The Lifecycle of Egalitarian Input for an Enterprise Portal

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Abstract. In this paper, a participatory design (PD) lifecycle and resulting HCI techniques are woven together and illustrated as they were used for a global enterprise portal. An argument is made that a PD lifecycle can be created and extended with multiple inputs during a software engineering lifecycle by contextual design processes, card-sorting and surveys that generate artifacts and gates for the CARD process. Additionally, the lifecycle can aid HCI practitioners in developing usable information architectures based upon knowledge gathered from workers in an iterative, egalitarian process.

1. INTRODUCTION

The roots of participatory design (hereafter PD) come from a strong need within the computer science industry to comprehend, in a democratically-based process, the needs of workers outside the political mechanisms of organizational and monetary determinants. The inspiration for such a movement within the HCI community arose from trade unions in Scandinavia where workers wanted to influence the design process of the technology they used. [1] Throughout the 1990s, PD became a term that classified a process (CARD and PICTIVE) by which design decisions could be considered and informed democratically within an organization.[8] Today, PD enjoys a large following of practitioners within the HCI community, both in Scandinavia and throughout the world. The value PD brings to the design process is one that combines social and functional findings in the design of software.

For the purposes of this research work, PD techniques were used in combinatory ways in order to 1) understand the levels needed between individual and collective action within a work environment and 2) how researchers can apply PD techniques throughout a software engineering process in order to inform their findings and gate political (self or other) findings within the design process. This paper illustrates a case study for Siemens Global Enterprise Portal that shows HCI methods deployed along with the outcomes and input that influenced a PD lifecycle.

2. Types of PD methods

Below PD methods are discussed that were used in novel combinations within the lifecycle in order to validate design decisions.

2.1 CARD-sessions

CARD is an influential PD technique developed by Tudor in 1992 and refined in practice in 1993. [10]

The CARD technique is a game-like procedure through which a diverse group can lay out, design, or critique a task flow or activity flow. The materials in the CARD technique are physical playing cards, each of which represents a work activity, an object in the workplace, a person, an interpersonal activity, or a mental operation or state.[8]

The information in the CARD session is gathered by question and answer by different members of the group as to what types of work they do, the way they do it and who they may interact with or what they may interact with during the course of their workday. Some of the problems that result from these types of sessions range from “inhibition,” due to political hierarchy (your boss sitting next to), to the inability to consciously recount what one does do (tacit knowledge).

2.1.1 Pros and Cons of CARD

During and after all the inputs have been collected (usually as cards on paper or posters) from the CARD process and recorded, an assessment takes place in which members of the participatory assessment team prioritize the findings.[8]

The strength of CARD, as with most PD practices, is that the empowered voices of workers are recorded and ordered and *heard*, then are funneled up through the layers of management in order to influence decisions and requirements for the next levels of technology innovation. This information becomes a tangible artifact to the design of the system. For management, the benefit of PD is in the exposition of new ideas that were not conceivable before the input from CARD sessions. As a tool, it becomes both a channel for workers’ input and an organizational system for artifacts to the design process. It is therefore politically deconstructive in its nature, but also yields tangible design artifacts for the development of systems that should easily map to user acceptance and future usability requirements.

The cons of CARD are that within its process the balance between initial inputs may simply be based upon activity levels of workers as they verbally recant them to the team. Or, inputs for the session used as CARD stimuli may be focused on specifically management-driven functionality (the financial reasons for building the technology), and not on the observation of tacit work practices. Therefore within the egalitarian lifecycle illustrated in this paper, contextual enquiry or ethnographic research must be done *before* the CARD sessions. Additionally, contextual information must be observed in order to understand a true prioritization of requirements at the end of CARD sessions. By adding and cross-referencing contextual findings with workers and initial requirements from management, a cross-referencing of session stimuli can take place.

2.2 Card Sorting

The CARD process is similar to card sorting [9]. Card sorting is a process that was invented during the 1890's by Herman Hollerith, an employee of the U.S. Census Bureau in order to group massive amounts of information. Cognitive science adopted a form of this method in order to understand more clearly how people organized mental models of information. HCI practitioners use the main concepts of card sorting in order to allow users to group information into categories.

In card sorting, individuals are presented with cards with labels and asked to sort these cards into categories or groups (similar or grouped or dissimilar, regrouped). This type of research leads to varied and interesting examples of mental models and, in a technique similar to CARD, allows the worker to become a co-designer, evaluator and arranger of content through the shuffling and arrangement of cards. The results often are clusters and groups of information as seen by the worker, thereby giving the researcher a clearer understanding of the topology and affinities within categories of information and nomenclature.

The differences between CARD techniques and card sorting are that in card sorting, labels are predetermined and fixed on the cards that the worker shuffles and orders, but with CARD

the cards are annotated by the worker and PD group, and information is added or changed on the card in accordance with the dynamic interchange of information within the PD session. This makes the CARD sessions more flexible in the gathering and refining of task-related information.

2.2.1 Card Sorting Pros and Cons

Alone, card sorting does not equal the rich and varied information that can be gathered during ethnographic research or from CARD sessions, because it does not gather the data necessary to inform scenario development and tacit task evaluation. Additionally, card sorting is usually performed one-on-one, with very little interaction between other individuals.

Within the PD lifecycle proposed in this paper, the outputs are helpful in defining hierarchical topologies and understanding the mental models of workers. By understanding these mental models, information architecture development as well as content structuring can be seen as natural outcomes from the sessions. Usually, information architecture is *imposed* on the content in order to sort it into categories with little understanding of the mental model of the worker. Additionally, to strengthen and cross-reference these findings card-sorting data can be influenced by survey results and ethnographic findings.

2.3 Contextual Design Research

Contextual research and ethnography seeks to gather information in context by "shadowing" the worker and recording information as the specified timeframe elapses. [12] The environment is as important to the ethnographic researcher as is the collection of interactions from the subject. Artifacts and notes are created as investigation progresses in order to help understand the task-flow and steps a worker may take in proceeding through ordered and arbitrary tasks during the timeframe. [7]

2.3.1 Pros and Cons of Contextual Design/Ethnographic Research

The power of ethnographic research lies in its ability to help designers observe information in context, in one-on-one situations with workers, in order to understand a task more fully. [7]

Outputs from the ethnographic process can easily be used as tangible representations of workers to executive and engineering teams early in the cycle. These help to ensure representation until more detailed results (prioritized requirements and wire frames) can be gathered to influence the technology development. The performance of ethnographic and contextual enquiry before CARD sessions aids in the capturing of affinities of tasks, whether completely documented or seen as snippets of activity, in notes or artifacts in order to gain a full picture of the tacit activities of a worker as an observed, rather than as a relayed/recanted/remembered activity. The benefits of this type of research can yield outputs of full scenarios of daily tasks, as well as artifacts that can be automated or spoken about during PD sessions. The other outputs are personas and scenarios that can displayed to the political groups invested in the direction of the technology within the organization.

The cons to ethnographic research within this proposed PD lifecycle is that it does not clearly group content or nomenclature into mental models as input to the macro-level for information architecture decisions hence all of these techniques must be combined.

2.4 Pros and Cons of Surveys

Surveys are tools that can be deployed easily and inexpensively to a large population in order to gather information on its demographic.

Surveys reap little results for understanding the co-design process or activity-based information that all PD activities offer. Therefore, as a tool within the lifecycle, the strength of the survey lies in its ability to accurately deliver information about usage and makeup of the demographic.

2.5 Simple Random Sampling

Simple Random Sampling (hereafter SRS) is a proven mathematical method that was developed in the field of statistics. SRS simply constructs a small number of samples, chosen at random, to statistically represent a whole population. For example, a SRS not only gives each individual an equal chance to be chosen, thus avoiding bias in the choice, but also gives every possible sample an equal chance to be chosen. Random sampling design works because statistically, small groups of samples chosen at random have shown to be relatively accurate in their portrayal of a larger sample.

2.5.1 Pros and Cons

With easily distributable surveying at the HCI practitioner's disposal, SRSs done with large groups of workers allow for the collection of data for each area of the proposed PD lifecycle without a large expense. [5]

3. Case Study

It is reasonable to believe that most PD techniques focus *as an end goal* on the *analysis of the result*. However, this paper introduces the idea that in a PD process, in order to address the *functional needs of workers and interactions of a technology team 1) PD methods must be combined at the right moment within the cycle to inform the iterations the design team must go through and 2) the combination of those methods must address checks and balances within the lifecycle itself.* In order to do so, a lifecycle can be crafted that refers back to workers during each step. Also, the output from the findings can be fashioned into political objects that can carry the agenda of the workers' needs into higher political realms. Finally, by combining different well-established PD techniques, outputs from the egalitarian lifecycle can be used by the design team for decision-making processes and feedback to all phases. Bridging all these gaps is a continuous cycle of decision-making. While this paper does not attempt to map all of these dynamics, it does propose that while there is a *process* and *artifacts* of inputs and outputs, PD processes can help in gating and influencing the next steps for technology design teams. Focusing on worker input during this process can also allow for a built-in balance towards egalitarian technology.

3.1 Understanding the Demographic: Who is the Worker?

For this study, the entire population of Siemens employees was considered to be the worker population and the design goal was to define the high-level information architecture for an employee portal. This is the overall general classification of a population that was presented to the team, one that needed further defining and criteria in order to further explore and classify worker needs.

Initially, we received a 200-page report with user roles within the company as they were classified by a meta-data engineering committee that had defined user via their technical access rights within the organization.

The team determined simple criteria of definition that represented members of this population in order to begin analysis and represent workers' needs immediately into the planning sessions.
These criteria were then used as input for the basis of a large-scale survey (6,000 employees). The initial targeted user group was classified via human resource records based upon title. The survey returned enough information to represent a picture of the high-level content needs of workers within their domain.

The survey was additionally cross-sectioned, as content usage for each worker was derived from data from internal groups of executives, managers, technologists. This aided in creating a survey that was comprehensible to people and derived enough data to understand the preferences of content usage based upon title. This, then, gave an overall understanding of the worker groups within the organization and a general role (persona) could be established and named, aptly, Employee-As-Me. This was a role developed simply to say that all employees within the organization belong to this group, have needs, and have a specified domain, title, and tenure within the company.

The results from this survey, along with the persona (role) established throughout the international work groups (comprised of executives, technicians, HCI professionals, etc. …) created an initial representation of workers which had not been represented in the work groups previously. The ongoing hope of the design team became simply to *represent* workers and an initial HCI lexicon within the global workgroups, thus opening pathways for discussion and consideration.

The original criteria used for the demographic research were high-level and lacked tacit and task-level contextual information. The worker requirements the author noticed at this level revolved around content needs as mapped to title. This became valuable for understanding usage in a general way within the culture but did not adequately address our design needs. In order to work at this level, the design team further developed criteria to comprehend tasks and the specific content needs of workers as input for the CARD sessions.

In order to reassess the statistics of employees within the organization, the Employee-As-Me role could be broken down into further groupings that most represented the population. A SRS from this population allowed for a select number of ethnographic research participants who could represent the overall population.

3.1.1 Conducting the Analysis

Ethnographic/contextual enquiry research was performed over a period of three months in the US and two months in Germany. Targeted users were "shadowed" [12]. Task-flows, artifacts and videotapes of conversations were collected. Task flows were represented in UML and task-flow format and meetings took place in which technologists/engineers were involved in the ethnographic research and addressed what was valuable information from workers. Workers were invited to comment on the individual and the consolidated task-flows. Annotations of conversations, artifacts and affinities of artifacts were collected and grouped with individual task-flows.

3.1.2 Benefits to the Lifecycle

All survey findings on content usage originally derived from the initial level of research was cross-referenced to the ethnographic findings, allowing for an expanded listing of content (later used in card-sorting). This generated a better understanding of content needs from the high-level survey results. Many times nomenclature (labeling) of content came into question based upon internal employee classification versus original content labeling from the survey, but those issues were easier to sort out than a lack of results.

3.1.2.1 Task flows and Tacit Findings

Task-flows were also generated from the research and shown as diagrams, with conversation annotations and artifact footnotes. These diagrams could later be used as individual tasks-flows per worker and as consolidated task-flows of worker groups based upon our persona criteria. Additionally, there were interesting findings, similar to those from CARD sessions, in which individuals expressed their interrelations with other workers in the organization and how they interacted with those workers in task format. Artifacts were saved and diagrammed [7], put into a report and delivered to working committees internationally.

3.1.2.2 Political Implications

These more detailed ethnographic findings (personas, scenarios, task flows) were used within the work groups to reinforce the political presence of workers' needs within the technology development plans. The task-flows and content inventory also could be used for upcoming CARD sessions.

In order to validate and confirm our findings, engineers working on the project were involved in discussions regarding the UML task-flows as they were documented while observing workers in the workplace along with the subject-and-design team. Discussions revolved around evaluation of automation possibilities, level-of-effort, prioritization and initial emotional investment in understanding the tacit process of workers within the organization.

3.1.3 CARD Sessions

Once survey and ethnographic results were generated, they became the artifacts to the CARD sessions. As inputs they served dual purposes: they were input to the members of the group and a starting point to defining the sessions.

The CARD sessions involved multiple SRSs of the worker population. A safe, inviting and participatory atmosphere was engendered from the outset and a JAD structure was used to facilitate and capture data from the sessions. Titles were encouraged to be forgotten, as well as the possible political implications within the organization of any comment. Participants were asked to discuss important scenarios of their work and these were diagrammed and captured on a white board for all members to see. When validation sessions were conducted within the group for the ethnographic findings, activities were printed on colored cards and titles of the workers were omitted from the activities. Each member was asked to annotate or speak aloud their input into the task. For example, with "creating presentations," different members input different subtasks and duties they believed they did alone or shared with other workers. Additionally, members of the session were asked to discuss the intersections between titles and activities and to address issues such as "delivery," "dissemination," etc., all major concerns for the intended employee portal. As with the Muller model, we found that

grouping our findings into categories such as 1) Observable and Formal; 2) Skill & Craft; and 3) Description aided in our analysis of these sessions. [8]

3.1.3.1 Outcomes

Once the results were compiled from each poster and session, we learned that our findings were insufficient in the area of mental models. We could understand roughly the intersection and activities of certain work groups and could classify those activities into categories as used by Muller, but were unable to categorize and order a model of these findings into a high-level mental model of hierarchy. We had a deeper understanding of tasks, the corollaries between activities and different titles within the company, and tacit versus formal activities. In order to more accurately understand the mental models, we would need to perform card-sorting exercises.

3.1.4 Card Sorting

With tasks and personas established through the ethnographic research, findings were minimal as to the classification of mental models and the hierarchy of content for workers.

Over the course of two months, the content labels that would be used for the card-sorting research were discussed in the meta data workgroup based in Germany, the information architecture work group, and the user experience work group. As inputs to the decision-making process were all outputs from the previous research: Survey, Ethnographic Research and CARD sessions. Additionally, data usage logs were generated from operating companies within the United States and Germany, and usage was examined through the lens of clicks and streams. Finally, a list of 50 content labels was generated. Translations between cultures were deliberated upon and a set of card labels brought about by consensus of all working groups.

The design team set out over the course of the next two months to perform card-sorting tests with more groups that were based on representative SRSs of the whole population. The process was simply used to discover the mental models of individual workers and to statistically calculate the most common clusters among groups of workers and workers overall.

3.1.5 Inventing the CARD Remote Test to Confirm the Information Architecture

The outcome from all the tests to this point had yet to generate a comprehensive information architecture framework that could be fully validated; however, screen-level details for separate applications were bountiful, due to the results from contextual research, CARD sessions and interviews. After iterations within the working groups, the design team created a remote card-sorting prototype that could be deployed over the internet in order to begin validating a functional prototype of the information architecture. For this, we developed a combined CARD/card-sorting test. Testing could then be performed remotely and SRSs could be expanded in order to gather feedback from more of the population in Germany and the US.

3.1.5.1 Outcome

The data captured from this testing addressed the following criteria: 1) easily quantifiable as results in order to quickly inform the design team as to the validation of the high-level groupings, and 2) it needed to be formatted as screenshots from the testing that could act as posters and be easily understand and read by the design team. The results from our invention gave us mental model prototypes based on worker roles and their intended content needs and groupings validating earlier findings.

3.1.6 Prototype Testing—PD as Evaluation

As inputs from all phases producing mental models and workers' task-based information, the teams decision-making process for wire frames became an outgrowth of the earlier research rather than separate from it. Screen-level wire frames of the employee portal and their paper prototype testing was the next step in the lifecycle in order to validate whether the findings had truly translated into the blueprints for the technology.

4. Outcome: Effect and Efficiency

Satisfaction surveys given before and after the portal launch show employee satisfaction is 35% higher with this version of an enterprise portal than it had been with individual intranets. Specific activities, such as the filing of an expense report, are 60 to 70% more expedient for executives, 30 to 45% faster for managers with staff, and 10 to 15% higher for managers without staff. This last data was derived from initial capturing of task-completion times during a usability test of individual intranets, and the completion times of the task after this version of the portal was implemented.

Results from a pre-design ISO 9004-4 Customer Satisfaction Test show better results overall with the new design.

5. Discussion

It is not the sole purpose of this PD lifecycle to improve ergonomic or employee satisfaction or efficiency, but it is a very important byproduct of design that seeks to understand needs rather than fulfill political agendas. After technologies have been built, with however many good intentions to include the worker's voice in the lifecycles, there are also effects that technologies bring into the workplace.[3] Those effects can collectively be disadvantageous to certain subgroups of a demographic—disadvantages such as job elimination or under-representation within the design. In a effort to define a full lifecycle of PD involvement, it is the author's concern that the ongoing collection of data within a PD lifecycle may be one of the factors least understood in this lifecycle. More data and criteria that go beyond usability evaluation need to be discovered within a continued PD lifecycle after technologies are built. It also became obvious during the course of this research that certain cost-benefit analyses that promote the automation of worker tasks may not be advantageous to workers. Whenever this situation occurred it was documented and brought up in meetings, but quantifiable results were very difficult to find on the side of the worker when faced with cost benefits. More methods to gauge this would be valuable to a PD lifecycle. The effects to workers over time could yield valuable results if considered during the initial PD lifecycle.

The purpose of PD as originally formulated for trade unions in the 1950s was to address social egalitarianism within the fashioning of technology and to embed workers' inputs into

this process. It must be noted that within the discussed lifecycle, HCI techniques and their incorporation for CARD sessions are mentioned, but a full sociological study *in situ* of the culture of organizations could reap worthwhile results and could add to the initial inputs to a PD lifecycle.

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