

Report on a Panel Discussion on Human-Centred Process Improvement at Software Process Improvement '96

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Abstract

In 1996 representatives of the Human Computer Interaction community organised a discussion at the conference Software Process Improvement '96. This discussion explored the benefits of and approaches to the improvement of the human centred (HC) parts of system development.

The panel used a number of case studies to describe the HC approach to systems development and usability engineering activities and provides a forum for discussion on how HC process improvement and software process improvement can be combined to improve the quality of software-based systems.

The session was run in the usual fashion, starting with an introduction to the topic followed by brief presentations from each panellist opening out into a managed discussion. The discussion covered the system aspects of Human Factors, involvement of users, the impact of HC processes on other processes, the nature of HC processes and how HC processes could assist with requirements. The paper concludes that there is benefit in an exchange of experience between the Human Factors and Software Process Improvement communities.

The paper follows the order and form of the panel session.

Software Process Improvement '96

This conference was held in Brighton on the third to the fifth of December 1996. The primary theme of the conference was how software process improvement impacts on business goals and performance, and on software product quality and user satisfaction. The conference was twinned with three other software process-related conferences and all three were attended by more than 200 quality managers, consultants and staff concerned with process improvement from all over the world.

Why a session on HCI at as SPI conference?

A recent survey of European IT developers (Maguire and Graham, 1996) suggests that concern over user issues is widespread. 91% of respondents felt that user and organisational issues are important and 58% felt that they did not address these issues properly.

Another study (Hefley, yet-to-be-published results from the ACM interactions survey) indicates that while 70% of organizations use a process for managing product quality, only 32% explicitly addressed usability as an integral part. Thus, 68% of the organizations either do not follow a process for managing quality or do not address usability as an integral part. Of the organizations surveyed, only 11% *always* integrate their process with their overall product creation process. Only 36% of the organizations surveyed follow a defined process that explicitly addresses usability/ease of use as an integral part of this process.

The theme of the conference was the relationship between software process improvement and product quality, customer satisfaction, business goals and business performance. Given the increasing recognition of quality in use of software-based systems as the key to product success when considering the total customer experience the panelists argued (successfully) that HCI was of considerable interest to the conference because quality in use makes a significant contribution to total product quality, is paramount in customer satisfaction and improves business performance of both the producer and the client organisations. Quality in use is in some shape or form already a stated business goal of many software developers. The ISO 9241 Part 11 definition of usability is *'The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction'*. The standard goes on to define effectiveness, efficiency, user satisfaction and context of use. It provides a means to define and measure usability or **quality in use** as a product attribute.

The authors proposed that methods for achieving quality in use and designing the total customer experience are not the exclusive purview of software process improvement. A family of processes concerned with developing products and systems which meet user requirements exist in the discipline of Human Factors. The panel described human centred processes to the conference, how they can be assessed and how they can be related to software process improvement.

Introduction

Software Process Improvement is becoming mature. The primary challenge of providing tools for bringing software development under control and making it dependable has been met. Now it is time to look at the (so-called) second-tier issues, such as the processes required to improve the quality in use of the product being developed. Trillium contains a usability engineering road map and a change request has been made for CMM-2 to address usability processes. IBM (1992) allocates the contribution to usability between system components as follows:

- 60% object model: properties, behaviours, common metaphors
- 30% interaction techniques, device mappings, standard menus
- 10% visual representation and aesthetics

This immediately tells us that look and feel is the least of the problem, although it is the most visible. The object/concept design is on the other hand the least well

considered and explicated, the source of biggest problems, and the most difficult to fix. The ratios suggest the best distribution of design effort and decisions for a cost-effective, usable system.

The authors believe that the assumption behind in the software industry's current improvements in usability engineering practice is that integrating HCI, human factors, usability, etc. into software engineering implies enhancing software engineering by extending the repertoire of software engineering methods to include HCI methods. As a usability design solution, this corresponds to a restricted view of usability, which is concerned with the ease of use of the specified function. Under this approach usability engineering is concerned with accepting or identifying the user interactions associated with specified function and providing user interfaces to support those interactions. The major problem with this approach is that a software product design is presumed and the HCI design problem is to make it usable. User Centred Design (UCD) methods can be applied under this approach, and could well result in a better solution than might be derived in the absence of UCD methods. In this context, UCD methods are concerned with ensuring that the user interfaces to be provided are optimised from users' points of view. From a general human factors perspective, however, we would claim that this whole approach to usability design is inherently limited, and that all usability solutions derived by this approach are likely to be sub-optimal.

Problems deriving from the restricted approach to usability are avoided by taking an extended view of usability which subsumes utility (utility being the functions to be provided to the user). This is because the functions provided to support user tasks contribute about 60% of the ease of use whereas the specific design of user interfaces contributes only 10%. Activities concerning the identification and specification of such functions from the end user's point of view should therefore be part of the design process. Adopting an extended view of usability implies a substantial, if not radical, change in the role of HCI/Usability engineering in the design of software-based products. Under this approach, specification of function cannot be considered to be simply a software engineering activity and must be based on considerations relating to disciplines quite different from those on which software engineering is based.

Under this broader view process improvement moves away from the current capability modelling approaches which focus on the developer's concerns with the process and turns towards a focus on the users' concerns about the product that they are to use. The question is how software process improvement should take account of this broader view. The goals of having a HCPI panel session at SPI 96 were as follows:

- to inform the conference about human centred issues and the benefits of a human centred process in a range of industries,
- to inform participants on the scope and methods for human centred process improvement in a range of industrial sectors,

- to describe the changes to software process improvement methods when they are applied in human centred process improvement,
- to facilitate a discussion of all of the above focused on how HCPI and SPI should best be integrated, or at least related.

The following sections describe the panel for those in the SPI community who were not able to attend the conference. The panelists are described and their position statements are presented with minor changes to reflect the requests for clarification and presentation graphics. The discussion session is also reported. Conclusions and, since time ran out before we discussed the last item on the above list, suggestions are also made for further collaboration between the HCI and SPI communities.

The Panel and their Presentations

The members of the panel have many years of experience in the integration of Human Factors into organisations. The members represent a broad range of industrial sectors: consumer electronics, large operating systems, bespoke military systems and public sector software. Their use of process improvement and maturity modelling covers organisational self improvement, management of subcontracts and validation of skills transfer. The individual presentations will explore the reasons for improving human centred processes in this range of market sectors and outline the methods which are being used to address their goals.

The Current Work of the Panel

Simon Hakiel, IBM, Hursley, UK. IBM is currently implementing a corporation wide Integrated Product Development process which includes explicit User Centred Design (UCD) activities. IPD has a customer-oriented process, which is marketing driven, and which is concerned with identifying what a product is required to do in terms of function and performance, and a specifically user-oriented UCD process, which is concerned with determining how the required capability is to be realised. The UCD process is not just old usability in a new guise, it is a multidisciplinary team approach to the design and assessment of all aspects of a product with which users come into contact, with explicit user participation in assessment at all stages of design. IBM's implementation of UCD is an outside-in approach to product development. The initial focus is on the design of all the aspects of the product that users see and touch, and code development begins only after the high level design of all the externals has been validated by users.

Ashok Gupta, Philips Research, Redhill, UK. Philips are improving the quality of the creation processes of the software and hardware of products and services from shavers to telecommunications systems. One key aspect is Humanware Process Improvement (HPI). End users have different concerns to system developers. End users want quality in use and are not very interested in how the development process of a product was managed. In order to achieve quality in use a

manufacturer has to look at who users are, how they work and play. Inspired by the CMM Philips has defined key Human Centred activities which address the issues which are important to end users.

Anna Giannetti, SOGEI SpA, Rome. SOGEI SpA is developing its own approach to modelling Software Usability as an improvement of its proprietary software methodology DAFNE (DATA and Function Networking) and its Quality Control and Assurance Procedures. The objectives are those of improving the usability of both high-level and low-level design, by means of user-centred prototyping cycles and the usability of the end products and services by means of precise quality control measurements and system testing. The model which is being developed is part of the European MAPI (MUSIC Assisted Process Improvement) project which aims at introducing and verifying MUSIC methods and tools, by integrating those methods and tools in a real industrial endeavour. SOGEI SpA is also active in other Process Improvement Initiatives at Italian Level and is member of the European Software Institute, involved in the Learning Organisations project.

Brian Sherwood-Jones, BAeSEMA, Glasgow, UK. BAeSEMA has developed a metric to assess maturity of processes relating to usability and safety in use. The metric is currently being used for in-house benchmarking and process improvement, but the primary aim is as part of tender assessment for the supply of software-intensive safety-related systems to BAeSEMA acting as prime contractor. The model is generally of the CMM form, but with some tailoring.

Jonathan Earthy, Lloyd's Register, Croydon, UK. Lloyd's Register has developed a usability process maturity model and assessment method to assess capability with particular usability methods and gain an overview of organisational maturity with respect to usability. The model is being tested on the European INUSE project as part of a usability technology transfer initiative. Human-Centred process capability assessment fits into a range of capability assessment services offered by LR.

Position statements by the panel

Survey of audience:

The audience was surveyed at the beginning of the session. The audience for the panel (one of four parallel sessions) was 25, around 10% of the conference registration. All attendees felt that Usability and Human Factors are important. However, none of the attendees knew the contribution which each component of a system makes to usability, only one collected usability defect reports, one had defined human-centred processes and one knew the ISO definition of usability. This indicates that there is great potential for technology transfer between the Human Factors and Software Process Improvement communities.

Discussion session

The discussion was planned as an exploration of the relationship and common ground between human centred process improvement and software process improvement and an outline of how the two should interact to better achieve the conference goals. The main topics were expected to be:

- the risks and costs of achieving real usability,
- what it means for an organisation to be human centred,
- differences between the treatment of end-user issues in organisations,
- usability and the value chain,
- control of projects orientated towards meeting user task requirements,
- assessment of human centred activities.

In fact questions were more requests for information and clarification. This, and the surveys reported at the beginning of this document, indicate that considerable preliminary information exchange is required in order to establish usability process improvement as a routine part of software process improvement.

Comments from the floor

A Defence contractor from Canada repeated the point made by panelists Ashok Gupta and Simon Hakiel, that usability is not the responsibility of Software Engineering but of System Engineering. One other Defence contractor in the audience had also made this split in his development processes. However, the sense and benefits of a split between human-centred/usability and software engineering processes do not let IT **system** developers off the hook. In most cases, especially in MIS and data-related applications, the software **is** the system and software developers should integrate with and will probably have management responsibility for the human-centered process. It should also be noted that both organisations which separates usability from software processes were in the Defence sector which is often ahead of other sectors with the systems/human factors perspective.

Questions from the floor

How do you involve users/how do you get feedback? For effective involvement of users there are a number of things to get right. This includes:

- Involve users, and that means end-users, from the start of the project, even at the tender preparation stage, the human-centred process starts with the identification of a need for task support.
- Gain user commitment to involvement in development, this may require allocation of funds for attendance at trials, focus groups, secondment to advisory panels extended site visits, selection of user representatives etc.

- Take user feedback as data **not** information, certainly don't follow stated end-user requirements without due understanding and interpretation. Elicit and take feedback in context, assess it against general principles of software ergonomics, take account of the level of technical awareness of users, model and analyse the proposed interactions.
- Take sufficiently large samples to get adequate depth and breadth of user feedback.

What is the impact of a usability process on other processes? Human-centred processes provide better defined user and organisational requirements, design support, usability testing procedures and post-delivery feedback. To reduce the impact concentrate effort on the exchange of information between existing practices and usability processes. Human-centred practices are always carried out in some shape or form before or after delivery. Human-centered process improvement can make these processes explicit so that existing practice in relationship to usability can be understood. The more formal the process the more explicit and visible the impact of “usability processes” on the overall process.

Have human-centred processes a formal underpinning equivalent to engineering? Usability is not “engineering” but that shouldn't mean “don't do it”. User-centred design is a soft science and we need not apologise for this fact. Human-centred processes expand the scope of systems development and require broader skills. There are terminologies, methodologies and documentation formalities imposed by the base disciplines which include ergonomics, psychology, graphic design, interaction design and anthropology, but user input itself is not formal. Activities such as requirements generation, decision-centred design, participative development, formative evaluation etc. all require skills in working with people both on their own and in groups. Avoidance of bias and influence, interview and facilitation skills, balanced reporting, reconciling and using statistical, case study and generic data, test design are the type of skills used.

The “requirements problem”. This issue was not discussed in the panel session but was a theme of the conference. Several papers and discussions pointed out that between 50 and 90% of the problems with system development arose from incorrect or creeping requirements. Since user and organisational requirements are the most difficult to elicit and specify it follows that human-centred processes, which are specifically intended to assist in this area, are a significant or even total solution to system/software development problems in this area.

Conclusions

There will be considerable benefit in an exchange of methods and experience between the Human Factors and the Software Process Improvement communities. Human Factors offers assistance with the requirements problem and allows the design and organisational integration of workable software improvement processes.

SPI can formalise and integrate HF into system development. Both developers and end-users stand to win. As the hardware bottleneck is being controlled it is fast being overtaken by the software bottleneck. Additionally, as the functionality of both consumer and professional products is increasingly implemented in software, it becomes ever more imperative to couple SPI with user-centred design.

It is hoped that the panel session and this report will lead to further interaction between the communities and that SPI conferences will continue to include sessions and papers on human centred process improvements. It is up to the HF community to offer the same facilities to the SPI community.

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