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FACILITATING CO-CONSTRUCTION BY SOCIAL PRACTICE DESIGN: A CASE OF GEODISTRIBUTED EMPLOYEES FACING THE DESIGN OF MODEL-BASED ENTERPRISE SYSTEMS

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Abstract

This paper describes the experiences of practicing social practice design (SPD) activities with user groups, in geographically distributed, collaborating manufacturing companies, struggling with the introduction of model based enterprise systems. Within a European project, we observed and routinely analyzed ongoing development and assessment work of model based technologies and methodologies, in these companies. Based on an ethnographic study of Modelling sessions and Validation sessions, we performed an in depth analysis of people semantic and pragmatic perspectives (a necessary and needed 'second step back'), and identified core disconnects on modelling concept use and language, and on motivations and goals, between technology designers – modellers - and domain experts – users - clearly hindering project progress -. These disconnects were addressed with user groups in the form of SPD sessions ('second order' activities), which consisted mostly in a series of design game and scenario-building workshops, enriched by open conversations and perspective sharing and comparison. The paper describes how these SPD sessions facilitated the creation of sense making and trust, enabling participants to engage and learn, and to act as change agents in the project, opening the way to co-construction of solutions with other actors.

Observations of Modelling and Validation sessions showed that participants could not automatically build on a deep understanding of modelling and its trade-offs; they adopted the representational conventions they had learned to use. Lack of sense making and lack of co-construction were observed, along with lack of facilitation for genuinely participative conditions. Modeller-guided Modelling sessions showed no appropriation of object decomposition and relationship structures by domain experts, nor contribution from users to leadership in the modelling process; only imposition of hierarchical structures by modellers, in the midst of a cloud of mistrust and suspicion. Validation sessions of the model-based approach showed that 'common' users do not perceive the value of the approach, as they have not been helped to gain a conceptual understanding of modelling, of the trade-offs of abstractions, and of how a model may productively interact with work practices. In this distributed project, different concepts of various user groups all conflicted with modellers' concept.

The SPD facilitation interventions helped participants in stepping back from the "official view" of the work process created in the course of the project, and in focussing more on their own experiences, opening up for creativity. SPD events were grounded in the belief that, when it comes to one's own things, people with no special knowledge of the issues to be discussed can contribute something valuable, especially on those matters that they perceive as problems for themselves; it was impressive to witness how people with no management perspective can engage in strategy development within a very short time. The methods were easy enough to adopt without much preparation and rich enough to stimulate learning and valuable insights; people felt comfortable and not at risk at being judged. Participants expressed how important the experience of working creatively on solving "real problems" had been for them. We can understand this also as a result of the longitudinal character of our SPD engagement with people in the project, which had provided us with good knowledge about work practices, potentials and problems on the one hand, allowed trust building on the other hand.

Keywords: participatory design, organizational change, modelling, social practice design.

1 INTRODUCTION

As described elsewhere (Martin and Jacucci 2008), trying to define better requirements by participation, within a management given conceptual and pragmatic sense-making frame, not always appears to be feasible. In these cases it is appropriate not to confine design *between* requirements and solutions: even the given frame must be abandoned, and new goals co-produced in cooperation by all stakeholders. This occurs whenever there appear to be no shared concepts, motivations, goals, and even language, among the various actors: the establishment of relation and trust in the project is hindered, and replaced by ambiguity and suspicion. The given frame should be abandoned, sufficient sense making and shared understanding recovered, facilitated by management through appropriate *infrastructural* measures, like co-construction (Cattani and Jacucci 2007) in Social Practice Design (SPD) approaches (Jacucci 2007; Jacucci, Tellioglu, and Wagner 2007a, and 2008a). As a result, trust relations and a cooperative setting are re-established, solving a *structural* problem, and a new frame emerges along with brand new goals and outcomes (but also changing the very meaning of the whole process, and reshaping its *governance* beyond what intended in most IT design projects; so that these new, 'open' design practices generate a new scenario for design, requiring a new design *deontology*).

This paper describes the experiences of practicing SPD to address the *structural* problem above, in the domain of IT and Globalisation – a domain afflicted by geographic distribution and cultural differences, conspicuous sources of ambiguity -. The adopted *infrastructural* measures, seen to be effective in the case hereby described - a European project that we shall name MODELBASED, introducing technology based support of cooperative engineering design in global distributed manufacturing -, include people travelling between sites, promoting shared understanding, carrying out open conversations, organising design games and scenario building user workshops, promoting concept emergence and learning, and relation and trust building (all 'second order' activities).

This experience is far from being a complete and successful experiment: there has not been access to sufficient time, resources, and political support to PD practices. But a wealth of indications and partial results have been harvested, on needs, opportunities, and practices for promoting shared understanding and trust, and for letting emerge idiosyncratic solutions at each project site, that make this experience precious for the investigation of Distributed PD issues in global settings.

This paper provides an account of this event from the point of view of social practice design. It first describes our approach, including the activities we have prepared for facilitating users' work, analyzes our observations and arrives at a set of conclusions concerning use of these activities as part of SPD.

2 TAKING 'A SECOND STEP BACK' AND MANAGING AMBIGUITY AS PART OF SOCIAL PRACTICE DESIGN (SPD)

The Participatory Design (PD) approach consists of a conceptual framework and a diversity of methods in support of participation in design (Bodker et al. 2004). The methods are grounded in intense participation with users and they combine the use of ethnographic techniques with creative design and intervention. PD research has over the last 20 years developed activities in support of a stepwise decision-making process in the overall design process. What practitioners of PD have less focused on is the implementation phase of IT, when users have to integrate the technology in their work, in many cases changing work practices (Jacucci, Tellioglu, and Wagner 2007a, and 2008a). They also, with some exceptions, have not looked systematically into the organizational environment probing together with users how to support the potential of IT through organizational measures. Ciborra (2002) strongly argued in favour of an organizational view onto IT implementation and stated that the unveiling of real world organisational forms requires a different analytical approach from the one especially common in industrial organisation Weick and Quinn (1999) contend that organizational change requires changing the meaning system – to speak differently, communicate alternative schemata, build coordination and commitment.

The notion of social practice design springs from reflections such as these (Jacucci, Tellioglu, and Wagner 2007a, and 2008a), and it reflects a vision advocating for a design oriented approach, with

researchers preparing the grounds through ethnographic work, defining key issues around which to organize change processes around IT implementation, and participants analyzing, co-constructing, and performing, and this more in an improvisational than a 'rational' mode.

With the *proviso* of the presence of a *dichotomy*, of equally relevant aspects, between attempts to establish *functional rationality* ('first order') in technical systems and organisational processes on the one hand (reducing *uncertainty*), and attempts to establish *culture change* ('second order') through facilitation and learning on the other (managing *ambiguity*). Watzlawick, in studies of the pragmatics of human communication (Watzlawick *et al.* 1967), identifies content and relation as equally relevant. Bion in studies of the psychology of groups distinguishes between the *task* to be executed, and the equally important establishing of *relation and trust* in the group.

In our organisational innovation SPD projects, we address intentionally and consciously both issues of functionality, content and task, and issues of communication, learning, the establishing of trust relations among people (Cattani and Jacucci 2007). As a result, SPD approaches blend 'first order' (*linear: from problem and resources, to vision of solution, plan, execution, and evaluation*), and 'second order' (*bricolage: open conversations, workshops, co-construction and learning*), nurturing relation and trust to produce results by co-production through the promotion of sense making.

Trust being a pre-requisite for establishing a web of shared understanding, how can trust be nurtured? Carl Rogers (1951), in his person centred approach studies of therapy, advocates the respect of three criteria on the part of the counsellor, for establishing working communication and trust relation with the client. Rogers felt that a therapist, in order to be effective, must have three very special qualities:

- Congruence -- genuineness, honesty with the client
- Empathy -- the ability to feel what the client feels
- Respect -- acceptance, unconditional positive regard towards the client.

He extended these criteria to learning, and company consulting (Rogers 1969, and 1980).

SPD takes up these criteria: applying these requires introspection, self-awareness, clear and clean intentions, and control, on the part of SPD facilitators; as well as their awareness and intentionality in conceiving, proposing, co-constructing with clients an appropriate path in the given context, towards the desired development: a path that is more important than the very content, and task objective. Control over 'second order' activities – communication, learning, the establishment of trust relations, as well as control over the application of Rogers criteria -, requires, in the words of Bourdieu (1992), taking 'a second step back' in looking at our intervention.

3 THE SCENARIO

This paper describes the experiences of practicing social practice design (SPD) activities with user groups, in geographically distributed, collaborating manufacturing companies, struggling with the introduction of model based enterprise systems. Within European project MODELBASED, we observed and routinely analyzed ('first step back') ongoing development and assessment work ('first order' activities) of model based technologies and methodologies, in these companies (Jacucci, Tellioglu, and Wagner 2006, 2007, and 2008). Based on an ethnographic study of Modelling sessions and Validation sessions, we performed an in depth analysis of people semantic and pragmatic perspectives (a necessary and needed 'second step back'), and identified core disconnects on modelling concept use and language, and on motivations and goals, between technology designers – modellers - and domain experts – users - clearly hindering project progress -. These disconnects were addressed with user groups in the form of SPD sessions ('second order' activities), which consisted mostly in a series of design game (Jacucci, Tellioglu, and Wagner 2007a, and 2008a) and scenario-building workshops, enriched by open conversations and perspective sharing and comparison. The paper describes how these SPD sessions facilitated the creation of sense making and trust, enabling participants to engage and learn, and to act as change agents in the project, opening the way to co-construction of solutions with other actors.

3.1 Project MODELBASED

In project MODELBASED crucial issues of sense making have emerged. Priority sense making needs of personnel asked for been given central stage to secure engagement. A blunt step forward was needed to attempt coping with the demand for awareness, involvement, confidence, and interpersonal communication and trust building, in a geographically distributed global setting entailing vast cultural differences. A differences was the traditionally open attitude towards PD of Scandinavian companies, with respect to the closed one of Central and Southern European companies, without previous exposure to PD concepts and practices. This difference had a great influence on the case.

To complicate matters, in MODELBASED there are specific issues of *model abstraction* from different perspectives, and of accountability of modelling methods and tools used by designers and users. Sense making demands arose within the workforce, because of the unfamiliar concepts of abstraction, granularity, unit of analysis, and even purpose, of modelling. These conceptual and practical problems exemplify what Bittner, in his brilliant essay 'The concept of organization' (1965, cited by Wagner, Schmidt, and Jacucci 2008), wrote about organizational rules, arguing that the sense of a organizational rule (and, a fortiori, a model) is relative to the practice for which it has been devised. This is reflected in his suggestion to 'attain a grasp of the meaning of the rules as common-sense constructs from the perspective of those persons who promulgate and live with them'.

In MODELBASED *mishaps* have been the norm: misunderstandings between modellers and users, and misalignment between different use case sites. Modelling is abstraction for creating useful explicit representations. As an abstraction, it is purposeful, practice-related, therefore conceptually arbitrary. Specific perspectives guide modelling, identifying worthwhile purposes. Hence misunderstandings, misalignments, mistrust. Confronting these difficulties involved social practice design activities, promoted by missionary roles travelling between all sites, and established in their role early on. These people had to bear the burden of promoting shared understanding among all.

3.2 Information Technology and Globalisation

We wish to highlight the congruence of what this paper is describing, with aspects cited by Galliers (2004): ... *building team cohesion among distributed personnel ...*, ... *providing the social networks to develop rapport, relationship, and trust...* In his keynote at ECIS in Turku, 2004 on IT and Globalisation, Bob Galliers stresses research findings on "i) The importance and challenge of building team cohesion among distributed personnel. ii) The need to develop integrative and collaborative work among distributed teams: providing the social networks to develop rapport, relationship, and trust among team members, and building in-company understanding to 'circumvent' cultural differences. iii) Over-reliance on standardized processes, 'best practices', methodologies, ICT.

3.3 The case

The case is followed during the 30 months of the project, describing the action research type intervention, and identifying steps forward and points of breakdown. PD techniques employed to assure inter-regional shared understanding, include: learning sessions on modelling, user workshops, design games, scenario building. Real modelling sessions were carried out at use sites, managed by modellers, as part of the project 'first order' activities, and we have carried out ethnographic observations of these, in order to analyse participation in enterprise modelling (a 'second step back'). Facilitated toy-modelling sessions with users only, were also organised as part of the 'second order' activities, to investigate how users could better acquire understanding of modelling by abstraction.

3.4 Exploring acquaintance with modelling at SITE C

To set the stage for our discussion, and to help illustrate sources of conceptual difficulties involved with modelling projects such as the one at hand, we anticipate here, before sessions 4 and 5, results relative to SITE C (for short, similar results pertaining to the other sites) of an investigation of user acquaintance with the modelling concept within project MODELBASED. Three groups of users at that

site were encouraged to embark in self-lead modelling sessions, having an everyday object as target. This activity was part of the sense-making and awareness facilitation work, and it was carried out after two years from the beginning of the project, near to its end; yet, generic users are still seen to be receiving first exposure to basic modelling concepts. When facilitated, they are seen to be able to become aware, and to crisply reason with modelling concepts, hastily proceeding to score, in absence of mistrust, and of suspicion of different goals and hidden agendas.

Understanding modelling by abstraction.

At the beginning of their session, all groups were exposed to a presentation by a key user in the company about his experiences with product modelling, with the aim to create an interest in modelling and evoke enthusiasm. This was followed by a presentation by a facilitator, on ‘modelling by abstraction’, with the aim to help participants understand the choices and trade-offs connected with abstraction. Users should realise the need to decide the view from which they want to create a model and reflect on the level of detail they are introducing. Users were provided with a hands-on experience with modelling in small sub groups. The task was to model an everyday product, not connected with SITE C, using simple material (posters, coloured post-its, colour pencils). The product chosen was an ice cream. The task for each small sub group was to decompose the product, to define parameters, and to present their model on a poster.

Modelling from different perspective generates different model concepts.

The three approaches to modelling were quite different. The first small subgroup practiced what we saw as an engineering approach. They started with a definition of ice cream “as a frozen mixture of cream, sugar & flavours”. It took them a while to then agree on a flow – select a recipe, make it, distribute it (in paper or plastic boxes), make it eatable (select a carrier material, add flavours), eat it. They also introduced a constraint – the ice cream should be prepared on the spot. The group took in their own view “a generic view of the model” and put a lot of energy to come up with one best model. The other small subgroup worked on what they later termed “a decision based model”. They started with the user perspective, quickly identifying “spilling” as a danger and making a distinction between different types of containers and talked about which one was suited for eating ice-cream where, specifying additional parameters. They realised that there were other perspectives to consider. Going into the seller’s point of view helped them determine an entirely different set of parameters.

‘Opportunistic modelling’

The third subgroup was dominated by a participant (M) with experience in marketing. He hesitated to work with the simple material we had provided, insisting to work first in the medium he is familiar with. This group treated the ice cream as a potential SITE C product, trying to first “decide what things are important for their company, then we go in depth for these, coming up with alternatives, in the next step we can choose which alternative and decide what is important for the product – this is my meaning on how to use modelling”. M suggested to define a goal, which was set as “eat for pleasure” and then there was a lot of discussion (and confusion) about which attributes and behaviours to define: they ended up with the parameters: packaging, flavours, and emotions; and the behaviours: melt, freeze, psychological emotions, physical emotions. The group saw this model as useful in accompanying product development, as helps develop and enact a goal-oriented activity and offers a structure that can be developed. The important outcome in their view “is not the model, it is the product, their company ice cream, a redefinition of the concept of a model”.

Main findings

First exposure of generic users to basic concepts of modelling by abstraction, but end of project. Quite different model concepts emerge from quite different perspectives, and different language is used. New terms are invented by some: decision based modelling, opportunistic modelling. ‘The company ice cream’: a redefinition of the very concept of a model.

4 MODELER-GUIDED MODELLING SESSIONS WITH USERS

Section 4 is based on the results of ethnography-type observations of *modelling sessions* at the three project sites, which exhibit crucial unresolved user issues of sense-making, and of misunderstanding

and misalignment between modellers and users, relative to concepts, methods and goals. Results in this subsections regard regular project modelling activities in MODELBASED – not ‘toy’ problems, as just illustrated above -, where professional modellers from software development companies interact at various sites with domain expert users from generic industrial company partners, in order to construct models to be used in the project platform supporting collaborative engineering. Our multi-sited ethnographic study of engineering modelling practices helped define and develop quality measures for modelling processes and modelling technologies that are firmly grounded in ethnographic-like field-work. Ethnographic qualitative analysis is adopted as an approach that, when combined with computer-based modelling, can lead to more robust representations (Viller and Sommerville 1999). We analyse design work in the early stage of development of a modelling project and the intermediate embodiments of use case specifications as the creation and the manipulation of a multiplicity of design representations (Schmidt and Wagner 2002) and discursive practices (Suchman 2002), that take their shape and meaning not in any single location but through their incorporation across different milieux. Distributed modelling sessions are seen as the mobilizing and framing across domains and use cases of an organizational decomposition and re-design strategy supported by a specific modelling platform and a specific modelling process, i.e., the MODELBASED technology and approach. Based on ethnographic observations in the early stage of development of modelling, modelling process and modelling platform have been understood in real work environments and the qualities of modelling as a distributed participatory practice have been understood in terms of:

- A. for what concerns modelling as a distributed process:
 - a. appropriation of object decomposition and relationship structures;
 - b. leadership of the classification process and of the definition of discrimination criteria;
- B. for what concerns modelling as a distributed platform:
 - a. provisionality of models as fragments of classification;
 - b. openness of the tool to overlapping hierarchical relationships;
 - c. iterativity and reconciliability of object decomposition and relationship structures.

Observation reports are made available in detail elsewhere (Campagnolo 2008). Results are summarised here. Our main argument is that much of the articulation work that makes any approach of organizational decomposition possible cannot result as the imposition of strict hierarchical structures by modellers. A condition for the success and duration of a classification system like a modelling system is that hierarchical and membership structures become shared by domain experts, and that once the hierarchical and membership structures become shared, the classification process and the definition of discrimination criteria should be lead by domain experts.

The *appropriation* by domain experts of the modelling tool object decomposition and relationship structure in SITE A is very limited. This is due to the absence of a discussion on the purpose of the translation of the process under consideration to a different modelling language. Although domain experts had the opportunity to choose which modelling template to use, the *leadership* of the classification process was dispersed and the discussion was framed in a way that domain experts choice of the modelling template came first than the choice on the set of processes to model. In SITE C the appropriation by domain experts of the object decomposition and relationship structure is more advanced. In SITE C, domain experts *appropriated* the object decomposition and relationship structure by the creation of their own ‘meta-model’ (a collaborative product and process development). As a second step, a methodology (textual scenario description) to analyze requirements has been proposed by the planner and accepted by domain experts, in meetings where models and modellers were not present. However, during the modelling session addressed to deliver a ‘solution model’ the coach modeller does not allow domain experts to run their own methodology to *lead* the classification and the definition of discrimination criteria, by suggesting a different methodology.

5 MODELBASED VALIDATION ACTIVITIES

Section 5 is based on observations of *validation work* in MODELBASED (a detailed account in: Jacucci, Tellioglu, and Wagner 2007b). Goal of Section 5 is showing that whenever insufficient

facilitation effort supports user sense making and learning, disconnect and failure ensue. Alternatively, user generated solution concepts can spontaneously emerge locally, with appropriate facilitation.

5.1 Observations of the validation activities at SITE A

During the validation event, we were able to observe a configurable virtual workplace, creating a model-based interface to the enterprise system and to be in the future connected with the work environment. MODELBASED is to help manage the target setting process of interaction with suppliers, keeping track of the negotiations, until the final agreement has been achieved. This is a high priority, because is difficult to organise meetings with multiple suppliers which are geographically distributed over the whole world. There is a problem at SITE A of loosing documents - “there is a lot of confusion, with all the different repositories, for example when there is a recall campaign”.

An interesting discussion about the need for tracing the process took place during this session, when the manager mentioned that she would like to import the document into the work environment so as to provide information about the status of documents – had any changes be made, with which results? Her view is that MODELBASED technology MODEL is not for supporting immediate interaction, just exchange of final values, while “the story should be managed in the work environment” – The work environment should track arguments and decisions, in form of emails, meeting reports, etc.

We want to stress a general point of observation: There are conceptual problems that have not been thought through yet. A central question is the role of models in the target setting process with suppliers. At present the idea is that tracing the negotiation process is done in the work environment, where emails and meeting minutes are stored and can be revisited. We think that a model is more than just a data repository, hence MODEL could and should be used to keep track of negotiations in real time and without additional effort by users. The question than is what kind of useful information can be extracted from the model with respect to details of who, what, and when of changes. What is “the story in the model” needs to be articulated.

5.2 Observations of the validation activities at SITE B

During the validation event, we were able to observe the following applications and activities:

- Collaboration between SITE B designers – observation of use and demo;
- Collaboration with a supplier on distributed design and verification – demo and discussion;
- Configurable Virtual Workplaces to be used at SITE B – demo of mock-ups and discussion.

MODELBASED cooperation support software has been developed, with the result that engineers in locations can remotely work on small errors without having to communicate explicitly. In addition, some error-prone processes have been automated. This application has been in use for some time and has been efficient in supporting distributed design. However, the workflows are not model-based.

5.3 Observations of the validation activities at SITE C

Validation work outcome at SITE C – a Scandinavia country, traditionally more permeated by PD concepts and practices than the other two sites, these being located in Central and Southern Europe - was richer than in the other two cases, and it is here described in greater detail.

5.3.1 SITE C 1: The approach to product modelling elaborated by users at SITE C

Users here had undergone a learning process in another project about product modelling in the automotive industry (referred to as ‘the Chalmers project’). SITE C was at that point interested in product configurability and L., studying the theory of product configurability (as laid down in a PhD thesis), started developing a product description of a heating element with simple tools – he used MS Excel, as well as post-it notes. This was an important exercise in understanding configurability, with several crucial insights. A small user group was set up, including a CAD technician and two interns, and on average one modelling session per month was conducted,

The aim was to start with a product description and to define configurable components. (CC) shows the product description of the seat heating element, with alternative functional requirements (FR), design solutions (DS), constraint parameters (CP) for each of the design solutions, design parameters (DP), performance parameters (PP).

Product description such as these can be used in support of decision-making, L. argued. He also produced descriptions of the configurable components for the carrier and the heat producer and he connected these descriptions to responsibilities: "It is to rearrange the way of thinking of how the product should be developed in CCs, then we have also to rearrange our responsibilities in the organisation". What L. started with MS Excel was then continued with MODEL and resulted in specific requirements for CVWs.

L. also talks about the need to add the configuration of the production, which is beyond the scope of the MODELBASED project.

We gained some basic insights from this demo of product modelling at SITE C. This is a good example of how users can help designers in understanding in which direction an application such as MODEL should be developed. The domain expertise of users is needed to make modelling useful. We can also see the effect of MODELBASED not having practiced a participatory design approach. The project team had focused on modelling task patterns, because they were executable. Product modelling was 'discovered' by users as a result of a synergy with another project. But in manufacturing product modelling is essential.

Users at SITE C identified several advantages of product modelling, as they have addressed by themselves, before and outside the MODELBASED project:

- Users learn by modelling, they "improve their view on the product, making it more systematic", and they develop a shared understanding of the product. One positive side-effect is the "scientific touch": "By using this towards our customer, we were promoting our company as a better company".
- A major challenge is to identify the relevant parameters and agree on them: "We have been spending a lot of time to identify what in the product variation should be modelled as a performance parameters, what should be modelled as a design parameter, what should be modelled as a constraint parameter, and what should be modelled as a variant parameter". One key insight was that selecting parameters is dependent on the particular perspective users assume and the context for which it is needed - "there is no best model". Users also noted that the ambiguities in naming parameters disappear, when restricting the scope of a problem and digging into detail.
- A central advantage and aim of product modelling is to achieve product configurability, hence flexibility. Users mentioned that this focusing on "the irreducible part", "the good component" supports deciding "which project to engage in" and identifying a potential for innovation.
- Users also observed that product models do not only represent physical components but that they can and need to be extended including parameters connected to roles and responsibilities or 'business agreements'. What is important here is that users 'by force' do not restrict modelling to mechanical aspects but include aspects of human organisation, contracts, and so forth, which are to do with assigning responsibility and establishing trust. A big step forward for users at SITE C was the experience that modelling requires to abstract from the physical and that it requires a deep conceptual understanding of a problem.
- Users emphasised that it makes not sense "to push for modelling everything" unless such a deep conceptual understanding has been achieved within the organisation in a participatory way. They came to favour a bottom-up approach to modelling, starting with simple tools and simple modelling tasks so as to be able to engage users. They also expressed the value of non-executable models for the organisation: "And the target for MODEL has always been executable models. But we also see it as the final target. But also non-executable models like the one we had produced. You can learn a lot from non-executable models also, because it drives the discussions you can say. You have to ask yourself a lot of questions to produce that model. By asking yourself these questions you are learning. Or you structure your knowledge".

- A problem is the lack of a methodology for product modelling that for example provides a reasoned way of deciding how many configurable components to define. Furthermore, modelling should be extended from engineering to include social and organisational aspects.

5.3.2 *SITE C 2: Creation of a collaboration model with suppliers – observation of modelling*

i) Users working with the modelling tool.

SITE C has been working on creating a collaboration model with suppliers. The validation team observed a modelling session with a facilitator. The background presented by L. is the experienced problem with the TRIM specifications due to the failure on the side of SITE C to communicate material specifications with one of its suppliers. Two virtual workplaces (CVW) have been developed that systematically capture and connect the expected properties of materials with those of the product. The basic idea behind these workplaces is that the design responsible at SITE C fills in the customer requirements and can compare them with the suppliers' product specifications. This is to avoid double work (on the side of SITE C and the supplier) and to get timely information about missing or incomplete specifications. But there are also more long-term objectives connected to the project.

ii) Evaluating the modelling approach incorporated in the tool.

Users in this session basically acted as knowledge providers. Apart from L. none of the users understood the model and the modelling process, they were only expected to answer the modeller's questions. They were not supported in evaluating the model itself, what is abstracted and how the model relates to the practice.

What we observed was users filling in missing information and this activity was separated from model construction. Knowledge exchange in this session was filtered and reduced by the matrix representation, with users filling in descriptive values. Their only opportunity for increasing the richness of the model was to introduce new tasks (e.g. test reporting). We want to emphasise that this is not to blame on the facilitator, who acted in a highly participatory and supportive way, but is due to the view on modelling implemented in the tool.

What we can see from the conversations is that conducting meetings of different kinds is not a differentiation criteria that has been taken care of in the model. This is why users' controversial perspectives take place outside the model without having an impact on it.

Another example is users' discussion about what should suppliers and customer see and make visible – prices? These and other sensitive issues are buried in the category information exchange, which has been constructed as relationships between tasks and supporting processes.

Our observations are in line with Grinter's (2000) findings on a successful configuration management system. Reflecting on this success she pointed to three reasons: systems developers (in her case) understood and accepted the model of work implemented in the CMS, which for example led them to accept a bug tracking system that posed some constraints; representations were understandable and useful - the developers could trust what the system was telling them about the current development state; and the 'right' work was automated. Our argument is that for modelling to be successful at SITE C users need to be able to develop a deep understanding of the models and that the tool itself has to support building models and experimenting with them so as to develop well grounded abstractions.

5.3.3 *Main validation results at SITE C*

In summarizing our observations we can point to several insights:

- Some users have accepted the modelling idea, independent of the tool, for which several improvements need to be considered.
- However, 'common' users at SITE C do not perceive the value of the approach, as they have not been helped to gain a conceptual understanding of modelling, of the trade-offs of abstractions, and of how a model may productively interact with work practices.

- While the focus was on simple executable models (task pattern execution) and configurable workplaces that contain task support for information exchange (between SITE C and suppliers), product modelling has received little support although it is highly relevant in manufacturing.
- There is an open ambiguity between users expecting model support of tedious work activities and users more interested in complex not easily executable models with a potential for innovation.
- There is a need for developing a strategy to anchor modelling in the organisation in relation to the existing and ongoing product-lifetime-management enterprise system project.

6 SOCIAL PRACTICE DESIGN

Section 6 describes ('second order') *facilitation work* that has been intentionally organised as SPD activities to support the emergence of solution concepts; here user frustration generally yields to comfort, ease, and satisfaction. Validation of this SPD work is also addressed, showing evidence of effectiveness towards goals of appropriation and empowerment.

In Sections 4 and 5, based on an ethnographic study of Modelling sessions and Validation sessions, we performed an in depth analysis of people semantic and pragmatic perspectives (a necessary and needed 'second step back'), and identified core disconnects on modelling concept use and language, and on motivations and goals, between technology designers – modellers - and domain experts – users - clearly hindering project progress -. These disconnects were addressed with user groups in the form of SPD facilitation sessions ('second order' activities), which consisted mostly in a series of design game and scenario-building workshops, enriched by open conversations and perspective sharing and comparison. These are reported in detail in (Jacucci, Tellioglu, and Wagner 2008b). Here we make available in short results of analysis and interpretation.

6.1 Analysis and interpretation of SPD data

6.1.1 SPD at SITE A

Although the SPD session at SITE A could not build on an extensive previous engagement with users, we had the opportunity to further validate our approach. Our main observations are:

- The modelling session with simple physical tools confirmed the importance of stepping back from the "official view" of the work process created in the course of a project such as MODELBASED. It helped participants focus more on their own experiences, opening up for creativity. How relevant such an opening up may be seen from the fact that this "official view" did not change much during the course of the project. It is an idealised description of processes and identified problems, which, from the point of view of an ethnographer, lacks depth and telling detail.
- The session also confirmed that the notion of modelling, in particular the assumption that "almost everything has to be modelled", has not been critically examined. Participants could not build on a deep understanding of modelling and its trade-offs. They adopted the representational conventions they had learned to use. At the same time, the physical tools helped them take first small steps beyond these conventions, for example using two round building blocks for indicating a "heavy problem", and they used the physical props as "thinking tools".

6.1.2 SPD at SITE B

With this SPD session we had continued a series of interventions that had started in April 2007. Participants expressed how important the experience of working creatively on solving "real problems" had been for them. We can understand this also as a result of the longitudinal character of our engagement with people at SITE B, which had provided us with good knowledge about work practices, potentials and problems on the one hand, allowed trust building on the other hand. Results:

- Participants were able to produce a 'power statement' as a group concerning their US based distributor, showing that they have the confidence and competence to change the contract;

- The company's president saw that the present staff of engineers (and a few marketing people) are capable to elaborate views on a solution path to perceived problems and that the ability to communicate and learn are important assets of the company;
- There is a lot of curiosity concerning new ways of working (e.g. experiment with a model-based approach, develop tools for interaction with customers) but the lack of resources will make it difficult to follow up on the produced visions (as became clear from some comments in the feedback session).

6.1.3 SPD at SITE C

When analysing our observation of how participants worked with the SPD methodology, we come to several conclusions:

- The SPD event was grounded in in-depth exposure of the researcher team to the ways of working in the company and perceived problems. This is one of the main reasons why the How Questions worked well and participants, within relatively short time, arrived at productive Visions of Solutions. Participants became aware of a path towards a model-based approach in the company.
- The methods were easy enough to adopt without much preparation and rich enough to stimulate learning and valuable insights. People felt comfortable and not at risk at being judged. Participants gave positive feedback on the SPD sessions, with comments such as:

"I like the brainstorming part, you say everything that comes to your mind".

"I liked the modelling session on the ice cream. I liked that other groups had completely different approaches".

"It is fun to be creative and listen to the others – you not often do this freely – and it is interesting how different characters play different roles in the group".

We also conclude that SPD works better with people who are open, curious, and innovation minded.

The manager was confirmed in his experience that people at SITE C could start working with non-executable models on a small scale but with a large trade-off, and this with very simple tools. Crucial was the strategic insight to present the model-based approach as part of the PLM project, a view that can be expected to improve acceptance and motivation within the company.

It is evident that SPD is found to work for the present purpose of facilitation, and that most principles of facilitation, introduced in Section 2, have been verified as relevant and present.

7 DISCUSSION

7.1 Interpretation of observations of modelling sessions and validation sessions

Interpretation of data in Sections 4 and 5, clearly shows both need for sense making and co-construction, on the one hand, and for an unavoidable role of trusted facilitation in creating conditions for them, on the other.

7.1.1 Observation of modeller-guided modelling sessions with domain expert users

The modelling sessions described in Section 4 show that there was no awareness, intention, attempt, by modellers in the project to strive for shared goals, motivations, concepts, and language, for sense making and co-construction with domain expert users, or to apply facilitation for enabling sense making and co-construction (*no appropriation by domain experts of object decomposition and relationship structures, nor their leadership in the modelling process, like classification and definition of discrimination criteria; imposition of hierarchical structures by modellers*), while mistrust and suspicion were floating around in the atmosphere of these meetings.

7.1.2 Observation of validation sessions

As seen in Section 5, validation activities at SITE A (*a model is more than just a data repository*) and B (*workflows are not model based*) both show insufficient sense making of users versus modelling, and the significance of modellers proposals, and insufficient facilitation in the project. Validation at SITE C shows sense making (*a major challenge is to identify the relevant parameters and agree on them: "We have been spending a lot of time to identify what in the product variation should be modelled as a performance parameters, what should be modelled as a design parameter, what should be modelled as a constraint parameter, and what should be modelled as a variant parameter"*). One key insight was that selecting parameters is dependent on the particular perspective users assume and the context for which it is needed - "*there is no best model*", (users also observed that product models do not only represent physical components but that they can and need to be extended including parameters connected to roles and responsibilities or 'business agreements'. What is important here is that users 'by force' do not restrict modelling to mechanical aspects but include aspects of human organisation, contracts, and so forth, which are to do with assigning responsibility and establishing trust. A big step forward for users at SITE C was the experience that modelling requires to abstract from the physical and that it requires a deep conceptual understanding of a problem) deriving from pre-existing company practices on product modelling, with hints of differences with respects to modellers' own (users emphasised that it makes not sense "to push for modelling everything", and expressed the value of non-executable models also), and endorses genuine participation in PD, a need users there are aware of (*a deep conceptual understanding need be achieved within the organisation in a participatory way*); while lack of sense making and mistrust regularly emerge again in presence of different goals between modellers and users (*no user understood model and modelling process, they were only expected to answer modeller's questions, and they were not supported in evaluating the model itself, what is abstracted and how the model relates to the practice; not to blame on facilitator, but due to the view on modelling implemented in the tool*), hindering co-production (*while the focus was on simple executable, product modelling has received little support although it is highly relevant in manufacturing; open ambiguity between users expecting model support of tedious work activities and users more interested in complex not easily executable models with a potential for innovation*).

7.2 Interpretation of SPD sessions

In Section 6, SPD at SITE A shows importance of facilitation SPD work for appropriation (helping participants in stepping back from the "official view" of the work process created in the course of a project such as MODELBASED, and in focussing more on their own experiences, opening up for creativity); concepts and goals can be exposed by SPD to all, as well as the lack of them (*participants could not build on a deep understanding of modelling and its trade-offs; they adopted the representational conventions they had learned to use*), and are seen not to be shared, in case they be not (*while G2 primarily raise critical issues related to the work process, G1 approaches the task from the perspective of the modeller who already has formed a notion of a "logical" process description*); a precondition for creating awareness.

SPD at SITE A shows importance of relation and trust building for sense making and appropriation (participants expressed how important the experience of working creatively on solving "real problems" had been for them. We can understand this also as a result of the longitudinal character of our engagement with people at SITE B, which had provided us with good knowledge about work practices, potentials and problems on the one hand, allowed trust building on the other hand); and the importance of facilitation, open conversations, learning, for sense making and trust building, and of the lack of these (*it became visible that engineers at SITE B had not been exposed at all to modelling during MODELBASED. While at SITE C the manager was able to communicate a convincing example of product modelling as an initiation into a hands-on experience with modelling, here the time was too short for communication and learning; interestingly in the feedback session, several participants mentioned that their curiosity had been evoked*).

SPD at SITE C shows that SPD works, in attaining co-production (*the SPD event was grounded in in-depth exposure of the researcher team to the ways of working in the company and perceived problems*);

this is one of the main reasons why the How Questions worked well and participants, within relatively short time, arrived at productive Visions of Solutions; participants became aware of a path towards a model-based approach in the company), whenever Rogers attention points are applied (the methods were easy enough to adopt without much preparation and rich enough to stimulate learning and valuable insights; people felt comfortable and not at risk at being judged), people are capable of incredible things when facilitated (the SPD event was grounded in the belief that people with no special knowledge of the issues to be discussed can contribute something valuable; it was impressive to witness how people with no management perspective can engage in strategy development within a very short time). Ciborra's concept on 'cultivating the infrastructure is always seen at work (crucial was the strategic insight to present the model-based approach as part of the PLM project, a view that can be expected to improve acceptance and motivation within the company).

7.3 Self-validation of SPD work

SPD was carried out as a series of observation, analysis, and interventions, mostly consisting in design games and scenario-building activities. As designers and moderators of these interventions, the facilitation team faced the problem of self-validation – validation of their own techniques and the competent use of them. We approached this problem by defining an observer position (one person of the team acting as an observer without involving him/herself in the interventions) and by carefully documenting users' responses. The main criteria in validating SPD were:

- Are designed interventions successful in enabling participants to voice insights, mobilise resources (experiences, knowledge), cooperatively develop visions of solution to perceived problems?
- Do we find evidence of communication and learning in our observations of participants' solution creation activities?
- Could we see a connection between emergent sense-making and emergent trust?
- In how far has the longitudinal character of our engagement with users in the company helped build a trust relationship?

All these questions received positive answers. SPD events were grounded in the belief that, when it comes to one's own things, people with no special knowledge of the issues to be discussed can contribute something valuable, especially on those matters that they perceive as problems for themselves; it was impressive to witness how people with no management perspective can engage in strategy development within a very short time. Particularly encouraging is the fact that participants acted and reacted in a field completely new to them and no expert is available, how they are able to generate and communicate their perspective and align it with those from other communities of practice. The modelling exercise proved a simple and effective way of creating a rudimentary notion of modelling. Participants had not at all been aware that the abstraction process depends on the view taken by the modeller and that the model is not a property of the world but of the modeller. Such an introduction to modelling should have happened early in the project so as to enable people to move from being restricted to providers of domain knowledge to active and critical participants.

8 CONCLUSION

People generally felt comfortable and not at risk at being judged. Participants expressed how important the experience of working creatively on solving "real problems" had been for them. We can understand this also as a result of the longitudinal character of our SPD engagement with people in the project, which had provided us with good knowledge about their work practices, potentials and problems on the one hand, and allowed trust building on the other hand. In conclusion, we have experimented with user workshops based on design games and scenario building, and on open conversations and learning, as ways of practicing SPD facilitation towards co-construction in a distributed setting. Design games and other activities clearly enabled participation – they supported participants in engaging. As part of SPD, they form an important part of a cycle starting with ethnographic fieldwork – formulating 'how questions' -, probing solutions, finding new solutions, feedback. SPD is seen to constitute a successful phenomenology based PD framework for approaching co-construction - through facilitation of communication and learning, of sense making and awareness,

and of the acquisition of perspectives of others - particularly in projects that involve a large number of users and stakeholders distributed across space, time and organizational structures. Facilitation is here articulated by missionary roles travelling between project sites. User perspectives on the project in different sites at the beginning were not well defined, and they were far apart; perspectives further developed in terms of concepts and goals, and tended to harmonise – among themselves and with those of designers -. Whenever solution concepts did emerge, different at different sites, each conceptually legitimate, practicable, sustainable, they were demanding to the project a change of concepts, motivations, goals, and results; all locally valid, understandable by others, possibly join-able in a *federation* perspective, rather than in one of straight *integration*.

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