

Humanware Process Improvement - institutionalising the principles of user centred design

**Ian McClelland, Tedde v Gelderen,
& Bronwen Taylor** Philips Design
PO Box 218, 5600 MD, Eindhoven, Netherlands
+31-40-2733311
HPI@design.corp.philips.com
<http://www.philips.com>

Ashok Gupta, Philips Research Labs
Cross Oak Lane, Redhill, Surrey, UK
gupta@prl.research.philips.com

Bill Hefley
Social and Decision Sciences &
Human-Computer Interaction Institute
Carnegie Mellon University
Pittsburgh, PA 15213-3890 USA
+1-412-268-3238
hefley@andrew.cmu.edu

ABSTRACT.

At Philips Electronics N.V. a programme known as Humanware Process Improvement (HPI) has been set up to bring about a stronger user focus in product creation processes around the company. An HPI model of an “ideal” User Centred Design process has been developed and assessments are being carried out in development centres around the world. The purpose of this paper is to outline the HPI programme, to introduce the model and to report some of the lessons from the implementation of the assessment programme.

KEYWORDS

User centred design, process improvement, usability engineering, process assessment.

THE HPI PROGRAMME

Background to HPI

A recent industry workshop [14] identified two interdependent themes: (1) a general drive in industry to manage quality and development processes in rigorous ways, and (2) the extent to which customer satisfaction is becoming a key success factor. The Philips Humanware Process Improvement efforts are focused on increasing the user focus in the Product Creation Process so that Philips can “reliably produce products (meaning products, systems, or services) which satisfy the users in all of the ways that are important to them.” [9].

Humanware is a term used in Philips to describe a product which satisfies the user in all the ways important to them. The focus is on the total experience of product use, from first encounter to disposal. It goes beyond usability (which it includes), covering the aesthetic, emotional and cultural significance of the product for the user.

Humanware Process is the process needed to be able to identify and deliver products with Humanware qualities,

The Humanware process must be an integral part of the Product Creation Process (PCP) to ensure that products are accurately targeted to meet the needs and expectations of their users.

Humanware Process Improvement is a programme introducing the set of activities needed to enable businesses to improve their PCPs by strengthening the user and customer focus. These practices embody a set of principles focused on accomplishing necessary Humanware processes. These principles can be used to guide organizational activities, as a basis for assessing current practice, and as a means of integrating improvement of Humanware processes with other ongoing process improvement activities.

Philips, like all electronics companies, is facing the challenges of converging technologies. The growth of digital, networked technologies generates different commercial horizons, with different partners and market players. Radically new combinations of functions in products change the type of users, their expectations and the context in which they use our products. Thus the motivation to renew product creation processes (PCPs) and, in particular, to redefine how a business such as Philips needs to handle ‘user interface design’ and ‘quality in use’ is great.

Another important design consideration for consumer products is the need to appeal on sight to customers, (direct customers for Philips being the dealers and retailers) and to consumers buying products in shops. Shelf appeal is of prime importance in selling the product to consumers. It is only later, when the product is in use, that traditional usability issues become important for the user, who may not be the same person as the consumer. This extends the range of the qualities we design to, adding social/cultural dimensions, pleasure of ownership and use, status, fun,

enjoyment, and engagement with the product to the traditional usability concerns [11]. It also extends the number of target groups products have to appeal to, including customers, ie dealers and retailers, consumers and end users.

Philips comprises a number of Product Divisions, dealing with a very wide range of products, from car headlamps to electronic component mounting machines, from shavers to magnetic resonance imaging machines. Naturally there are a number of different Product Creation Processes in the Product Divisions, to produce such a varied range of products.

The HPI programme was developed to fit into this wide range of contexts. It is characterised as follows:

- HPI is generic, covering software and hardware aspects of products for customers ranging from consumer to professional and industrial,
- HPI is a systematic approach to the implementation of user centred design practices based on assessing current design practices.
- HPI aims to initiate improvements to daily design practice, not just assess current practice,
- HPI targets the design practices essential to the satisfactory management of 'quality of use' both in itself and in relation to the total design decision process. The target is not to refine design practices in relation to only software technology.
- HPI goes beyond usability. It is concerned with all aspects of product quality relating to user and customer satisfaction.
- HPI is designed to establish repeatable practices which can then be managed and improved as an integrated part of the overall product creation process. Philips also has two other improvement programmes currently running which both incorporate maturity levels; Software Process Improvement, and Product Creation Process improvement. It is anticipated that HPI will eventually be built into a comprehensive Product Creation Process maturity model.

Benefits of HPI

We claim that the business can benefit in three areas:

- higher quality products
 - better targeted on users and their needs
 - higher quality in terms of usability, aesthetic, emotional and cultural appeal
 - reduced risk of poor design solutions reaching the market
- more efficient and effective process
 - better targeting on users allows
 - more effective use of scarce resources
 - improved focus and quality of specifications
 - early identification of design problems results in
 - cheaper correction of defects upstream
 - reduced rate of product returns and risk of recalls
 - improved communication within UI teams.

- the organisation
 - increased knowledge and skill of UI team members
 - more manageable planned process
 - improved resource planning
 - opportunity for process improvement
 - improved company image

The HPI model

In common with similar process improvement programmes, HPI has a model of an "ideal" User Centred Design process. The principles incorporated into this model will surprise no one familiar with the generally agreed user centred design practices advocated by many practitioners over the years. The practices and principles set out in the HPI model are summarised in the table.

Each of the items shown in the model has been described in detail according to a framework of headings:

- The goal, describing in one or two sentences the essence of the practice,
- What it is, describing in general terms what will be done
- Who should be involved? outlining the roles involved and how they contribute to the practice,
- Links to other parts of the PCP
- Measures of Implementation listing what will happen in an organisation where this practice is carried out.

HPI assessments

The HPI model is supported by an assessment questionnaire, used to identify what needs to be improved in specific product creation teams. An assessment examines current working practices in the team, based on recent project experience and compares them with the HPI model. In any business some of the practices described in the model will be in place, but it is probable that there is not a perfect process, incapable of improvement, in any of the product divisions.

HPI is aimed at the people who are responsible for the definition and development of the products placed in the market. This usually means product managers, developers, designers, human factors specialists, and others who play a role in designing and developing user interface solutions.

The assessment is carried out in a group discussion with the members of a particular UI team., structured around the HPI assessment questionnaire. The objective of each assessment is to reach consensus within the UI team on the most important areas for improvement, and the key actions that need to be taken as follow up.

Improvement actions are self determined, not prescribed. The issues identified are stimulated by the HPI model and assessment questionnaire, but the priorities are set by the group themselves.

Humanware Process Improvement Model		
<p>1 Humanware areas in the PCP. To ensure appropriate work practices are incorporated into the host PCP.</p>	<p>2 Humanware relating to the external world. To ensure that the business can anticipate what is required by users and customers</p>	<p>3 Management of Humanware in the PCP. To ensure that the practices in parts 1 and 2 are supported and integrated into the PCP.</p>
<p>An iterative cycle of three activities:</p> <p>1.1 Understanding Use UI design teams develop a shared understanding of how the product is expected to be used in practice based on information from user studies and/or market research.</p> <p>1.2 Creation and Simulation Representations of design solutions are created to make the proposed solutions tangible.</p> <p>1.3 Humanware Evaluation Design solutions are evaluated against Humanware criteria, with appropriate user involvement, to ensure that they will satisfy users.</p> <hr/> <p>recorded in two documents:</p> <p>1.4 User Centred User Requirements Specification Records information about the users, their tasks, the context of use, and Humanware goals and ‘quality in use’ criteria upon which designs are based.</p> <p>1.5 User Interface Specification Usually a combination of document and simulation, describes the User Interface in a form that enables developers to implement the design.</p> <hr/> <p>followed by verification:</p> <p>1.6 Humanware Quality Acceptance Evaluation to ensure that the design meets the agreed requirements before release for production and sale.</p>	<p>2.1 Humanware in market intelligence End-user and customer information relating to Humanware issues is gathered to guide the planning and creation of future products.</p> <hr/> <p>2.2 Humanware in market feedback End-user and customer feedback is gathered from products in use to identify strengths and weaknesses of current products.</p> <hr/> <p>2.3 Humanware in product strategy and planning Product Strategy and Planning draw on reliable information about product users and customers when making product planning decisions.</p> <hr/>	<p>3.1 Humanware responsibility Responsibility for Humanware is clearly allocated in relation to policy, product development programmes, and individual projects.</p> <hr/> <p>3.2 Humanware Project Management Humanware activities are resourced and scheduled in a Humanware project plan, which is integrated with the overall project plan.</p> <hr/> <p>3.3 Humanware Communications Internal communication is promoted to ensure that the Humanware policy in the organisation is implemented effectively.</p> <hr/> <p>3.4 Integration of Humanware into the PCP Existing procedures, eg Quality Assurance, Change Control, are extended to include Humanware activities ensuring that they are carried out as an integral part of the PCP.</p>

HPI AND OTHER PROCESS IMPROVEMENT PROGRAMMES

Many of today's state-of-the-practice software engineering organizations are assessing the maturity of the processes they use and are putting into place various forms of continuous process improvement activities to plan and carry out improvements to their existing software development processes (often referred to as total quality management (TQM) or software process improvement (SPI)) [3,7,8,10,15]. Many of these organizations are using the Capability Maturity ModelSM for Software [15] to provide guidance for these improvement efforts.

Humanware processes are seldom integrated with these software engineering processes [2]. In 1994, Hefley et al. reported that few ongoing process improvement efforts include state of the practice in HCI design in the processes being improved [5]. For example there is now a proposal to include Usability engineering in the Capability Maturity Model for Software [15] but only as part of a single key practice in its Software Product Engineering Key Process Area. Therefore, there will be a continuing need for HPI practices to complement SPI activities by integrating User Centred Design principles into the software product creation processes.

Other commercial efforts to improve processes from a 'quality in use' point of view includes the Usability Management Maturity Model [4], the BAeSEMA Total System Maturity effort [16], the Trillium Model [1], and the EC INUSE Usability Maturity Model [13]. Models such as the INUSE model could become part of emerging, accepted international standards, so that companies would be required to have defined Humanware processes. HPI provides an evolutionary step for organizations to begin to move in these directions.

But these examples do not represent widespread practice as yet. A recent study explored a number of issues surrounding established processes in development organizations [6]. This study was conducted in collaboration with ACM Interactions magazine and the HPI team as follow up to a CHI'96 workshop [4]. The spectrum of respondents to this survey covered a wide variety of industry segments. Preliminary analysis of the results indicates that while 70% of organizations reported using a process for managing product quality in their organization (software development process, product development process, product/service creation process, etc.), only 32% of organizations explicitly addressed usability/ease of use as an integral part of their process.

THE HPI PROGRAMME IN ACTION

A programme of HPI assessments has been carried out in consumer electronics business areas covering:

- traditional and networked television systems

SM Capability Maturity Model and CMM are service marks of Carnegie Mellon University

- personal audio products
- video cassette and disc players

The projects selected as a basis for the HPI assessments were all operational product development projects where the user interface was a key part of the products being developed.

The functions represented in the assessments included:

- product management
- engineering development; software and electro-mechanical
- human factors
- interaction design
- product design
- market intelligence
- quality assurance

The outcome

In recent years UI design and development work has grown substantially and a lot of excellent UI design work is being implemented. However in process terms the host PCPs are *immature* so far as integrating 'quality of use' aspects (user, usage, usability and enjoyment) into UI design.

Indicators of *immature* processes are that projects tend to be planned in an ad hoc way and there is a heavy dependency on individual skill and expertise [10]. User-centred Design practices are not built into formal descriptions and therefore they can easily be put to one side if a manager has no interest or sees no relevance in using them.

Indicators of a managed, maturing process include: clear descriptions of the key practices that make up a coherent process, accessible evidence that the key practices are carried out. Mature processes are proactively managed

The participating UI teams recognised that UI design and development needs to be more clearly defined to ensure that a managed coherent UI process which can be repeated in a disciplined way is established.

The main issues

A number of common issues were identified by the UI teams as a direct consequence of the assessments. These are summarised below. Our comments, for confidentiality reasons, are necessarily general. In each case specific improvement actions are running.

Many of the issues raised in the assessments concerned management of the processes. This mirrors the experience of the Software Engineering Institute with SW-CMM, which deliberately deals with management issues at level two in order to be able to implement what are called engineering practices once the framework of process

management is established. Examples of concerns raised are:

- Responsibility for the UI issue
As systems grow in complexity and, as a consequence, the complexity of the teams that have to build them increases, better definitions of responsibilities at a project level are required.
- UI design and development planning
A more disciplined approach to integrating UI design project plans into total product development plans is needed. Key to this is that UI teams work to a common project documentation system.

There were also issues raised about the day to day working practices described in sections 1 and 2 of the model. In some cases the groups involved are taking actions themselves, and in others, like the improvement of documentation, actions are being taken across the Product Division. Examples of the concerns raised were:

- Relevant 'quality in use' criteria.
The qualities that consumer electronics products must meet go beyond traditional usability issues. New tools are required that enable UI design teams to identify the relevant criteria and reliable methods to assess quality in use.
- PCP Documentation
The need for key Humanware documents to be defined more precisely to improve the efficiency in implementing the specifications, promote greater reuse of work and improve the sharing of information between different business groups, was widely recognised. (The need for improved documentation was also a major discussion point at the DIS 97 conference in Amsterdam.
- Prototyping capability.
Two issues were of main concern. Developing prototyping techniques for new types of UI technologies that are not easily represented using graphical representations. Developing the role of simulation/prototyping technology in relation to managing the UI process.

The assessment experience

A key result was increased collective awareness of why a Humanware process is needed, what it can deliver, what it involves, who needs to be involved, etc. What we see in Philips today are wide differences in experience and knowledge about how user issues are handled in the product creation process. The HPI Assessment is designed to help develop a common framework for defining how Humanware practices can be best incorporated into the product creation process. The assessment session develops a common vocabulary, making it easier to discuss Humanware issues.

The assessments proved to be positive and constructive sessions. Participants typically remarked that this was the first time they had ever sat together and discussed UI design as one coherent process and that it had helped

them to understand the relations between the different activities better.

"An HPI Assessment is like holding up a mirror to oneself; what one sees is not always nice, but that's life!"
- Piet Coelewij, Philips TV

The initial expectations of participants were often not positive. Among many competing demands on the time and attention of product developers, process improvement always appears to be abstract and unattractive. The discussion itself removed the worries over irrelevance and abstraction.

"Initially, Humanware seemed abstract and yet another process improvement exercise! Now, after the assessment, it looks really very good and very useful. This is a tribute to your work!" -
Noriko Namba, Philips Audio

CONCLUSIONS

The assessments have shown that we have a workable assessment procedure which delivers practical benefit and helps UI teams and their managements to identify improvement actions. The experience of implementing the assessment programme also confirms a number of general points about implementing process improvement.

A process change takes time to become established. The process must be seen to work in order for it to gain acceptance throughout the organisation. Also incremental changes are more likely to succeed; this year's changes build on the work of the previous year.

As improvements take time and resources, and since many of the early issues raised concern management practices and structures, it is also vitally important to have the full and committed support of management.

Perhaps the biggest hurdles are at the beginning, convincing people that they need to improve their Humanware process. As the participants said, the assessment is the first opportunity they had to focus on Humanware processes, so that the first exercise brings about a great increase in awareness.

Once it is underway an improvement programme should fuel itself by delivering benefits. Realistically, when developers face so many competing demands on time and resources to deal with ever increasing competition and the rapid rate of technological innovation, there will always be a need for encouragement to focus on user centred design.

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