Ontologies in practice

Per Flensburg, Gunnar Mosnik
Växjö University
per.flensburg@vxu.se, *gunnar.mosnik@vxu.se*

Abstract. This paper is about use of ontologies within the manufacturing industries. We identify a multilayered ontology where the consistency problems usually are not treated. A scenario is used as illustration of which problems and possibilites we might meet in the area. Based upon that we conclude that storytelling might be of interest and a short literature review is undertaken.

Background and problem description

Modern production are organised in supply chains. The ongoing diversification and competition from low salary countries calls for a highly specialised production often organised as contractors, sub-contractors, sub-subcontractor etc.

A supply chain within the manufacturing industry is often organised in tiers, i.e. layers each performing as sub-contractors to the layer above. Assume we have a product P, which is manufactured of 7 pieces, A-G (Figure 1). A subcontractor manufactures each piece; especially in this case, part B consists of 4 pieces, which in their turn are manufactured by sub-subcontractors in tier 2. Part B2 consists of two pieces, and a company in tier 3 manufactures the first of them, B21. B21 in its turn consists of three pieces, each manufactured by a company in tier 4.

This way of producing requires much administration and in order to cut costs it must be carried out automatically. As long as we have long series it pays off developing specific systems, but increased customer orientation demand more customisation ˏ   It requires

massive integration of the information systems in the whole supply chain. This is the main challenge of the information systems today.
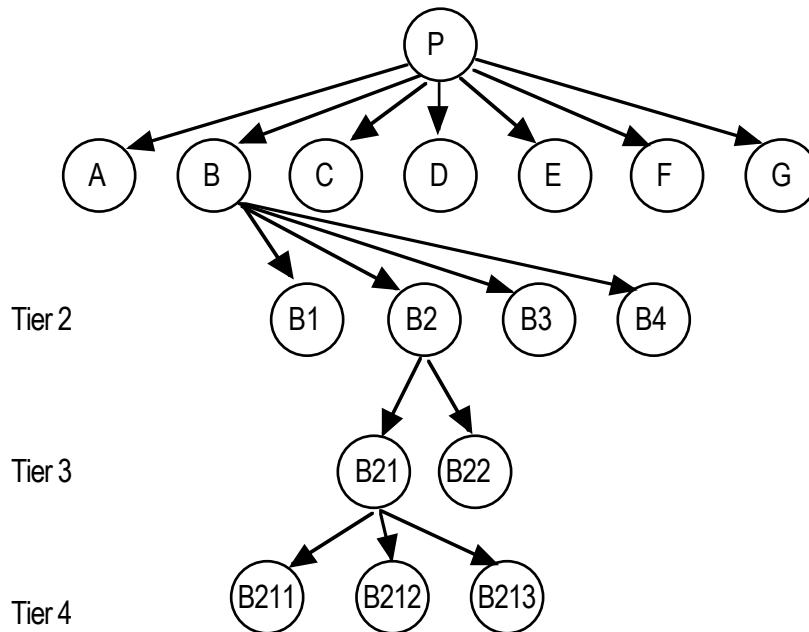

Figure 1 A supply chain in four tiers

The consequence of this way of manufacturing is increased specialisation. Each company specialises in producing a specific part and does that best and cheapest in the whole world. In order to survive and obtain sufficient volume, the company has to provide their articles to many other contractors and thus have a need for integrating with many systems. For instance, the part B212 might be part of many product trees, thus having a need for being placed in several and different contexts. Often companies do not interpret the same concept in the same way. However, the translation must be done very simple and almost automatic, else the company will have no chance to compete with low salary countries, where this integration is not needed. The integration is performed using web services or Service Oriented Architecture.

An absolute prerequisite for an enterprise application integration (EAI) is the possibility to transfer information between the companies business systems, which, by no means is any trivial task (Bouzeghoub and Lenzerini 2001). System integration, information mapping is increasingly more important. In order to make e-business B2B easier so called *Web services* emerge (White and Hall 2000; Metz 2001; Ströbel 2001; Willaert 2001):

"Web services technologies are being developed as the foundation of a new generation of B2B and EAI architectures, as well as important parts of such "on demand"

components as wireless, and autonomic computing. In order to fulfil the promise a set of technologies must be specified, standardized, realized in language bindings, and supported by interoperable products." (Kreger 2003).

As argued earlier (Flensburg 2003) these methods do not solve the basic problem, which is within the field of ontology. In order to further explore that area we have to discuss what is an ontology and how is it used and by whom. We first give a traditional definition of ontologies and then continue with a scenario to illustrate some issues, usually not covered in the ontological textbooks.

The literature (Gomez-Perez 1999; Sowa J F 2000; Fensel 2001) describes ontologies as "shared descriptions of a common reality". However, the use is not discussed so much, the interest is very soon turned to technical details of representation and implementation issues. The ontology could, from a use point of view, be seen as a vocabulary, a set of well defined and agreed words used for information about a certain piece of reality, such as a specific physical object, a business process (or part thereof) or the content of a textbook used for teaching in primary school.

A scenario[1]

The automotive industry is an industry that fits into our business model. For many years we have seen a plethora of subcontractors growing. The traditional way of dealing with integration is by demand. For instance Volvo tells you: "If you are going to deliver parts to Volvo-cars you have to use EDI and this and this system. Period!" For small companies this can be very expensive and if they are to deliver to more than one brand, it can be impossible.

The process of designing a car involves not only design of the appearance of the car, but also design of the workflow for manufacturing of the car (Figure 2). This workflow might look something like Figure 1. The process also involves engineering of the car, i.e. in detail describe how the different parts should look like, which quality they shall have, which material etc. There is of course a dependency between the design of the car, the engineering and the workflow. The total design process of a new car, takes about ten years from the first idea to the start of production. The car manufacturer earlier strictly controlled the whole process, but today we see an increasing trend to more component orientation. The whole process, from design to production of the specific components of a car is

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[1] Please note that this scenario is completely fictitious and all resemblance with reality is purely coincidental!

outsourced to sub-contractors, thus making the control and administration much easier.
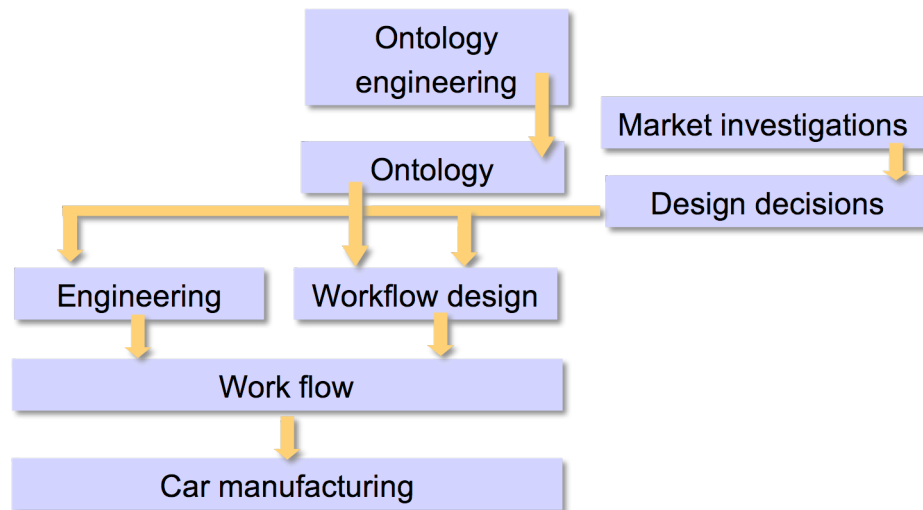

Figure 2 Design and manufacturing of a car

Let us now assume we have a multi-tier production, where parts of the sub-contractors (or sub-subcontractor or sub sub... etc) manufacture components to many cars. We can for instance think of Eschkild, who manufactures electric components to many cars. Suppose we have a component like the one in Figure 3.
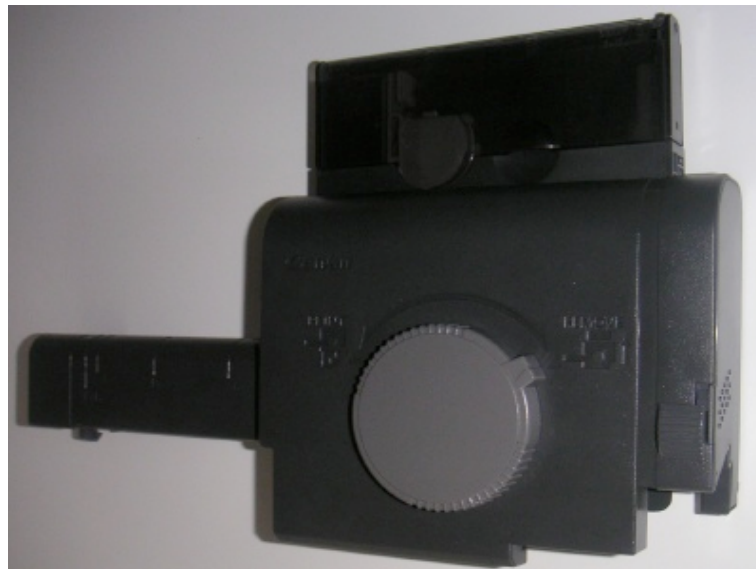

Figure 3 A component to a car

It is used for electronic fuel control and the same part can be found in many different cars. The active part is a chip called NGC7645 and a sensor

called CVF-9728. The sensor measures a certain aspect of the fuel, the measure is transported to the chip, which perform certain calculations and transmit the result to the fuel pump. The chip is located behind the grey wheel in the lower part of the picture. The chip is sensitive equipment and needs protection for light, heat, vibrations, oil and water. That's why it is mounted in a plastic casket, designed to fit into a suitable place in a car. The caskets are tailor-made for each car and in some times even for a specific type of a car manufactured at a certain year.

The part has to be replaced about every third year. Since it is a crucial part the replacement, need to be done very fast. Therefore, it is always mounted at an easily accessible place. As consequence is a huge stock of spare parts needed, principally one for each type of car and model year and since each part is expensive, many moneys are bound in the stock.

The part is manufactured by the following sub-contractors:

The chip: Two independent companies manufacture it, they call the chip bz-342-Iu and VB67543218. There are small differences in the design, but it should not affect the performance. In fact both companies use standard chips, but print different numbers on them, thereby increasing the price 200%.

The sensor: Only one company manufacture it and the process requires two other sub-contractors.

The casket: It consists of 14 parts, manufactured by 18 different companies, where each part can be manufactured by at least two different companies. A part number provided by Eschkild identifies each part. Beside that, the part often has a number provided by the manufacturing company. Each part can thus have several numbers; dependent on who you are talking with.

Eschkild in one of their factories in Germany does the assembly. Since there are many versions the production is done in small series.

Now we study manufacturing of the grey part we have talked about earlier. Eschkild calls it YZJH-987-321-H, it is manufactured by three companies called Unaman, Sunaman and Vinaman. They use different numbers for them. It is summarised in Table 1

Eschkild	YZJH-987-321-H
Unaman	76543 9876 7
Sunaman	1102-FGR
Vinaman	Dozenlocker 12

Table 1 Four names on the same thing

In Figure 4 we try give a hint of the contexts in which this little tiny plastic thing occur. To make it more realistic we have to have in mind that every car manufacturer also have a unique name for it, yet more it is unique also for the brand and sometimes also for the year and the type. We guess there are about 637 different names for the same thing.

Since the part is fragile it often needs repair, i.e. replacement. This cost a lot of money (≈300€) and is a substantial contribution to the income from the aftermarket. Therefore, it is ensured that the part can only be delivered from the authorised garage or car vendor. No pirate parts are manufactured, simply because it is too small series. The complicated structures of the identifying contribute also.
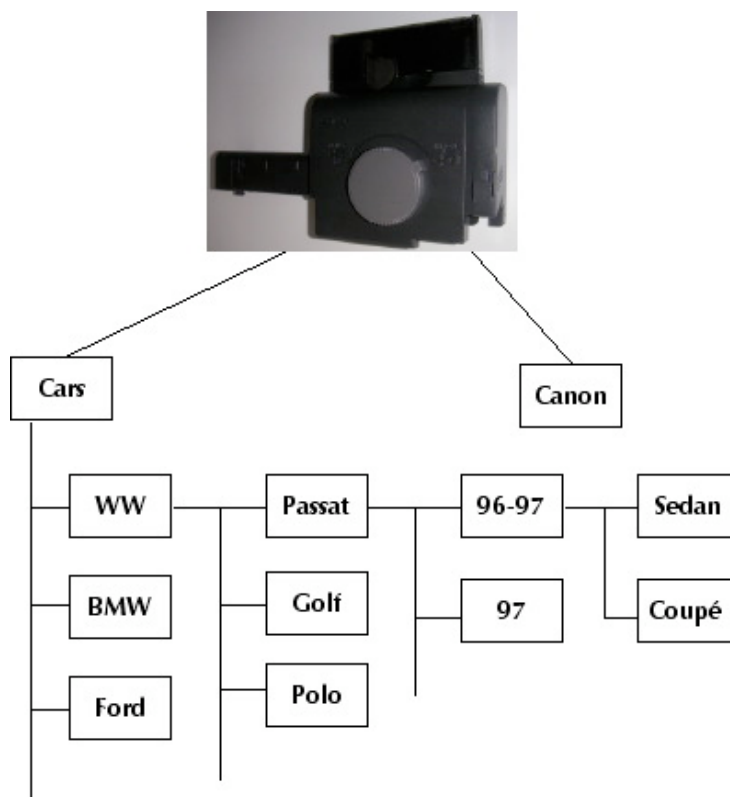

Figure 4 Different contexts for the same thing

Vinaman, however, is a vendor for an extra device to a Canon Inkjet printer to Canon. They have discovered that the grey thing in the middle is the same in both instances and Vinaman use the same name: irrespective of their customer, they call the thing Dozenlocker 12. Vinaman has also discovered something else: Dozenlocker 12 is exactly the same thing as a lid they produce for a marmalade jar and which is sold for a fraction of the

price. They can thus offer the Dozenlocker 12 at a considerably lower price than the other companies and soon becomes main vendor of this thing

In Sweden there is a smart motor mechanic called Bosse Bildoktorn who has taken a course in ontology engineering. He discovers the complicated structure and then discovers a way of repairing the fuel control component. He simply smashes the grey lid, replace the chip with a standard chip, replace the grey lid with a marmalade jar lid and glue it back. All is done at a fraction of the cost an authorised garage charge and then you even get the marmalade as a bonus! The trick is soon spread and all the car vendors suddenly discovers a considerable decrease in their after market sale of this device.

Analysis of the scenario

In the scenario, we see the same thing, a tiny plastic lid, being used in over 600 different ways and being named in as many ways. For the car manufacturing part they are aware of this and hopefully the integration of the systems can be handled with some translation tables. However, there might be 600 mutual translations, so the problem is by no means trivial. Concerning the Canon part, they are not aware of the similarities, except for the one the companies that are supplier to both. Since it is a small and specialised factory, they see this by looking at their actual production. In the same way they discover the similarities with the jar lid. These similarities can be explained by the DIN system resulting in only certain standard measures used for exchange purpose.

We also see a deliberate strategy aiming at the after market from the vendor's side, which effectively was punctuated by Bosse Bildoktorn. In fact, his brother is owner of Vinaman.

From an ontological point of view, the grey lid is exactly the same ting in all cases. If this is known by the people working in the vendors, the knowledge can be very useful. However, in many cases this knowledge is not at hand and the companies are producing the same thing in many different contexts.

An interesting question now raises: Could this knowledge be discovered in a more planned way? Could it even be automated or at least supported by an information system? In our mind, it could, rather easily! Both the lid and the chip must have some specification and if you compare those specifications with other chips and plastic lids manufactured it should be easy to detect. The specifications must of course be available for a customer. This is correct at least for the chip, since it is a standard product. The trick is simply to understand what the specification means and how it is used in the specific context at hand.

In order to discover this detailed description and understanding of the physical device is needed. For the chip we have a drawing or some layout but to understand the function from this drawing might not be an easy thing. Realising that Figure 5 represents an adder is by no means trivial.

Figure 5 Layout of an adder

It might be argued that there must exist some other description of the chip than the drawing. There must be some description of the function. Still, adding two numbers can be done in many ways and it requires some analytical skill to realise this.

Concerning the lid, it might be more difficult, since it is not a standard product, it is manufactured for some specific purposes for some specific customers. At Vinaman it was discovered due to the fact it was a small company where the workers saw the similarities between the two things.

However, it is easy to obtain the actual physical dimensions from the drawing, the problem is to obtain the drawing, since it is probably not a public document. There is also the question of the material. A chemical formula might give some hints about the properties of the material, but it does not say anything about the properties needed. Maybe the specification requires and extremely sustainable material, seen from the point of view that the plastic casket is placed in a tough environment. On the other hand, the chip broke every third year, so in practice no longer sustainability is needed. Therefore, the lid of the marmalade jar is good enough.

The issues we have discussed have been on different levels and it is not easy to be aware of which level. The most basic level is a specific instance of a physical ting. As information systems designers we never think on this level, but the workers in the factory, for the customer who buys thing, for them this level is their work, their reality. When we as designers think of a real thing, we think on it on the type level. In the scenario discussion we though of the plastic lid on a type level, we did not thought on a specific lid. I some cases, for instance when dealing with the cars, where the device

is mounted, we have a need for thinking on instance level and this must be reflected in the information systems.

We have also, but only briefly, discussed issues on the manufacturing level and especially how to repair the device. Our main discussions in fact was about certain aspects on the work flow level, that is the structure of the tasks and resources needed to manufacture a car. Also this was on a principal level, we did not discussed workflow of a specific car (for instance Volvo S40), we discussed workflow in general. Our conclusion in this analysis section is in fact on the level of methods for designing a workflow for cars. Naturally, there is also a level of design methods for workflows in general. We summarise the whole picture in Figure 6 (it can be compared to Figure 2)
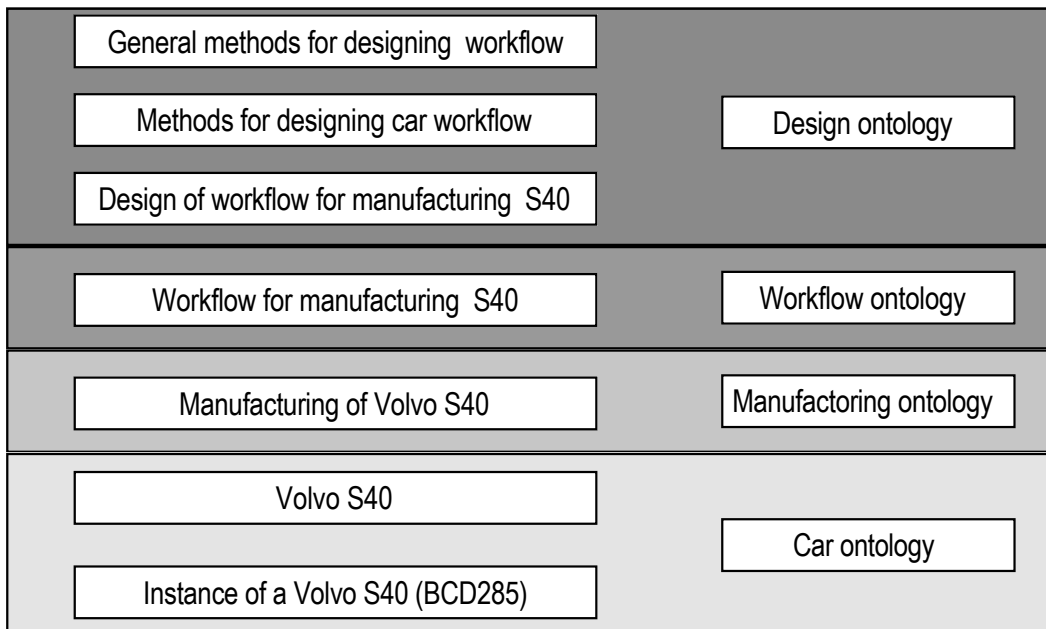

General methods for designing workflow

Methods for designing car workflow

Design ontology

Design of workflow for manufacturing S40

Workflow for manufacturing S40

Workflow ontology

Manufacturing of Volvo S40

Manufactoring ontology

Volvo S40

Car ontology

Instance of a Volvo S40 (BCD285)

Figure 6 Levels in car production and their ontologies

It is to be noted that there are different ontologies used at different levels. We also have an instance at each level, for instance we have a specific Volvo S40 manufacturing ontology, which is a specialised version of a general manufacturing ontology. For the car we have in fact three instances: First a general car ontology, then a specific Volvo S40 ontology and then an ontology for the specific car.

Concerning design, it seems to be a different case. Here we make a difference between the actual design process and methods for designing. This is in accordance with traditional systems development; the project is not the same as a development model. Concerning methods for design, we identify the same difference as between a Volvo S40 and a car. On the

ontological level, however, we suggest the same ontology to be used, since we are actually talking about the same thing: project management!

Ontology – its use and context of use

Our discussion in the scenario wandered between the levels without being aware of their differences, which we in fact often do in our daily life. Our everyday language is very suitable for moving between levels, however in computerised information systems, the levels are extremely important, since the rules are different on them.

Let us discuss the ontology of the different levels in Figure 6. First we have an instance of a specific car (with the number BCD 285). Issues of interest at this level is for instance the repair and maintenance history, the owner(s), used distance, way of driving, name of the car (many owners give their car a name, especially old cars) etc. In the specific scenario we have a device (Figure 3) placed somewhere in the car, but this device is not individually marked, so it is impossible to say anything about the individual device. On this level the issue of interest might be time elapsed since last time the device was changed. Looking at the car type level, the information systems designers usually consider this level as the instance level. The ontology on this level is a description of a specific type of car and it is instantiated every time a car of that type is manufactured.

The ontology of the manufacturing level is different from the ontology of the car level. If the interest on the car level was focused on the car parts we here focus on tasks, resources used for doing a certain task, task allocation and task quality. We can in fact see that the workflow is the ontology of the manufacturing process. All the time we are talking about a specific car model. Designing the workflow is in fact ontology generation of manufacturing Volvo S40.

From a scientific point of view we are not interested in designing workflow for a specific car model, we are interested in methods for designing a workflow. We see some similarities but also differences with the manufacturing levels. Designing a workflow is a work, it is a manufacturing work, since something – a workflow – is made. However, it is a one time work and not as car production, mass production. One time work we call project work and it thus turns out that methods for designing workflows for manufacturing cars are instances of project management and thus a third type of ontology is introduced.

Sticking to a specific car model we have identified three genuinely different ontologies:
1. Describing the car type
2. Describing the work of manufacturing the car type

3. Describing the project for designing the workflow for the specific car type.

The first ontology is described in the drawings and material list of the car. The second ontology is described, at a generic level, by certain branch organizations or standardisation agencies (as for instance ISO). The third level is described in the project management handbook of the specific car manufacturer, which is an instance of a generic project management model. There are some connections between the levels, but how can we ensure consistency between them? How can we ensure they fit together?

In the scenario this was the case and in reality it is also the case. We can approach social constructivism (Schütz 1967; Berger P L and Luckmann T 1968; Cook and Brown 1999) but we can also approach a new trend within information systems: Narrative methods and storytelling. At IRIS27 there were a whole work-group of six papers discussing aspects of it. We thus though a literature review within the area of storytelling could be useful. In this work we found an interesting area in a combination of AI and game design where a huge amount of work was done.

Literature review

A literature review was undertaken and we found many interesting sources. We investigated 5 main sources, namely:

1. IRIS community
2. Story Networks (Davenport)
3. Chris Crawford's "Erasmatron" story engine
4. Mateas
5. Computer Graphics Center in Darmstadt and Rostock

From the IRIS community we found three interesting articles from the last IRIS, among which we choose three (Baruchelli P 2004; Bolin M, Bergqvist M et al. 2004; Clemmensen and Vendelø 2004).

These articles provide a theoretical base why storytelling can be used in information systems and information systems design. However, some more practical experience was whished. We found them in the "Story Networks" which provided descriptions of many projects, both on-going and finished. They were mainly based upon the idea of interaction of many people to create a story. We might use some ideas for our purpose, but it seems to be a rather time-consuming process. The contrary seems to be the case with the research of Chris Crawford, who in his "Erasmatron"

story engine has developed a detailed framework for story-telling more or less, mostly more, automatic. We therefore turned our interest to automation and found Mateas who has written a PhD-thesis about story-telling. He has constructed some robot-based machines, which create stories based upon agents and his thesis is about story-telling agents. We also know that in Computer Graphics Center in Darmstadt and Rostock they arrange a yearly conference within storytelling and we have ordered the proceedings from them.

In the following sections we give a brief description of some of the works we have found.

IRIS community

Clemmensen & Vendelø: Evaluation of Companies' Storytelling on the Web

Their paper describes a procedure for evaluating company web sites. They demonstrate that the visitors (in this case students) choose the company that has a web site with rich narrative qualities above the company that has a web site with good graphical appearance, but poor narrative qualities. In our mind, this is a support for the idea of narration and story-telling

Baruchelli: Theatre and new media: a possible way for participated technology-supported learning?

The paper proposes a theoretical discussion about a possible innovative approach to technology-supported co-operative knowing and learning within organisations. This approach proposes the construction of new media theatre-oriented as learning process, according to a combination of theatre techniques and metaphors, new media language, new technologies and specific training contents.

Baruchelli suggests a theoretical base consisting of:

- constructivism and learner protagonism
- theatre and learner everyday life
- technology and new media and learner language
- social construction and learner participation.

An important effect highlighted by (Meisiek S 2001) is related to the idea that the theatre is a duplicated reality that allows to the audience to compare representation and real life and, watching with their own eyes, they become active part of the same representation, thanks to a *second order observation.*

Baruchelli focus on learning and our focus in ontology use and praxis within the manufacturing industry. The approach is also theoretical and provides more a theoretical background than concrete suggestions.

Bolin et al: A Narrative Mode of Change Management

In the paper the authors propose the use of myths, tales, and stories as triggers in change projects. They claim that: "*Even though there is by now a rather substantial literature on narratives in organization theory, very little research has focused on narrative as a vehicle for change and organizational development*". Their main problem, addressed in the paper is: "*How could we use myths, tales, and stories as triggers on group level in workshop situations in order to create a creative and dynamic atmosphere in which change can be achieved*?" The problem is different compared to the problem addressed in this paper; Bolin et al focus on myths and stories for changing people's mind, while we focus on the same approach for changing a description.

Bolin et al refers to Claude Lévi-Strauss (Lévi-Strauss 1966; Lévi-Strauss 1995), Paul Ricoeur (Ricoeur 1988) and Barbara Czarniawska (Czarniawska 1998; Czarniawska 2000) supporting the idea of organizations using stories and myths as a way to recognize social life in itself.

They also talk about roles and plots in myths. They give an example from Campbell (Campbell 1949; Campbell 2004) where the plot is organized around three stages: "separation", "initiation" and "return". Typical roles are prince, king, queen, princess, trickster, guardian and helper. The roles support the plot that is moving through the three stages: the hero gets a call; he has a helper at hand; the hero is tested by having to solve a number of tasks, e.g. dragon-fighting, crucifixion, finding the elixir. At the end the hero returns and saves the princess. Such a myth can be used in an organizational context to raise consciousness about strategies to solve problems, showing best practice, i.e. to organize change work.

Other examples of roles is given by the authors:

- The Antagonist: The evil, the villain with whom the hero finally has to fight. E.g. troll or an evil queen
- The Giver: Those who put the hero to a test, give the hero a magical object
- The Helper: Assists the hero when it really matters
- The Wanted: The beautiful princess who disappeared, marries the prince
- The Hero: He who decides to act, accepts the challenge, who wins and ascends the throne

- The Mandatory: He who encourages the hero to act, requires the assignment carried out, abundantly rewards the one that carries the assignment. E.g. King or Queen
- The Delusive Hero: Believes himself to be at his best, claims to have carried out a heroic deed, looses by being exposed and punished. E.g. The Looser

These actors can be related to a set of basic tasks or situations that occur in myths as well as in organizational change work:

- Predicament: The problems the actors try to solve
- Intentions: What the actors try to do
- Actions: What the actors do to achieve their intentions
- Objective: The tools the actors use.
- Causality: The effects (both the predicted and unpredicted) of realizing the acts
- Context: The many details surrounding the actors and the acts
- Surprises: Everything unexpected happening in the story.

Bolin et al tested the method on a real company, in fact a merge of two colsultancy firms. This test integrated five processes described by Greenwood and Levin (Greenwood and Levin 1998), namely:

- Create a discourse aimed at sharing different company views, and interpretations of history
- Develop a common vision for the future
- Engage the participants in creative activities, searching for action plans to reach desired goals
- Facilitate a collective prioritizing among action issues
- Link planning to action, action to group and highlight specific actions

The outcome was a set of action issues that participants wanted to pursue collectively.

The authors finally conclude:

Using narratives in group-exercises was new to the studied organization. By using this approach, a completely different way of working was introduced. It did however work well and created a creative climate with many challenging proposals for solutions. One of the goals for the experimental change project was to reach a concrete proposal for price setting. This was achieved in the form of the tale of "Lennart and the peas". (Bolin M, Bergqvist M et al. 2004)

The project's aim was to integrated two different company cultures and make people think in similar ways. This is different from our goal, however the ideas of roles and structures of myths are useful for us.

To sum up the ideas so far coming from the IRIS community: Storytelling is appealing to human beings as shown by (Clemmensen and

Vendelø 2004), there is a possible theoretical foundation within constructivism, ANT and modern organisational theory as shown by (Baruchelli P 2004)and (Bolin M, Bergqvist M et al. 2004). The latter also demonstrates some practical use, which unfortunately not can be applied to our problem. One demand not fulfilled is easiness and few efforts in creating a story.

Mateas: Interactive Drama, Art and Artificial Intelligence

Searching for approaches to storytelling which not requires much efforts we found a PhD thesis of Michael Mateas (Mateas 2002), where he describes "Façade", a system for creating interactive dramas. It is based upon believable agents, which means autonomous characters exhibiting rich personalities, emotions, and social interactions. Mateas claims there has been little work about how to use believable agents for building interactive, dramatic worlds, which means storytelling. He describes an interactive drama as a dramatically interesting virtual world inhabited by computer-controlled characters, within which the player experiences a story from a first person perspective.

In the theory of dramatic writing, beats are the smallest unit of dramatic action, consisting of a short dialog exchange or small amount of physical action. Mateas means that, beats organize both the procedural knowledge to accomplish the beat's dramatic action, and the declarative knowledge to sequence the beat in an evolving plot. Furthermore, the character's behavioral repertoire dynamically changes as beats are sequenced. Mateas dramatic base is a Neo-Aristotelian theory of interactive drama.

Mateas presents *Façade*, an interactive drama system that integrates character (believable agents), story (drama management) and shallow natural language processing into a complete system (Figure 7).
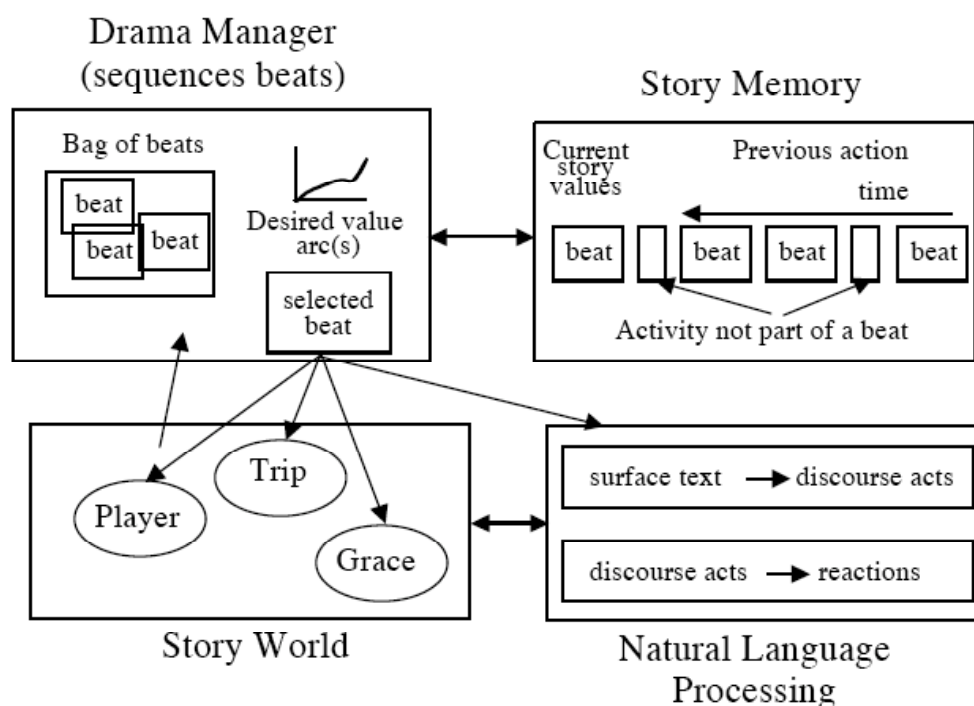
Figure 7 Façade interactive drama architecture

Façade has been developed further, since the thesis was written 2002. It is described at Interactive Storynet[2] as:

> Façade is an artificial intelligence-based art/research experiment in electronic narrative – an attempt to move beyond traditional branching or hyper-linked narrative to create a fully-realized, one-act interactive drama. ... You, the player, using your own name and gender, play the character of a longtime friend of Grace and Trip, an attractive and materially successful couple in their early thirties. During an evening get-together at their apartment that quickly turns ugly, you become entangled in the high-conflict dissolution of Grace and Trip's marriage. No one is safe as the accusations fly, sides are taken and irreversible decisions are forced to be made. By the end of this intense one-act play you will have changed the course of Grace and Trip's lives – motivating you to re-play the drama to find out how your interaction could make things turn out differently the next time.

We see this is not exactly our problem...

The Story Networks Group (Davenport)

At Media Lab Europe we found a wonderful proclamation of the group (http://www.medialabeurope.org/research/group.php?id=9):

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[2] (http://www.quvu.net/interactivestory.net)

Imagine the stories we would tell, if we could construct video movies as easily and playfully as we now use spoken language. The Story Networks group explores storymaking principles and technologies that enhance cinematic story creation and sharing as activities of intelligent play and seeks to discover the empowering and framing constraints of designing these experiences for digital delivery over emerging networks in contemporary social contexts.

The group was founded by Glorianna Davenport. According to the web-page (http://www.medialabeurope.org/people/bio.php?id=10) her research explores fundamental issues related to collaborative co-construction of digital media experiences; where the task of narration is shared among authors, consumers, and computer mediators. Her work combines rich narrative content with customizable, personalisable storyteller systems, which dynamically serve and adapt to a widely dispersed society of audience.

Media Lab Europe was founded 2000 as a joint venture between MIT and the Irish government. All information is fetched and copied from the URL above. In fact 18 projects are described at the page.

Interactive Portrait of the Liberties

Valentina Nisi, Glorianna Davenport, Mads Haahr (Trinity College, Dublin)

This distributed portrait of place takes advantage of the modular, anecdotal and popular qualities of community tales. Inspired by Mairin Johnston's historical account of the neighborhood, location specific stories are been rendered using a range of media techniques for later replay at or near the represented location. In the future, the collection can be augmented by members of the local community.

This project describes techniques for retrieving and store stories, which in our case can be applied to a work station in a car factory. We think, however, it use at the other levels are limited.

Office Voodoo

Michael Lew, Glorianna Davenport

Using physical, graspable voodoo dolls, video viewers manipulate the emotions of the protagonists in this interactive sitcom. The work promotes the idea that a loop-based approach to video story construction can be used in interactive TV stories, which incorporate near-real-time video editing. This work won the new media award at the Montreal International Festival for New Cinema and New Media.

This method might be applied to work flow design. Instead of dolls models of workstations can be used, instead of emotions certain resources and their use can be modelled.

Tangible narrative objects

Jennica Falk, Glorianna Davenport

Sensor systems, wireless networks, hand-held computational devices invite exploration of tangible narrative objects. These objects can enhance role-play in distributed or local narratives. Live role play provide insight into design principles as in players of these games use physical props, costumes and background history to help them transform into their assigned game character.

This technique could be used at the design method levels, which is also indicated in the project description.

Without knowing much in detail, we identify some interesting techniques. However, Media Lab Europe was on the 14th of January 2005 put into voluntary solvent liquidation, since MIT and the Irish Government could not agree upon the founding. The future of the projects seems insecure and since the approaches only covers part of our area we turn to another website (http://robotwisdom.com/ai/crawford.html).

Chris Crawford's "Erasmatron" story engine

The page is an extensive description and link collection about the Erasmatron stiry engine. The background is this:

Chris Crawford has spent fifteen years trying to identify the fundamental psychological dimensions needed for interactive fiction, and with his new (1998) story engine-- the Erasmatron-- he's spelled out his discoveries in extensive Web-based documentation. Crawford's inventions seem to fill a gap that even Doug Lenat's Cyc project had left only vaguely sketched.

Crawford argues that real progress in AI will only occur when we solve the puzzle of modelling human psychology in a way that allows computers to tell stories. This programming challenge requires a new sort of thinking that has more in common with literature than with logic. He further says:

The fundamental innovations include: a model of human memory that allows gossip (via the 'historybook' and the 'grapevine'), a model of microeconomics that allows haggling, a model of human personality that includes some thirty traits, four moods, and eight dimensions of relationship, and a general theory of action that specifies a network of verbs where various 'roles' are defined for each verb, and where various options for reactions are defined for each role, and where 'inclinations to act' can be calculated for each of these options.

The traits, modes etc. are described at the webpage and for those who are familiar with role play games, it is familiar reading. Erasmatron is used to create a "storyworld". Crawford says that storyworlds consist mainly of webs of definitions of verbs. Verbs always have a subject and a direct object, and may have other secondary objects. The subject will be either a computer controlled player, or the 'human actor', or Fate, or Nobody. The story-engine monitors the web to identify opportunities for action for each character, which may then become plans, and finally real 'events'.

Much of the work of creating a web of verbs will be portable from one story to another, so Crawford expect future releases of the Erasmatron to include a huge 'generic story' that moves generic characters thru a generic world.

The most detailed peek that Crawford's site offers of verb-structure concerns dealmaking. It turns out that any simple deal has to be broken down into at least eighteen verbs, to make it interesting. Crawford's example is a negotiation with a hired bully to get them to 'rough up' another character. The resulting verbs are:

- DealForRoughUp
- OfferMoneyForRoughUp
- DemandRoughUpForMoney
- AcceptOfferMFR (Money For Roughup)
- RejectOfferMFR
- HaggleMFR
- MakeItAnOfferMFR
- GooseOfferMFR ('goose' means offer a little bit more)
- GooseDemandMFR
- GiveMoneyMFR
- VerifyDealMFR
- FulfillDealMFR
- RenegeDealMFR
- AbandonDealMFR
- VerifyFulfillmentMFR
- AcknowledgeFulfillmentMFR
- DemandFulfillmentMFR
- AccuseRenegeMFR

Erasmatron seems to an interesting approach. However, it is geared towards persons and relations between persons (roleplay) and not towards manufacturing. However, a great part of the workflow engineering consists of finding suitable sub-contractors. The processes carried out in this quotation might be described in Erasmatron, and thus a part of the car design process could be supported.

Other sources for storytelling

In Darmstadt in Germany, an International Conference on Technologies for Interactive Digital Storytelling and Entertainment has been arranged two times, 2003 and 2004. We did not manage to achieve the proceedings in time for this conference, so that will be one of our tasks in the future.

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