definition rests on four points:
> 1. Usability means focusing on users.
> 2. People use products to be productive.
> 3. Users are busy people trying to accomplish tasks.
> 4. Users decide when a product is easy to use."

At first sight, there is a laudable focus on the human being, but closer examination reveals a heavy emphasis on the economic aspect: 'product', 'quickly', 'tasks', 'use products to be productive', 'busy', 'accomplish tasks'. Many elements of it would, thus, be irrelevant for many types of IS, such as games, unless one distorts the meaning of words like 'productive'.

Many such definitions of usability or ease of use give undue emphasis to certain aspects, and are thus useless here. They may however be widened to include other factors by understanding HCI as multi-aspectual functioning. Table 4.4.1 lists several factors under each aspect. (Such a table can be useful as an aid to design and evaluation of usability, even though it needs to be fully developed.)

Table 4.4.1 Aspects of usability

Aspect	Usage of Elsie
Biotic	No undue muscle strain, RSI
Psychic	Minimise the number of keystrokes, clicks and movements needed. Easy recognition of shapes, sounds.
Analytic	Ease with which the user can distinguish or find the UI things that are important to them (e.g. toolbars present the main tools immediately visible).
Formative	Good structure of information (e.g. hyperlinks). Learning how to use UI to achieve various computer activity.
Lingual	Understandability, accuracy, veracity of what is presented (links to ERC). Obviousness of how to achieve their application goals via the UI.
Social	Ensure that cultural meaning is clarified and its presence as an assumption is clearly indicated to the user; use standardized UI style.
Economic	Freedom from clutter; good use of screen area. Good response times.
Aesthetic	Consistent style. Visual, aural style. Balance, elegance, harmony.
Juridical	Ensure that the style of display is appropriate to the type of information being displayed, which is the contention of Gibson's affordances as adapted to UI by Greeno [1994].

Sometimes there may be conflict between such aspectual norms. For example, the juridical norm of appropriateness can make it difficult to standardise the style of UI, as discussed by Basden, Brown, Tetlow and Hibberd [1996]. For example, on a web page, is graphic design more or less important than ability to find useful information? One way to resolve this is to take into account the qualifying aspect of HCI. When factors make different demands, on what basis may we judge between them? If, as suggested earlier, this is the lingual aspect, then its norms of conveying information, understandability and truth-telling should predominate. The aesthetic aspect of graphic design should serve that -- which is a major theme of that authority on graphic design, Edward Tufte [1990].

However, the lingual norms should not themselves be absolutized, because HCI only gains its meaning by referring beyond itself to ERC and HLC. The norms for ERC and HLC are even more important.

4.4.2 Normativity in ERC: Justice to (Virtual) World

The aspects of the represented content are those of the domain meaning which are signified by the symbols that constitute the program or whatever the IS is. The qualifying aspect of the represented content could be any, depending on the purpose of the IS, and so the normativity of ERC could be treated in a manner similar to that of HCI: ensure all other aspects represented in the content support and serve it. But, as in the case of Elsie, the purpose changed during use, and so such a strategy could be dangerous to the flexibility of the IS if followed too rigidly.

A better strategy, which offers greater future-proofing flexibility, is that the represented content should do justice to the full meaning of the domain of application. This is a juridical norm.

The responsibility for ensuring this falls, of course, on the IS developers, as discussed in chapter 6, but a few notes may be made here regarding actual user engagement with the represented content when they use the IS.

What does ’doing justice to the domain meaning’ mean? It is impossible to represent fully all relevant meaning, not just because of deficiencies in the knowledge acquisition process discussed in chapter 6, but because the lingual aspect of representation is non-absolute. But justice may still be done if certain points are noted (which arise from reflecting on the juridical norm of ’due’).

- # Ensure the user understands, and cannot be misled by, the HCI.

- # Capitalize on the user’s own knowledge of the domain meaning, including their tacit and other lifeworld knowledge of the domain. In a calculator (to take the extreme example) the represented content is almost exclusively of the quantitative aspect. Its use however relies almost completely

on the user knowing how it is appropriate to handle quantitative information in the domain of application. Software for ill-structured domains, especially KBS like Elsie, represent many aspects, but the user's knowledge of the domain is still necessary. This explains why Elsie, which represented the expertise of top-level surveyors and was intended to make this expertise available to surveyors of lesser experience, was in fact mainly used by top-level surveyors.

Ensure the user is aware of the limitations of the represented content. What can it not do that a human agent, unaided by the IS, might wish to do? Are any simplifications made? In what context was it constructed (e.g. American, British, European)? What assumptions does it make? The user should be made aware of all such limitations, and should not be lulled into a false sense of reality. The high visual faithfulness of virtual reality and photo-realistic imagery and animations lead users to expect they are faithful in all aspects, but this is seldom the case. For example, in the mid-1990s film Gladiator, when flying over the (virtual) Colosseum, the crowds looked unreal because the people were almost equally spaced, rather than huddling in groups as real crowds do (social aspect). It is often preferable to deliberately degrade visual faithfulness (e.g. by using two-dimensional diagrams or even text) in order to avoid false impressions of reality. ZAngband, for example, uses a diagrammatic, 2D view of the territory.

Ensure user is aware of opportunities to use it in ways not anticipated, and stimulate them to take advantage of these. Build up their courage and hope where necessary.

All these imply training (including tutorials, other documentation and on-line explanation) are vital if the full meaning of ERC is to be actualized, and thus the fullest success of the IS.

4.4.3 Normativity in HLC: Shalom

The norm for HLC may be said to be 'success' -- but what does that mean? As was clear in the case of Elsie, it is dangerous to judge the success or otherwise of an IS by whether it meets the objectives set for it. Dooyeweerd encourages us to define success (and failure) in a more sophisticated way, which accounts for unexpected successes or failures. It is by reference to the intrinsic normativity of aspects (§3.1.4) and the shalom principle (§3.4.3).

Alternatively, the norm for HLC is seen by some as 'emancipation' -- but, again, what does this mean? A common definition is "freedom from unwarranted constraints", but this presupposes clear meaning of 'freedom', 'unwarranted' and 'constraint', all of which are in fact far from clear. Dooyeweerd can, however, provide a useful definition of emancipation, by the same reference to aspectual normativity (which is 'warranted' and enables rather than constrains) and the shalom principle (which defines

'freedom' that is worthwhile).

The shalom principle urges us to seek positive ('good') functioning in every aspect. Here it means that use of the IS should enhance the user's HLC functioning in each aspect and degrade it in none, compared with not using the IS. That is, it should bring benefit and not detriment in each aspect. Table 4.4.3 lists examples of benefit and detriment in each aspect that an IS might bring; such a table can stimulate analysis during evaluation of IS in use, and also in IS development (chapter 6).

Table 4.4.3 Possible IS benefits and detriments

Aspect	**Benefits to stakeholders**	**Detrimental impacts**
Biotic	Improves health, vitality	Threatens, reduces health, vitality
Psychic	Makes people feel better, happier	Frustrates or saddens people
Analytic	Greater clairty in understanding	Confusion
Formative	Better planning, goal achievement	Destruction
Lingual	Better recording, communication, Higher information satisfaction	Reduced access to information, poorer quality information
Social	Leads to more respect, friendliness Better fulfilment of roles	Enmity, hatred, suspicion, Jeopardises role fulfilment
Economic	Better frguality, economy Better management	Waste, squandering, superfluity Mismanagement
Aesthetic	Harmony and integration Beauty, fun, interest	Fragmentation,Misfitting Boredom, Ugliness
Juridical	Justice to all, emancipation Assumption of respobsilbilities	Injustice, oppression Shirking responsibility
Ethical	Encourages self-giving, generosity	Selfishness, self-centredness
Pistic	Vision, commitment Orientation to true Absolute	Disloyalty, lack of morale Orientation to false Absolute

To achieve shalom -- benefit in every aspect -- is indeed a challenge. Some assume conflict between the demands of different aspects (e.g. economic and ethical) but Dooyeweerd believed there is no disharmony between them (§3.1.4). While we might not maximize profits by being generous, experience shows [Collins and Porras, 1998] that generosity and justice bring sustainable profits, and this is likely to be the same with IS. The late Enid Mumford was one who, it might be said, believed in this. Stahl, in his tribute to her [Avison, et. al., 2006,p.373] says "Most importantly, she had shown theoretically as well as practically that the assumption of reflective responsibility is not only possible, it is even economically viable in a market environment."

4.4.3.1 The ethical aspect of self-giving

But, if the active stakeholders are functioning well in ethical aspect of self-giving, as expressed, for instance, in the well-known norm of "Love your enemies, do good to those who hate you, bless those who curse you" [Luke 6:27-28, Good News Bible] then it is possible that negative functioning can have positive repercussions. There are at

least three ways in which this aspect is important.

It sets up an attitude in a community or organisation which allows all to become less defensive, competitive and, in their turn, self-giving. The generous positive response can engender its own positive repercussions, not least in the spreading of a generous attitude amongst the user community. It multiplies.

It blocks the normal negative chain of repercussions ('dog eat dog'). Conflicts can be defused, even those based on clashing perspectives, because we are no longer seeking our own advantage, pushing our own views or protecting our own interests, but seeking blessing for others, listening to and understanding their views, and protecting their interests.

Thirdly, The very success of information systems depends on this aspect. In Western cultures, we take the entering of information for granted. But Walsham points out [2001,p.55] that in some cultures people are unwilling to 'give away' information by entering it into an IS, because they fear others might take advantage of them. 'Giving away' information in this way involves the ethical aspect of self-giving.

Thus Dooyeweerd's insight that the ethical aspect of self-giving is to be kept distinct from the juridical aspect of what is due is remarkably apposite.

4.5 PRACTICAL DEVICES

Dooyeweerd's philosophy very readily leads to practical devices that can assist research and/or practice in an area. Most of these are based round his suite of aspects and assist analysis. Those presented here are ones the author has found useful.

4.5.1 Aspectual Analysis

Aspectual analysis involves noting the ways in which each aspect expresses itself in the situation being analysed. Several types have already been demonstrated, each resulting in a list or table:

- analysis of texts (§4.2.1)
- brainstorming multi-aspectual functioning (§4.2.1)
- analysis of distinct yet interwoven multi-aspectual functionings (§4.2.3)
- analysis of subject and object functioning (§4.3.2)
- analysis of represented content (§4.3.3)
- analysis of usability (§4.4.1)
- analysis of benefits (§4.4.2)

These can be used as examples to follow, though they only give a few example items in each aspect and in practical analysis one would expect more.

4.5.2 Aspects as Checklist: Guidelines for UI

All aspects have normativity (even the deterministic ones). This normativity offers a basis for establishing sound practical guidelines for developing or evaluating UIs or whole computer systems. The shalom principle of simultaneous realization of norms discussed in §3.4.3, emphasises the importance of attending to each aspect. While it is appropriate on occasion to focus attention on one aspect (usually the qualifying) we should always do so in a way that gives all the other aspects their due. If we over-emphasise an aspect, and in the extreme absolutize it, we begin to ignore other aspects, and the result is that the success or fruitfulness of our activity is jeopardised. Thus, for example, a web page that has superb graphics but is otherwise devoid of useful content it will fall into disuse.

Web pages are user interfaces, and we can see the normativity of many of the aspects recognised in the more mature published web design guidelines. Table 4.5.2 shows the 'Research-Based Web Design and Usability Guidelines' of the National Cancer Institute [2005] and the main aspects of each guideline (aspects indicated by the first letter of their name, from Q = Quantitative to P = Pistic). Many have two aspects, sometimes because they cover two things (e.g. "set goals" (formative) and "state goals" (lingual)) and sometimes because the main idea is of two aspects (e.g. sharing is both lingual and ethical). We do not differentiate between qualifying and founding aspects here, but could do if a more precise analysis were needed.

Table 4.5.2. Aspects of Web Design Guidelines

Guideline	Aspect Q S K P B P A F L S E A J E P
Design Process:	
Set and State Goals	F L
Set Performance and/or Preference Goals	F
Share Design Ideas	L E
Create and Evaluate Prototypes	A F
Design Considerations:	
Establish Level of Impt'nce	Q F
Reduce Users' Workload	E
Be Consistent	A A
Provide Feedback to Users	L
Include Logos	P A
Limit Maximum Page Size	S E
Limit Use of Frames	S E
Content and Content Organization:	
Establish Level of Impt'nce	Q F S
Provide Useful Content	F J
Put Important Information atTop of Hierarchy	A F
Use Short Sentence/ Paragraph Lengths	L E
Provide Printing Options	P
Titles and Headings:	
Provide Page Titles	F
Use Well-Designed Headings	F
Page Length:	
Determine Page Length	Q S
Determine Scrolling vs. Paging Needs	S K
Page Layout:	
Align Page Elements	S
Establish Level of Importance	S F
Be Consistent	S A
Reduce Unused Space	S E A
Put Important Information at top of Page	S A
Format for Efficient Viewing	S E
Font/Text Size:	
Use Readable Font Sizes	S P
Use Familiar Fonts [:	S P
Reading and Scanning:	
Use Reading Performance or User Preference	L
Enhance Scanning	F L
Determine Scrolling vs. Paging Needs	S

Guideline	Aspect Q S K P B P A F L S E A J E P
Links:	
Position Important Links Higher	F
Show Links Clearly	P A
Indicate Internal vs. External Links	F S
Use Descriptive Link Labels	L
Use Text Links	P
Avoid Mouseovers	P
Repeat Text Links	F E
Present Tabs Effectively	A
Show Used Links	F
Graphics:	
Use Graphics Wisely	P
Avoid Using Graphics As Links	A
Avoid Graphics On Search Pages	P E
Search:	
Consider Importance of Search Engine	F L
Indicate Search Scope	L
Enhance Scanning	F L
Navigation:	
Keep Navigation Aids Consistent	A A
Use Text-Based Navigation Aids	P F
Group Navigation Elements	F
Place Navigation On Right	S
Software/Hardware:	
Determine Connection Speed	P E
Reduce Download Time	E
Consider Monitor Size	S
Consider Users' Screen Resolution	S P
Design for Full or Partial Screen Viewing	P
Accessibility:	
Use Color Wisely	P
Design for Device Independence	P
Provide Alternative Formats	P F
Provide Redundant Text Links	F L E
Provide User-Controlled Content	L S

We can use aspectual analysis as a basis for critique. The first thing that strikes us is how many aspects are represented here. This is, of course, what one would expect from a good, mature set of guidelines such as the NCI guidelines are. Second, we might look for imbalance among the aspects. The spatial and formative aspects appear more often than most other aspects; we can ask ourselves whether this is appropriate. Perhaps more significant are some gaps, at least in this 2005 version, some of which are quite surprising:

The pistic aspect of vision of who we are is completely absent, yet one might expect some mention of the designers' vision for the website. (It is possible that "Set goals" implies some pistic vision for the site.)

The ethical aspect of self-giving is present only in sharing design ideas. Guidelines on how to give the reader more than is actually due to them, and thus create a site that feels generous, would be useful.

The juridical aspect is almost absent, only represented tangentially in the concept of providing 'useful' content. The juridical aspect would be relevant in terms of giving both the topic and the readers their due.

Perhaps most surprising is the almost complete absence of the social aspect -- the two inclusions are rather tangential. Since websites are read by people from any and every cultural group, with varying background knowledge, expectations and world views, we might expect a whole set of guidelines on appropriate use of cultural connotations, humour, idiom, and on respecting cultural sensitivities.

The kinematic aspect is almost entirely absent. Animation can be used to show movement, but have the designers of these guidelines overlooked this, treating animation as a mere sensitive or aesthetic decoration?

This aspectual analysis of these guidelines is not meant primarily as a criticism of the guidelines, which are excellent when compared with many others that are available, but rather to show how aspectual analysis can be useful as an evaluation tool, and how it might be used to suggest future improvements.

4.5.3 The Aspect Tree: Evaluating Computer Use

Reference to Dooyeweerd's aspects may be made the basis of various methods for practically evaluating a situation of HLC computer usage. To provide an overview of aspectual normativity (e.g. in HLC) the simple visual device of a 'fir tree' may be used. The aspectual fir tree is a double-sided bar chart showing each aspect, with bars to the left indicating negative functioning or repercussions, and bars to the right indicating positive, as illustrated in Fig. 4.5.3.1. The length of the bars can be used to indicate the amount (number and/or strength) of positive and negative in each. This devise shows at a glance where the main benefits or problems might lie. Notice

that there can be both positive and negative in any aspect.

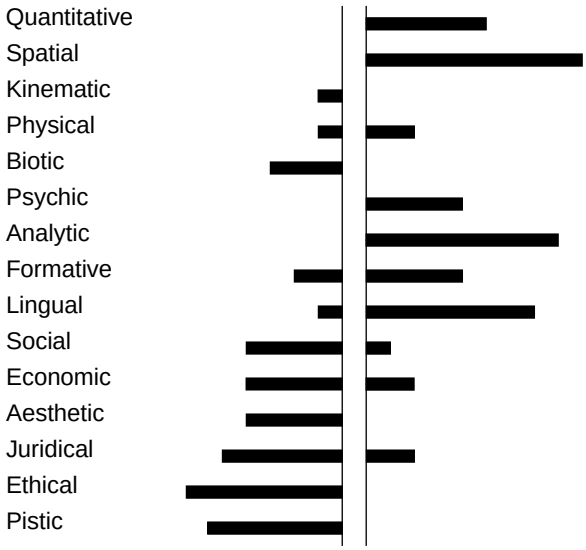

Figure 4.5.3.1. Christmas tree of aspectual repecussions

It can be useful in a number of ways, especially if we take an intuitive grasp of aspectual normativity and analyse the complex lifeworld of use rather than some pre-structured account or prediction thereof. For example, Mitev's description of the Socrate failure (see §4.1.3) has a lifeworld feel and we can make a simple count of the number of times each aspect is referred to (as indicated in the numbers in brackets there), either as a functioning or as a repercussion. We obtain the following chart:

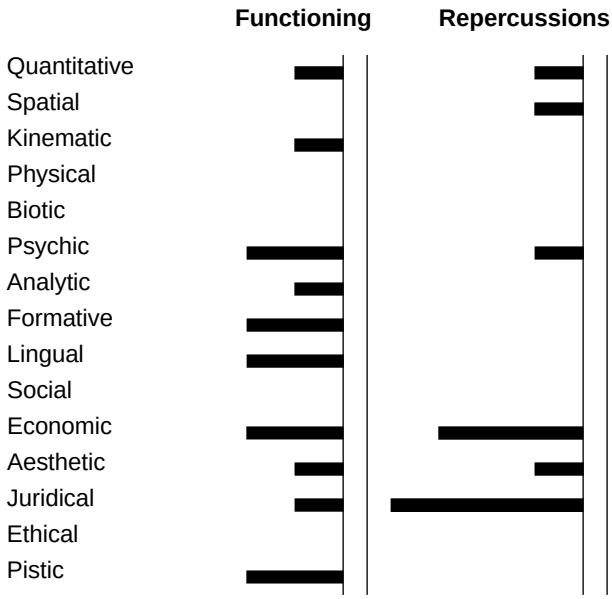

Figure 4.5.3.2. Aspectual view of Socrate failure

Even though only a single paragraph has been analysed -- and so

this picture will be grossly misleading -- several things become clear: that this failure involved negative functioning in many aspects, not just the technical (formative), that the aspects in which the significant negative repercussions occur might not be those in which the negative functioning occurs, and that the most serious repercussions (that Mitev was interested in) were in the juridical aspect. That Mitev was not aware of Dooyeweerd's aspects, but merely adopted a lifeworld stance, is testimony to the power of this approach.

The aspect tree device may be used for both retrospective analysis, as here, or prospective analysis, during design or prediction. It may be a single tree, showing either functioning or repercussions or both together, as in Fig. 4.5.3.1, or one in which functioning and repercussions are separated, as in Fig. 4.5.3.2.

But, as a pseudo-numerical device, the aspect tree can give an over-simplified picture if we are not careful. The following guidelines should be noted:

Never take the length of a bar as some kind of absolute value of aspectual functioning, and never compare two bars of similar length to conclude that functioning in one aspect is 'better' than in another.

But look at the overall patterns and groups. Often, as in Fig. 4.5.3.1, the main positive functioning or benefit lies in the earlier aspects, while the main negative functioning lies in the later ones. This should give cause for concern because the impact in the earlier aspects is likely to be more visible and to accrue in the short-term while the detrimental impact in the later aspects might become manifest only over the long term. This gives a false impression of the 'success' of a computer project if evaluation is undertaken too soon.

Then look at the longer bars. Do they truly indicate major repercussions or functionings, or do they indicate undue attention to these aspects during analysis? Make a specific study of these aspects, to determine which it is.

Look likewise at the short or zero bars. Are these aspects overlooked during analysis? Make a specific study to check, then redraw the tree.

Remember that everybody's understanding of the aspects is variable -- by interviewees, authors and analysts -- even though we all begin from the same intuitive grasp of their meaning. So, any further analysis undertaken should include appropriate checks.

In this way, the aspect tree device is not an end in itself so much as a stimulant to focus further analysis, which could be carried out using Winfield's MAKE method, described in chapter 6.

4.6 RELATING TO EXTANT FRAMEWORKS

Dooyeweerd enables us to construct a framework by which human use of computers may be understood. But we have made at best only passing reference to extant discourse in the area. This section discusses how extant issues might be addressed from within a Dooyeweerdian framework and how that framework might relate to extant frameworks for understanding usage.

4.6.1 Approaches Centring on Limited Aspects

A psychological approach has been a dominant way of understanding HCI since the 1970s. It has spawned much research and many theories, models and methodologies, from Miller's [1956] famous finding of the 'Magic Number 7, plus or minus 2' and the widely-known GOMS model for analysing user interactions [Card, Moran and Newell, 1983] to what are verging on comprehensive FFUs like Green and Petre's [1996] Cognitive Dimensions. By and large, however, this approach is limited to HCI and to considering the psychic, analytic and perhaps formative aspects thereof. This approach has very little to say about ERC or HLC.

There is a business-oriented approach to HUC, which likewise focuses on a single aspect, the economic. This focuses on HLC and has little to say about HCI or ERC, and is rather limited even for HLC. For example, when discussion 'The Trouble with Computers', Landauer [1996] focuses almost solely on productivity, and ignores matters like justice. This business-oriented approach has spawned such methods as cost-benefit and SWOT analyses, and research either to make these more sophisticated or to find alternative methods.

Dooyeweerd would see such approaches as scientific rather than philosophical, because it is science that focuses on single aspects (see chapter 3), and thus unable to furnish us with a comprehensive framework for understanding which is sensitive to the rich diversity and coherence of everyday experience. As such, these approaches could be 'plugged in' to our multi-aspectual approaches to HCI and HLC discussed earlier, contributing their specialist expertise.

However, Dooyeweerd might also be used to enrich the business-oriented approach itself. To Dooyeweerd, the kernel meaning of the economic aspect is neither maximising owner value nor maximising production, as in capitalist and 1970s socialist economics respectively, but it is frugality (skilled management of scarce resources), and this is seen as a positive rather than negative factor. (Green economics, interestingly, recognises this.) Moreover, the multi-aspectual definition of success in HLC is commensurable with, and could enrich, the business approach because business has important lifeworld characteristics. Some of this has been recognised in more recent writing in business and economics; for example Collins and Porras [1998] draw our attention to the importance of the pistic aspect of vision.

4.6.2 'Making a World of Difference'

In his book Making a World of Difference: IT in a Global COntext, Walsham [2001] provides an insightful discussion of HLC, ranging from individual use, through groupware, organisational use, inter-organisational and up to the level of society (the latter being more of interest to chapter 8). He spends two early chapters reviewing a number of approaches, first on the macro level of contemporary society, modernization, globalization and the 'information age', then on the 'micro' level of computers at work, covering issues of the relation between data, information and knowledge, the role of IT, improvisation versus routine work and the appropriation of IT, and finally power and politics. Almost all the approaches are theoretical in nature.

In Part 2, these approaches are assembled into a basket of conceptual and analytical tools, which he employs to analyse a dozen case studies at the four levels from individual to inter-organisational, with a core interest at each level. At the individual level his core interest is in identity (vision of themselves: the kernel functioning of the pistic aspect) of those who use IT. At the groupware level, it is teamwork. At the organisational level it is enterprise reorganisation. At the inter-organisational level it is trust. In Part 3, he addresses cultural and cross-cultural issues such as cultural values, with further studies. In Part 4 he discusses the study, suggesting directions and topics for future research. He concludes by saying, as mentioned in chapter 1 of this book, that his professional interest could be encapsulated in the question "Are we making a better world with IT?"

The basket of analytical and conceptual tools that Walsham used is impressive for its variety and its ability to cover both macro and micro issues. The macro-level tools include views on modernity by Giddens, on the 'risk society' by Beck, on globalization by Robertson, and on the 'information age' by Castells. The micro-level tools include views on data, information and knowledge by Checkland and Holwell and various thinkers in knowledge management, the lens of social construction of technology, Actor-Network Theory [Latour, 1987], views on improvisation by Suchman, Weick and Ciborra, views on cross-cultural appropriation of IT by various authors, various views on surveillance, and the lens of Foucault's notion of power-relations.

These may be assumed (because it is not stated otherwise) to largely constitute Walsham's framework of understanding these areas of IT use and the societal issues: what he considers important and meaningful, what he considers good or problematic, what cultural baggage he comes with, and the scientific paradigms he will entertain and conceptual frameworks he employs.

What interests us is to what extent Walsham's framework for understanding might suit our requirements here, and to what extent Dooyeweerd might engage with it. A general critique will be made first. Then two of Walsham's cases will be outlined to allow discussion of how his basket of tools is used.

4.6.2.1 General Critique

The general critique identifies the limitations with Walsham's work.

Firstly, Walsham shows a commendable interest in and appreciation of non-Western cultures. He is one of few to do so. But, as will become plain below, it is undermined by one of his conceptual tools.

Secondly, Walsham's study must first be commended for covering both ICT use and what we have called technological ecology. He brings these together into a single volume, though in different parts of the book and with different conceptual tools: macro and micro. But he does show some points of contact between the areas.

But he does cover only two of the five areas. He does not cover ISD (though he refers to it), and his work casts no light on the nature of computers nor on the shape of technological resources available to IS developers.

Thirdly, throughout his work runs an interest in the issue of identity: who people believe themselves to be in relation to their work (the kernel meaning of Dooyeweerd's pistic aspect). This is commendable, because the pistic aspect of IS use is too seldom consideredd (and indeed identity issues pervade the group, organisational and inter-organisational too). But, as a result, many important aspects of IT use were not reported fully, if at all, such as social impact on families, to what extent customers and others received their due or change on lifestyle (such as increased or decreased use of road transport). Therefore, Walsham's work should not be used as examples of the general picture of IS use.

Identity is not the only issue he discusses, but it is the central pivot around which all else revolves. So it is not yet clear to what extent his framework for understanding (or his basket of tools) can facilitate a study in which identity is not central.

Fourthly, the focus of IS use is on work, especially professional work. This means that his framework for understanding is not attuned to other types of use, including home use, computer games, computer art, and the like. Most of his cases, even of individual working, involve organisational systems, so it is not clear to what extent his framework is suited to, for example, studying personal use of word processors or photographic storage.

However, these criticisms should not necessarily be seen as weaknesses, only as indicating limited scope. To demonstrate weaknesses, two of his cases will be examined.

4.6.2.2 Two Cases

One case is of individual use of IT, while the other, drawn from the opposite ends of the spectrum, is of inter-organisational activity.

ComCo produced plotters, had a team of engineers to maintain them, but then outsourced the plotter business. The engineers became agents. The company had an ICT system, Traveller, to enable them to communicate, such as log their visits. Walsham cites stories from three engineers, called Gary, Keith and Neil. Neil loved fixing machines, did not see his job as including answering customers' other questions, and subverted and bypassed the Traveller system. Keith used the system, and ComCo itself, to further his own goals (setting up his own company). Gary wanted to give good service to customers, was loyal (in spirit as well as letter) to ComCo, used Traveller, but also went beyond the call of duty, such as keeping his own stock of spares.

The EPS (Electronic Placement System, the system mentioned earlier in the chapter) was intended to assist insurance brokers in placing risks with underwriters in the London Market. Currently brokers queue outside underwriters' offices with slips of paper on which all the details of the risk are recorded, along with information from subsequent negotiations. The EPS would replace face-to-face meetings with electronic transmission of risk information and make such queueing unnecessary. Also a swathe of underwriters could be targeted with a risk in one go, and those who accepted it most quickly would get the business. The EPS was not widely used however, even several years after its launch. Walsham discussed some of the reasons for this, including diverse views of the merits or demerits of electronic negotiation, and whether the inherent complexity of negotiation is "seriously impaired". But the main reason, according to Walsham, is that the system did not support the principle of Utmost Good Faith, which requires, and assumes, that [p.155] "a broker must display all known relevant information about the clieht and the insurance risk to underwriters upon presentation of the risk to them. ... A key issue concerned the difficulty of the broker inputting all relevant information ..." A more fundamental problem was that face-to-face interaction facilitates the devising of innovative insurance products, for which the London Market is renowned. Walsham sums up the case with [p.157] "Electronic trading offers some opportunities for speed, efficiency and the bridging of time and place. At the same time, complex insurance risks need delicate and sophisticated negotiation." This boils down to a balance between economic and aesthetic (in Dooyeweerd's sense) aspects.

4.6.2.3 Critique Arising from Cases

Walsham's description of both cases exposes a diversity of lifeworld issues, and may be commended for displaying the humanity of all the participants. Support for this view can be found in aspectual analysis of the text (similar to that undertaken for Mitev's case), which shows almost all human aspects represented. Given that the lifeworld exhibits diversity of meaning (according to Schutz, Habermas, etc. in chapter 1) such aspectual analysis can give at least a rough indication of the degree to which an analysis has been open to the lifeworld.

But while the descriptions of cases exhibit a lifeworld diversity and meaning, the interpretation of them does not. This might be

because his basket of tools seems more like a collection than a coherent whole, in that Walsham simply throws them all in together, without showing the relationships between them. He admits [p.62]:

> "The conceptual tools ... will be used to support analysis of these topics, but not in a mechanistic way. In other words, I will not use all of them explicitly in all the chapters, but rather use the conceptual tools selectively to illustrate specific analytical points."

There is therefore no guarantee (except perhaps Walsham's own integrity) that he has not simply selected the tools he prefers, with the danger that analysis will be partial or distorted. Despite his integrity, this may be illustrated in the above cases, chosen almost at random.

4.6.2.4 Too easily satisfied

It seems that one of the main benefits sought for the EPS was reduction in queuing time. This is based on the assumption that queuing is nothing other than an economic (in Dooyeweerd's sense) problem. But presumably (and this is not recorded) brokers had, over the years, devised informal ways of ensuring queueing time was not simply wasted time, such as by discourse and social activity in the queue, or by using it as thinking time. These are lifeworld issues, to which a framework for understanding should be sensitive.

But it is not clear how Walsham's basket of tools encourages the researcher or analyst to consider these. It might not prevent these issues emerging, but it provides no positive method for surfacing them, except methods that depend on participants remembering issues and being able and willing to make them explicit. As a result, it seems, Walsham was too easily satisfied with the view of queuing as it is seen by the formal system: as nothing but wasted time, and there is no indication that he probed more deeply about this particular issue, even though it is mentioned several times in the text in the way one might expect a major intended benefit would be.

But Dooyeweerd, with his ready-to-hand suite of aspects, might analyse queuing thus, by considering each aspect:

> The main visible problem with queueing is time-waste (economic aspect), but probably the main motivator of dislike is fear of boredom (sensitive and aesthetic aspects). However, opportunity exists to use the time imaginatively (formative aspect), for social or communicative (social, lingual) purposes or for thinking (analytic, formative). Moreover, it is also likely that a certain attitude has developed about queueing, either grumbling or accepting (ethical aspect) perhaps bolstered by a (pistic) view that "I am too important to have to queue" or "This is what we have always done".

Such a scenario immediately recommends itself to our lifeworld attitude as reasonable, whatever the details.

In practical analysis, once the aspects have been learned, their kernel meanings are so intuitive, that the issues above can occur to the analyst within the space of a few second. Then non-leading questions might be posed to find how the queuer responds to queuing in every aspect. Such aspectual analysis does not need to take long.

As has already been found [Basden and Wood-Harper, 2006], Dooyeweerd's suite of aspects can act as an excellent surfacing tool, which actually stimulates people to think of things normally overlooked. Moreover, Kane [2006] has found that the aspects used in interviewing can, rather than constraining interviewees, actually free them to mention things they might consider either irrelevant or embarrassing.

4.6.2.5 Distortion of the pictures

However, there is something much more problematic, because less explicit: the framework for understanding that Walsham used to comment on the ComCo case, while it exposed some useful factors, it led him into distorting his understanding of what was going on rather than be fully sensitive the lifeworld of the ComCo engineers.

The conceptual framework of Foucauldian power-relations, which Walsham brings as a lens to the interpretation of both cases, distorts it. Among the description of the EPS case is [Walsham, 2001,p.156]:

> "Shifting power relations between underwriters and brokers were also a subject of concern to both parties. One the one hand, the EPS system could facilitate simultaneous risk transmission, giving the broker the opportunity to 'flood' the market by sending the risk to a large number of underwriters at the same time, rather than queuing outside an individual underwriter's office. The underwriters feared a drastic change in trading conditions, from a leisurely but measured discussion of the terms of the risk, to a situation where the risk was eventually placed with only those participants who responded quickly and at the lowest price. // However it is by no means obvious that the underwriter would be the loser in the longer term ..."

While there might be some competition between brokers and underwriters, to see the relationship between underwriters and brokers as purely or mainly one of (competitive) power distorts the case. The key is the word "measured" above, a juridical word in this context: the underwriters were concerned that each risk received its due. This juridical concern, while it can involve and be mixed up with issues of power, goes beyond power. The power-relations lens is fundamentally unable to recognise it.

The distortion is even more evident in the ComCo case. While his Foucauldian power-knowledge relations lens might be appropriate to Keith and to some extent Neil, it was not appropriate to Gary's story. Walsham says [p.91] "Gary was able to draw on his deep knowledge of plotters to leverage power over Comco who placed high value on his expertise." But there is no mention in the text of of the story of Gary seeking in any way to 'leverage power over Comco', not even a hint of it. On the contrary, Gary exhibited the very opposite of power-knowledge relations, his whole attitude being characterized instead by loyalty to both Comco and customers and by self-giving generosity. And Walsham even admits [p.69] "Gary ... was content ..."

4.6.2.6 Enriching Walsham's Basket of Tools

The tendency to see things in terms of power-relations is by no means restricted to Walsham. This is a growing tendency among some IS academics, and it needs to be challenged, but that is for another occasion. What interests us is the effect of the power-relations lens. There is often two casualties, both illustrated in Walsham's cases. One is a concern to ensure what is due, the other is self-giving or generosity. Those who adopt a power-relations lens tend to find it difficult to see either of these motives in people. Self-giving in particular is almost the very antithesis of power-relations. It is ironic that in many non-Western cultures, in which Walsham shows a particular interest, generosity is part of the way of life, in sharp contrast to Western competitiveness.

This is not to diminish the importance of Foucault's insight into power-knowledge relations, but rather to object to making this insight the main key to understanding situations. However, his insight can be set in context by reference to Dooyeweerd's ideas. Foucault's notion of power is obviously rich and complex (in Dooyeweerdian terms multi-aspectual) but the way it is referred to in IS has a strong formative element: the attempt to shape things. It is also the aspect of will. What tends to happen is that this aspect is absolutized, making all the other aspects invisible. This is not surprising, when one considers Foucault's debt to Nietzsche.

The formative is only one aspect, however and, according to Dooyeweerd, later aspects, though they might involve it, cannot be reduced to it. The two casualties are the juridical and the ethical aspects.

Dooyeweerd's suite of aspects might provide a lens-system that is more sensitive to the lifeworld, especially in non-Western cultures where generosity is more of a way of life, such as in much of Sub-Saharan Africa. As mentioned in §3.3.8, each aspect can provide the centre of a perspective, acting as a lens that brings into focus a particular type of meaning. The formative aspect brings certain issues of power into focus. The pistic aspect brings issues of identity into focus (Walsham's particular interest). But with Dooyeweerd's suite of aspects we have not one but fifteen lenses with which we can bring many different things into focus.

This, coupled with the suggestion above that Dooyeweerd's suite of aspects could be used to get under the system-visible surface to the lifeworld diversity of meaning underneath, means that this part of Dooyeweerd's philosophy, his suite of aspects, might enrich Walsham's basket of tools. (In chapter 8, we see how it can enrich another of Walsham's tools.)

4.6.3 Winograd and Flores

Soon after it was published, Winograd and Flores' seminal work Understanding Computers and Cognition [1986], made a profound impression on this author. It did not so much create a new way of looking at computers in him, as undergird and express what he had

already felt and believed for over ten years (see Vignette 2) about the usefulness of computers. Moreover, though Polanyi's 'tacit dimension' was his mainstay at the time, Winograd and Flores also help him understand the difference between distal and proximal user interfaces (discussed earlier) before he discovered Dooyeweerd.

Winograd and Flores (W+F) questioned the prevailing 'rationalistic' approach to computers especially found in AI and suggested an approach based on phenomenology, hermeneutics and language theory. The first challenge was to the way computers were understood in terms of the Cartesian subject-object relation, as objects distal from, and operated upon by, humans. In place of this W+F offered the ideas of 'thrownness' and 'breakdowns' based on Heidegger's notion of being-in-the-world. Their second challenge was to the assumption that cognition is the manipulation of knowledge of an objective world, and that we can hope to construct machines that exhibit intelligent behaviour (as AI hoped to do). Instead, using Maturana's notion of autopoiesis, they argued that cognition is an emergent property of biological evolution and that interpretation arises from cognition, and that computers themselves can never be made truly intelligent. Their third challenge was to assumptions that language is constituted in symbols with literal meanings, that such symbols can be assembled into a knowledge base, and that they are used within organisations as a means of transmitting information. Instead, in accord with Searle's speech act theory, language is action, the listener actively generates meaning especially as a result of social interaction, and language is responsible for creating, not just being used within, social structures. It is impossible, they argued, for computers to use language in the way humans do (even though they might process natural language).

Using this approach, they suggested 'A new foundation for design' of computer systems. The aim of AI and KBS should be redirected, away from an attempt to make computers 'intelligent' or to support 'rationalistic problem-solving', towards building useful systems that are "aids in coping with the complex conversational structures generated within an organization" [p.12]. They continue, "The challenge posed here for design is not simply to create tools that accurately reflect existing domains, but to provide for the creation of new domains." This, they hope, will open the way to social progress and "an openness to new ways of being" [p.13]. They outline the design of a Coordinator system to support cooperative work.

W+F's work is still avidly discussed, and even inspirational, 20 years later [Weigand, 2006], being seen as a flagship of the Language-Action Perspective (LAP). The LAP itself focuses on computer use in organisations and especially the use of language in changing them, rather than AI issues.

4.6.3.1 Problems in Winograd and Flores

Though Winograd and Flores have inspired many, it is not clear what actual impact on the design of computer systems and user interfaces as a whole their views have had, as distinct from the influence of Shneiderman's notion of direct manipulation, the much-quoted

example of the Apple Macintosh, or the everyday, practical creativity of, for example, computer games designers.

One of the problems with W+F is their focus on organisational IS, and the work context. That computers are seen as bundles of conversations, and useful in coordinating networks of speech acts, raises questions about the extent to which their framework can throw light on other types of computer use, such as games, virtual reality, computer art or devices to make scientific calculations or simulations. It is difficult to see these in terms of speech acts, except perhaps metaphorically.

Their whole section devoted to 'Design' contains guidance only at a rather high level ("Speech act origination .. Monitoring completion .. Keeping temporal relations .. Examination of the network .. Automated application of recurrence .. Recurrence of propositional content" [p.159-161]). One might expect readiness-to-hand would be important in computer games, but their guidance is all in terms of 'conversations' between people in the application area of decision support in management.

But those are comments on the scope of W+F's proposal rather than a criticism of it as such.

A more substantial criticism is made by Spaul [1997], who questions W+F's claim to have opened the way to social progress. Weigand [2006] also mentions a similar concern by Suchman. Winograd and Flores offer no way of differentiating social 'progress' from its opposite -- nor even the more limited notions of benefits or detrimental impact -- because neither Heidegger nor Maturana nor Searle offer a solid philosophical normativity. There is little benefit in making computers more 'ready-to-hand' if what we use them for is harmful. The use of W+F's tool would be 'unreflective'.

Spaul also argues that critique of, and change in, social conditions and structures fundamentally cannot be based on Heidegger. Critique and change need a distancing of oneself from the social milieu. In the end, Spaul suggests that we need to combine the Cartesian distancing of thinking subject from thought-about object with Heidegger and briefly suggests how a Habermasian notion of the difference between lifeworld and systemic life might achieve this.

Spaul's suggestion would seem doubtful, because of the supposed opposition of Heidegger and Descartes when viewed from the Nature-Freedom ground-motive, were it not for Dooyeweerd's claim that he can resolve this antinomy.

(A flaw in Spaul's argument must be exposed which, as far as we know, has not yet been discussed. But Spaul conflates HLC with HCI, and proximal engagement with the computer is is of the latter, while critique of social conditions is of the former. There is no reason to believe that critical distance in HLC is incompatible with a proximal relationship in HCI. Indeed, in the case of Elsie, it was its very ease of use that led to change of the social structures of the relationships between surveyor and client. Nevertheless, Spaul's

highlighting of the fundamental problem with Heidegger is valid, and has been mentioned by others also.)

To make their idea work, W+F found it necessary to combine Heidegger's thinking with that of others. In order to argue the validity of the Heideggerian approach, they felt constrained to appeal to evolutionist philosophy to try to account for how cognition is not in Cartesian separation from the world but is part of that very (biological) world. And, when they attempted to work their idea out in their Coordinator system, they had to supplement Heidegger with Searle's speech-act theory. They assumed, rather than justified or argued, the validity of such combinations. Combining the ideas of two different philosophers might be considered creative and fruitful, but it raises serious questions, first about the choice of philosopher to accompany Heidegger, and second about the sufficiency of Heidegger. It seems to have been a source of problems. Spaul for example points out the radical incommensurability between Searle and Heidegger.

That Heidegger needs to be combined with other philosophers, whether Searle or Descartes, suggests a radical insufficiency as a framework for understanding. Why is it that Heidegger, perhaps accompanied by other existential phenomenologists, is not sufficient to offer a basis for practical IS development, for normativity, nor for critical distance?

4.6.3.2 A Dooyeweerdian view

Dooyeweerd made a comprehensive study of Heidegger and, though many of their ideas overlap, and both thinkers exposed Kant's failure to make the synthesis between understanding and sensibility into a critical problem, Dooyeweerd criticised Heidegger too for being "unable to pose it in a truly critical way" because "he clung to the immanence-standpoint even more tightly than Kant had done" [Dooyeweerd, 1984,II,p.536]. As to many before him, so to Heidegger, the transcendental ego was still sovereign [Dooyeweerd, 1984,I,p.112] and he presupposed a theoretical synthesis [Dooyeweerd, 1984,II,p.536]. This might help apprehension and amelioration of the problems above, in the following manner (which is a summary of the full argument).

Presupposing a sovereign transcendental ego rules out all normativity, on the basis of which a critique may be made of the social milieu, and presupposing a theoretical synthesis makes it difficult to engage fully with the diverse coherence of everyday life, including designing a system like the Coordinator.

There are two ways forward. One is to allow Dooyeweerd to be the companion of Heidegger, replacing Searle and Descartes, and supplying both a genuine normativity and a fully lifeworld attitude, while at the same time being in deep sympathy with Heidegger's notions of Dasein, etc. That avenue should be explored, in its potential to design systems and also critique social structures.

The other is to found Winograd and Flores' directly in

Dooyeweerd rather than in Heidegger. The framework developed above can provide a foundation for Winograd and Flores' work together with the reasons they appealed to other philosophies, and also Spaul's criticism, as follows:

Use of computers is multi-aspectual human functioning in which the user is fully engaged by virtue of responding as subject to all aspectual law. When considering HCI, in contrast to the Cartesian subject-object relation, which implies distal separation, Dooyeweerd's law-subject-object relation implies proximal engagement.

Our engagement with the world no longer has to invoke evolutionist philosophy because it is fundamental to Dooyeweerd's notion of law-subject-object.

The design of a system like the Coordinator, the purpose of which is qualified by the lingual aspect, must of course make use of humanity's best knowledge of that aspect, which might include Searle's speech-act theory in the role of a scientific theory rather than a philosophical framework. The design of a computer game would likewise be qualified by the aesthetic aspect. This concerns ERC (and IS development, chapter 6).

The HLC use of IS to critique social structures involves the user's functioning in post-social aspects, especially the juridical. This in no way requires Cartesian separation. Viewing Elsie though a Dooyeweerdian lens, it was not primarily critical distance that led to the change in social structures, but rather a functioning in the ethical aspect of (being willing to be) self-giving.

While, strictly, Dooyeweerd does not force us to differentiate HCI, ERC and HLC, his prompting us to focus on types of multi-aspectual human functioning made it easier to do so and provided philosophical grounding for doing so.

Though the above is only a summary of a fuller argument, it demonstrates the utility of Dooyeweerd in first exposing what might be the root of the problems that surround or inhabit a framework for understanding like that proposed by Winograd and Flores, then suggesting how Dooyeweerd could overcome some of those problems while retaining the original philosophical basis, and third suggesting how the framework could be grounded on Dooyeweerd directly.

4.7 CONCLUSION

Winograd [2006:73] says "The field of interaction design is in its infancy and we are still struggling with finding the appropriate foundational questions and concerns for new kinds of interactions." In his short article, it is clear that he is looking beyond HCI. The framework for understanding human use of computers (HUC) has raised a number of foundational questions and concerns, and suggested some new directions for research. Here the process by

which the framework was developed is reviewed and the framework itself is summarised.

The starting question was with what attitude we should approach HUC. The decision was made to seek to understand everyday use of computers, rather than limited aspects thereof. So a few cases were examined, including one of which the analyst (this author) had intimate everyday knowledge. This led to:

Use of computers is multi-aspectual human functioning, which may be examined by aspectual analyses of various kinds. The social aspects are particularly important.

This analysis revealed several different types of thing in each aspect, which led to distinguishing several multi-aspectual functionings. We then sought philosophical grounds for the difference, by examining their qualifying aspects:

Overall use is constituted of several multi-aspectual functionings, enkaptically bound with each other:
    # HCI (qualified by the lingual aspect),
    # ERC (qualified by any aspect, but which is related to general purpose of IS) and
    # HLC (qualified by any aspect related to the type of use to which the user puts it).

This put us in a position to seek deeper understanding of each. First the structure of each was examined, especially the relationship between human beings and the IS, and the normativity that governs each. This yielded:

Structure of HCI: May be understood in terms of law-subject-object and Gegenstand relations
  Structure of ERC: May be understood as the lingual aspect reaching out to all spheres of meaning of the domain
  Structure of HLC: May be understood as aspectual repercussion, with unexpected impacts analysable by reference to transcendental cosmic law, and aspectual crossover leading to indirect impacts.

Normativity of HCI: Usability as multi-aspectual normativity
  Normativity of ERC: What is represented should do justice to the domain meaning, whether virtual or modelled
  Normativity of HLC: Bring shalom to human living: the IS should enhance HLC in various aspects and harm it in none.

THree practical devices were briefly described: aspectual analysis, aspectual checklists and aspectual tree.

The benefits of this framework is that it not only enables but encourages us to address a wide range of issues sensitively and in new ways. Yet it also provides the means to examine each in depth, fully aware of all the other issues. So this framework will help form more useful guidelines to get the best out of IS, and will reduce the

detrimental impact of unexpected repercussions of IS use. It is an ethical framework because it provides a broader understanding of what is to be sought or avoided. It is holistic because it provides a means to see the points of contact and conflict between areas. Some links were made to other areas, ensuring coherence with them. This framework does not necessarily replace others, but can critique, underpin and enrich them.

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