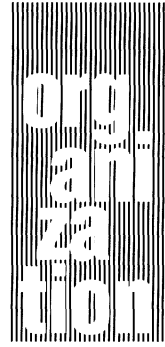


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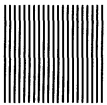
# Narrative Infrastructure in Product Creation Processes

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**Abstract.** *In product creation processes, perhaps even more than in organization processes in general, uncertainties are addressed and complexity is reduced. In retrospect, linearized success stories are told. The history of a product innovation in a biotechnology firm is used to show how actually, over time, attributions and typifications in stories, and the implied stories contained in interactions, link up and an overall plot emerges. Such a social-semiotic analysis identifies the narrative infrastructure which enables, as well as constrains, further actions, just like narrative enables and constrains the characters involved. In the specific 'genre' of product creation processes, the role of 'hero' shifts from the project team to the emerging product itself. Managers and other actors involved can profit from the reflexive understanding offered by social-semiotic analysis, and avoid becoming captive of the path they follow, even though reflexivity may hinder the build-up of thrust in the process.*

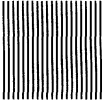
**Key words:** *agency; management; story*



## Innovation, Contingency and Narrative

The management of innovation literature is full of precepts and recipes for 'how to do better', and reinforces rational-control views of product creation processes. Actual processes, however, are much less rational and linear than the recipes suggest they should be. The Minnesota Innovation Studies (Van de Ven et al., 1989) have effectively undermined the received views. Their metaphor of an innovation journey, with its

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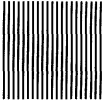
contingencies, its setbacks and its detours, captures the real-life complexities of product creation processes. The metaphor also helps managers and other involved actors to position themselves in a more productive way: they can now see product creation processes as a multi-actor process played out at several levels—which implies they cannot continue as modernist agents: too much is happening which cannot be controlled from one single point. Their role becomes one of repair workers and exploiters of opportunities, rather than rational controllers.

The hegemonic position, with overview and power in one hand, is then replaced by the prudent opportunism and risk-taking which go with entrepreneurship. Stories will now be told in terms of ‘deploying resources, . . . adaptability, and . . . riding with the punches’ (Law, 1994: 75). This is not to say that actors involved in product creation processes have given up ideals of rationality and control, out of despair or out of conviction. Law continues and observes that the perfect agent (in his empirical case, these are managers of a big public R&D laboratory) ‘doesn’t rejoice in the predicament of post-modern fragmentation and celebrate incoherence [but] is a thoroughgoing modernist. . . . As part of this, she can calculate the possibility and desirability of different options’ (Law, 1994: 75). Complexity is recognized, but the idea is to reduce it rather than embrace it.

Here lies our entrance point: how is complexity reduced in practice, and what does this imply for management of innovation? This question has been addressed before, in the Minnesota Innovation Studies and other recent work on innovation, but we do not want to add just another case study. Two specific aspects will be highlighted, which have been noticed before, but have not been given the attention they deserve (and deserve in their combination).

First, the multi-actor, multi-level character of the product creation process implies that the focus should be on interactions. Reduction of complexity is an actor strategy, but the outcomes depend on interactions of strategies in contexts. Any linearity in a product creation process will thus be a (precarious) outcome of such interactions, rather than a necessary feature. Still, a certain thrust develops during the journey, a directionality. We should not assume, however, that this must be the effect of the ‘right’ management.

It has been observed how retrospective accounts—and not just of product creation processes—will have a linear storyline, in which the eventual achievement functions as a goal to be reached from the beginning, and is realized in a number of steps, the stages of a journey along the path that had been visible from the beginning. Given the contingencies of the innovation journey, such an account will often be a simplification and distortion of a more complex process, and can therefore not be used as a guideline on how to manage innovation. There is something to be learned, however, if one realizes that accounts are produced all the time, not just after the journey has ended. There is a variety of accounts: formal



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and informal, technical and social, strategic and operational, for internal and for external purposes. These accounts are linked and build on each other. So, one can inquire how these accounts evolve along the journey, and why they can become more linear over time.

Here, the second aspect we want to highlight comes in: narrative effects. The stories, linearizing or otherwise, told by actors, and which may or may not become dominant, are but one example. More important for our analysis is the overall effect of interacting stories and what we will call 'narrative infrastructure'. The notion of an evolving narrative infrastructure will be elaborated below. Here, we just note, by way of example, how stories that are part of the culture of an organization depend for their force on an infrastructure. When Witten (1993: 97–8) reports the story, current in a management consultancy firm in New York City, about a junior consultant being fired because he did not break out of the traffic line (and drive down a fence, and pass through a housing project) to catch his appointment, her point about the emotional involvement that a story produces is just the tip of an iceberg. Beneath the waterline are the occasions on which it is retold (for instance, when a junior enters the firm), its availability on such occasions and people's awareness of its being available. This complex allows the story to be told in a forceful manner, so that it directs action and interaction, in the same way in which an infrastructure of roads and signs enables and constrains.

Analytically, the important point about such infrastructures is that they help to explain how coherence can emerge in multi-actor, multi-level processes, without any one actor specifically being responsible for it. In the words of Law (who refers to Foucault), 'forms of strategic arranging that are intentional [a product of actor strategies] but do not necessarily have a subject [the originator of the product]' (Law, 1994: 21). His further point, that changes are interordering or interdiscursive effects (Law, 1994: 22), is a generalization of our earlier observation of interaction of accounts.

Product creation processes are one example of emerging coherence, therefore they can usefully be studied with a narrative approach, in the broad sense we use 'narrative' here. Product creation processes may well be a special genre, with a typical form of narrative infrastructure. We shall present a case study of product innovation in a Dutch biotechnology firm to show the nature of this genre. In fact, we will tell a meta-story. While this cannot be a proof, in the full logo-scientific mode (to use a suggestive phrase from Czarniawska-Joerges, 1995), it is one which may help analysts as well as managers to position themselves better in relation to product creation processes.

In doing so, we link up with the debate about postmodernism in organization theory (Alvesson, 1995; Boje et al., 1996; Cooper and Burrell, 1988; Keenoy et al., 1997), with the (overlapping) interest in story-telling and narrative analysis in the management and organization literature (e.g. Czarniawska-Joerges, 1993) as well as more generally, and with actor-network theory, especially in its semiotic turn (Latour, 1984; Callon et al.,



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1986; Van Lente, 1993). We need not enter into a detailed discussion of this literature here.

There is one point, however, which is of central importance to our approach: the question whether postmodernist and narrative approaches remain locked in texts, and cannot say anything useful about action. Our starting point was contingency and complexity, and how it happens to get reduced in practice. Thus, if we take a narrative approach, we must indicate how we resolve this question of text and action.

### ***Narrative and Agency***

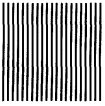
Newton (1996), in a recent article in *Organization*, highlights the tension between postmodern epistemologies and the need for action. Puzzles about 'retreat into the text' (p. 11) can be resolved, however, by taking narration, rather than text, as the starting point. Narration occurs in interactions, informs and shapes action, and makes action into something memorable. The need for action is not something separate from narrative.

The fruitfulness of taking narration in this broad sense is evident in another article in *Organization*, by Czarniawska-Joerges (1995), in the article itself and when it is taken as a starting point for further analysis. For the latter, her idea of a minimal plot in every narrative is important: a first act, describing the original state; a second act, presenting an action; and a third act, in which the changed (reversed) original state is shown, often accompanied by a moral about what has happened. In the way in which this minimal plot is presented, narrative is the cloak of agency.

Our suggestion is that the reverse is the case: instead of agency being first and cloaked afterwards in narrative, agency appears only in and through narrative. In other words, narrative is constitutive of agency. In product creation processes, the project team is constituted and acquires space to work on product development as an effect of prospective stories: 'selling' a lead for a new product and portraying itself as the 'hero' who will be able to achieve the desired new state. Agency materializes in this way, also literally (Law, 1994; Van Lente and Rip, 1998b), and an overall thrust is gradually built up.

Organizational literature often veers away from the basic point that agency and a thrust are created in and through interacting narratives, by looking at story-telling as a managerial tool, as a way to move others to do as one wishes (Boje, 1991; Mumby, 1993; Wagenaar, 1997). However, the manager's own actions are as much a part of evolving narratives as the actions of others that they intend to influence. It is the interactions which determine outcomes, rather than the force of the tool by itself.

When the constitutive role of narrative is recognized, stories become more than a tool: they shape the organizational landscape. Czarniawska-Joerges (1995: 23) considers implications for organization scholars, who must become reflective: 'for transforming ourselves from automatic writers inscribing the truth about reality, into authors aware of the possibilities and limitations of a genre in continuous development'.



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Organizational actors might also profit from being aware of the 'genre' they create and are part of, as we shall discuss in the concluding section.

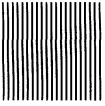
### Concepts and Methods

The product creation process we have selected for detailed study had its setbacks and detours, but was successful in the end. Both the complexities and their reduction can be traced. Before telling the story how narrative shaped the innovation journey, we have to develop the narrative approach a bit further, and give an account of our method of data collection and analysis (particularly, the issue of retrospective accounts).

Narrative in the broad sense is about more than telling stories, as is clear from recent work on narrative identity (Josselson and Lieblich, 1993; Shotter and Gergen, 1989; also the further extension using actor-network theory in Michael, 1996). Furthermore, narrative is not limited to the content of the spoken or written word; it refers to emerging plots in positioning and interaction (Davies and Harré, 1990; Van Lente and Rip, 1998a). There is a body of philosophical and organization studies literature which discusses the constitutive role of narrative (Bell, 1990; Czarniawska-Joerges, 1997; Kemp and Rasmussen, 1989). The key point for our purpose is how the contingencies, even chaos, of ongoing interactions are shown to acquire a shape, in fact a variety of shapes, through the stories told, at the time and afterwards (Harré, 1975; Latour, 1984). Tolstoy, in *War and Peace* (the book taken by both Harré and Latour as their example), shows this in literary detail, and identifies the different strategies of Napoleon and Kutusov to manage and exploit contingencies and the possibilities offered by story-telling.

How to analyse narrative in the broad sense? Consider the phrase 'the setting of a story'. In fictional literature, this refers to the circumstances and conditions, the landscape of the story as it were, into which the reader is drawn, and in which the plot unfolds. The setting of the story is, so it seems, part of the text of the story. But there is more to the setting. The layout of the text, the cover of the book, the expectations of the reader, all these contribute to the setting, and are part of the thrust, and the effects, of the story when 'readers liberate plot and character from the prison of the text' (Newton, 1995: 305). The story is staged in words, as well as in these material and social circumstances. Thus, the narrative contract between reader and author (Bell, 1990: 179), or the author-reader collusion, is more than a wilful suspension of disbelief on the part of the reader. The material setting and the situation are essential ingredients.

Now turn the argument around. If the staging of the text of the story is an essential element of the story, and there is more to 'story' than words and a receptive listener/reader, then one can (and should) take 'story' in a broader sense as a setting, in the broad sense, and the actions and interactions played out in and with it. The actors can now be seen as characters in the overall mosaic of 'stories', and the actual stories they tell are



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one of the elements contributing to the evolving 'story' or mosaic of 'stories'.

It is here that our notion of narrative infrastructure comes in. On a first, and superficial, level there are terse and elaborate stories told by the actors (Boje, 1991). There are 'narrative contracts', but in an ongoing setting, say of an organization, these are mutual and cumulative. The teller of a story has a listener who will respond and become the author of a further story, building on, adapting and/or contrasting the earlier story—always in the broad sense, including material and social aspects. This turning of the narrative tables in ongoing interactions creates a multi-authored and always heterogeneous mosaic of stories. Sometimes, one master story evolves. What always happens is that some of the narrative building blocks continue to be taken up, become accepted ingredients, and, because of their being accepted, orient further action and interaction in the setting (and across its boundaries). The building blocks and their linkages constitute a narrative infrastructure, which enables as well as constrains.

By way of definition, we say: narrative infrastructure is the evolving aggregation of actors/narratives in their material and social settings that enables and constrains the possible stories, actions and interactions by actors. It can be seen as the 'rails' along which multi-actor and multi-level processes gain thrust and direction. When a narrative infrastructure evolves out of the stories, actions and interactions of the actors involved, actors become characters that cannot easily change their identity and role by their own initiative.

While the term 'narrative infrastructure' is new, what it refers to is pre-figured in studies of communicative interactions. For example, the well-known phenomenon of turn-taking in conversation can be studied over time to find out how a shared repertoire is created, and embedded in wider cultural repertoires. Similarly, when Boje (1991: 107) emphasizes how stories are co-produced by teller(s) and hearer(s), in a process in which blanks and gaps are filled in based on expectations and partially shared repertoires, one could also look at sequences over time, and how an infrastructure is built up.

People are engaged in a dynamic process of incremental refinement to the story lines of even very widely accepted story texts. Performances at times refer to taken for granted texts ('You know the story.'). and story performance is a process in which people interact to incorporate culture while rewriting oral history by revising the old stories that anchor the present to the past. (Boje, 1991: 110)

Boje, as is clear from this quote, focuses on what happens to stories. We are interested in how a mosaic of 'stories', in the broad sense, is created out of such stories and their settings, and how sometimes a master story evolves.

Product creation processes can be seen as one genre of such overall



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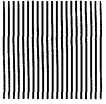
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'stories', and one in which novelty and uncertainty are important aspects of the setting. Actors, in fact, speak of the 'story' of the creation of the compact disc, or the personal computer. In our case study, of a biotechnology firm developing a new industrial enzyme, gemmase (the name is fictional), actors spoke easily of the 'gemmase story', and could compare and contrast it with other such 'stories'.

Narrative analysis of such broader 'stories' draws on narrative analysis of texts. For example, there is sequentiality (or constraints of the past, or increasing irreversibility), not just as a matter of choices being made by actors, sunk investments, etc., but through an evolving narrative. The reader–author collusion (predicated on a shared culture) imposes constraints on what can be said, and, similarly, the triangle of actors, setting, and narrative infrastructure enables and constrains action and interaction. In texts, for example, if character X has been introduced as male, it becomes almost impossible to let him become pregnant. In organizational life, there are role expectations, specific cultural repertoires including warning stories like the one about the young consultant being fired for not being prepared to break outside rules. And there are problem definitions and typifications, including views of what kind of product it is that must be created (which shapes the innovation journey) and views of what various strategic partners mean for the product creation process (which foreclose other options).

This type of analysis is necessary to trace the development of a certain thrust over time in the multi-actor, multi-level product creation process. In addition, typifications develop which become part of the narrative infrastructure and constitute the building blocks for an eventual master story. Successful product creation processes have 'heroes' and 'helpers' (and failures may have 'tragic heroes'), and are thus amenable to Greimasian semiotic analysis of actants in a story (Greimas, 1987). We shall follow their approach only loosely, however, because we are not limited to a written text, and some of the distinctions and figures introduced by Greimas lose their force when the story is multi-authored and interactive. In making this move from textual semiotics to social semiotics, we follow actor-network theory (Latour, 1984; Callon et al., 1986). While some concepts of actor-network theory, like enrolment and translation, as well as some of the case studies (Callon, 1986b), suggest entrepreneurial voluntarism (and have been criticized for that), it is the interest in emerging irreversibilities (Callon, 1991, 1992) and infrastructures (Latour, 1984; cf. also Van Lente, 1993: 212–23) which is important here.

An example of narrative analysis of the thrust of a project and its evolving story is Van Lente's (1993) study of a failed innovation. Particularly interesting for our purpose is his detailed tracing of prospective stories and their interaction, reinforced by assertions that the 'right' thing is being done. It then becomes difficult to say that a project should be stopped, and, if such a proposal is made, it disorganizes and embarrasses



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actors—because their narrative infrastructure does not support them any more. The case study concerned an innovation project aiming to develop a new isolating material, Tenax, important in a world of high-voltage transmission of electric energy, and being pushed based on expectations about its potential performance. Researchers, managers and members of the board of directors told stories of progress (actual and expected) for a number of years—and rightly so, in spite of difficulties, including the practicalities of producing high-voltage cables. The effort to maintain progress became too high, however, and in the space of one month, assessments were turned around. To the surprise of the board of directors and some external allies, the project collapsed, as if it were a house of cards—and indeed, it was a house of cards, because its strength resided in stories that had to come true. Interestingly, the theory about the electric performance of the new material, at first presented as a robust resource, now became ‘just a theory’, and the research institute KEMA propounding this theory was transposed from an ally to the scapegoat, the source of the failure.

Our own case study is one of a successful project, but one which was on the brink of collapse a number of times. We expect to be able to see the dynamics of narrative in the broad sense at work.

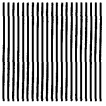
### ***Data Collection***

Reconstructing narrative in a retrospective case study is beset with difficulties. Sometimes, there is enough documentation on the early stages to get a view of the variety and the contingencies at the time, independent of the reconstructions by interviewees. We were fortunate in having access to all the project team files, the minutes, notes and letters, and official documents. These data were used to reconstruct processes and interactions (Deuten, 1994), and as an input for the interviews.

A successful product creation process also makes alternatives invisible, and contingencies along the innovation journey are then seen as noise, or perhaps occasions in which prowess of the victorious hero was shown. Trying, in interviews, to get behind such actor’s reconstructions will then seem to undermine their victory. Even when interviewees do not feel threatened, there is still the effect of outcomes being known, so that events, choices and actions at earlier stages will be presented as part of a development leading towards this outcome. Interviewees will automatically introduce characterizations in terms of ‘right’ or ‘wrong’ (just as watching a play or a movie where ‘seeing’ the storyline enables us to identify heroes and villains quickly).

One way to obviate such reconstructions after the event is to ask the actor to time-travel, and think back to the earlier situation. Documentary data and imaginative stimuli by the interviewer help him to remember the uncertainties and contingencies that were lived through, and get him to tell about them. (We say ‘him’ because most of the actors in our case study, and all our interviewees were male.) In this way, one can, on





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occasion, also see how contingencies were reduced by introducing narratives with a certain plot, which, because of the telling and the linking up with stories of other actors became true.

Another entrance point is provided by prospective stories told at the time, from expectations and the constitution of agendas up to the scenarios for uses of the product and the market assessments at an early stage of the product innovation process. Action is shaped by such stories. Documents of this kind from the project file were discussed in the interviews to find out about their setting and the role they played.

Our two main interviewees, Orlans and Bentrom (these are fictive names), were in a position to see themselves as agents, as persons who made a difference. Orlans was head of non-division R&D and responsible for pushing the project in its early phases; Bentrom was leader of the project team. Both were also natural narrators, and realized how they had been using stories to further their ends. Our method of 'time travel', putting them back in situations where we knew shifts in context or content had occurred (based on the detailed chronology we had set up using archival materials), worked well with them. We asked them to describe, not to justify (or condemn), and obtained materials showing a mix of contingency and purpose, reflecting uncertain responses to setbacks, and exemplifying how they tried to create agency. (Of course, all materials from interviews are joint constructions by interviewee and interviewer. But the construction is not arbitrary, so the result tells us something.) We also heard about the stories they consciously told as management tools, to team members and to other levels in the company. (Further details in Deuten, 1994.)

We shall present our data, in the next section, as indicating the evolving mosaic of stories which constituted the gemmase project. Our presentation implies a meta-story in which a narrative infrastructure emerges, and we shall highlight the meta-story in the subsequent section.

### **The Gemmase Project as a Mosaic of Stories**

Reduction of complexity and uncertainty is important to get a project started at all, but can, of necessity, be only tentative at that time. Management decisions and the resolve to get something going are taken, in retrospect, as the beginning of a project, but are themselves outcomes of earlier and less clear processes. In the case of the gemmase project, within non-division R&D, an old idea about using the enzyme gemmase as a feed additive (to improve the uptake of phosphates) was being reconsidered in the early 1980s. A contact person from the feed sector had told them that there might be a market for such a product. Because of the progress made in recombinant DNA technology, the production of this enzyme might turn out to be cost-effective.

Our interviewees stressed (in line with received views in innovation management literature) that a promising idea or a 'lead' must be trans-



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formed into a clear concept of the technology, the functions, the applications, and with expectations about cost of production and potential market—all this at a stage when very little can be said with certainty. Otherwise, they said, there is no orientation of action, nor can one convince others about the value of the idea. But making a clear concept is not just a matter of listing arguments. Orlans arranged them in a story about a world where gemmase would play a role: as an essential ingredient of animal feed (reducing costs for farmers as well as reducing the environmental burden of intensive farming) and as a key element in the strategic portfolio of his company. In other words, a trustworthy start-out story is essential in the early phase of a project. The start-out story is like a scenario, made robust through linkages with scientific, technical, economic and strategic elements, as well as the credibility of its authors.

Orlans, in fact, insisted on the importance, in product innovation processes, that 'there is somebody with vision and credibility, who convinces the others that this must be accepted'. (Note the use of 'must'.) He was such a person, and without him, he said, the project would not have taken off. Orlans actually spoke of himself as a 'product champion': representing the product-to-be to the world, but with the connotation of being a fighter who turns setbacks into challenges. Such a typification is an easily available role/identity in the repertoire of management culture (and in the management literature). In his case, he presented the promise of gemmase to other divisions, staff and the board of directors, realizing the multi-actor and multi-level dynamics involved and playing on them.

The start-out story was reinforced and convinced the board of directors. Part of the R&D budget was made available by the middle of the 1980s, and a small project team was constituted. A limited in vivo test with a known type of gemmase was done which performed very well in animals. However, within the company, there was some resistance to the project: would there really be a market for industrially produced enzymes in animal feed? There was no way of telling directly. A pessimistic as well as an optimistic scenario existed about the future of gemmase, both of them diffuse. The project team saw its task as making the positive scenario come true. An important step had been to involve a Working Party on Digestibility of Phosphates (*Werkgroep Fosfor-Verteerbaarheid*) of the Community Board on Feedstuffs (*Productschap voor Diervoeders*). The company needed the expertise collected in the Working Party, and, together, they made a detailed planning of the steps in the development and first applications of gemmase. The diffuse scenario became specified, and it was co-authored by credible actors. The content and context of the project plan convinced the board of directors, and the project team could continue and expand. Two things happened at the same time (and are in fact two sides of the same coin): commitment and resources created a protected space for the project plan to be realized, and the project team became a unitary agent responsible for progress, and thus for the necessary repair work.



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The project plan is an important element. It is a prospective story, setting out stages of the innovation journey. Since it is used in communication with higher levels, it is also an account before the fact, and the project team will be held accountable for deviations. The project team has to use the plan as a road map, even while realizing that the road is not there yet, and contingencies have to be faced. Finally, the project plan also allocates roles and tasks internally, and specifies linkages with external actors (within the company and outside it). It is a stylized story, with various characters and a minimal plot.

The team would check against the milestones in the project plan, and work harder if these threatened not to be achieved. When such efforts failed, one had to have a good story to tell the board of directors. Repair work, in the small and in the large, was structured by the need to follow the plan and so to stay on course, rather than only by the need to solve concrete problems.

The relationship of the project team with the board of directors was ambiguous. The regular reporting to the board of directors, as well as the reporting in incidental interactions with them, has a double function: on the one hand, sharing information within the company, in particular with higher management, and, on the other hand, a project team saying to its sponsor we're doing (reasonably) well, please continue supporting us. It is a balancing act, as Bentrom experienced it:

It is important to communicate uncertainties to higher management, although you have to be careful there as well, in my experience . . . You should prepare them so as not to have to surprise them later. On the other hand, if you indicate too many uncertainties, they say 'this won't come to anything, this guy is so uncertain'. [Or in a less personal vein] You have to steer clear from various dangerous rocks. For one thing, you should not raise exaggerated expectations. For another, you should not paint too sombre a picture, otherwise they'll scrap the project.

Clearly, there is a dialectics of promise (Van Lente, 1992). In the case of gemmase, the dialectics could profit from widely shared background expectations about the importance of enzymes, about markets, about regulation, so that Orleans could craft a convincing story and keep the project on its course. But circumstances could change: the relationship with the board of directors came under pressure in the late 1980s, when the company went through a process of strategic re-orientation. The company wanted to go back to its core competences. Enzyme production definitely belonged to the core, but capturing large slices of agricultural markets did not (even though the company had been trying to expand in this direction). Gemmase had to be repositioned to keep its support. Orleans and Bentrom successfully shed the connotation of gemmase as a commodity in the agricultural market, and convinced the board of directors that the company still had a role to play in this market, supplying gemmase as a specialty. The Commodity Board and animal feed firms were mobilized to support this claim.



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The new story was further strengthened by emphasizing the environmental advantages of the product. Apart from the substance of the argument, there were also PR considerations, not just for the product itself, but also for the image of the company as a biotech company in a time when societal acceptability of biotechnological products was an issue. Bentrom:

For some other enzymes produced by the company it was difficult to explain whether there was a benefit to the consumer. So it was noted that it was useful to have a product that is easier to explain. But it was not developed for that reason, of course. This was an additional advantage.

At the level of the company, the gemmase project helped to tell a story about the positive role of biotechnology in society. In the annual reports, the project was regularly brought up as a good example of the contribution of biotechnology to reduce environmental problems.

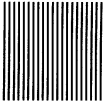
This turned out to be a mixed blessing for the project team. As early as 1987, the board of directors announced to the press that the company was working on gemmase. This was four years before the planned date of introduction on the market. The board of directors probably did so because it could score in the media with this environmentally friendly product (the fact that it would reduce phosphate burdens in agriculture was emphasized). In Bentrom's experience, this created an enormous pressure on their project:

As far as I was concerned, there was no need to do such a thing . . . On the other hand, the advantage is that the company commits itself publicly to this project, so they can't stop it easily any more.

The registration of gemmase was another problem that needed to be tackled, and where many actors at different levels were involved. At the time there was no relevant regulation in The Netherlands or at the level of the European Union, so the fate of gemmase was uncertain. Informal interaction of Orlans and others with officials of the Ministry of Agriculture indicated that there was a possibility of ad hoc admission. In Orlans' words:

This registration question was of course a difficult business. The Netherlands would have to risk its neck in advance of an eventual EU regulation, and defend this in Brussels. [The Department of] Agriculture has had difficulty in doing that . . . We needed Agriculture. On the other hand, it was clear to us from the beginning that Agriculture needed [gemmase] [because it would help them solve environmental problems in Dutch agriculture] . . . We have been active politically, put forward our story there . . . So a story had been established of [gemmase] being an interesting product.

A Director-General in the Department of Agriculture found the promise of gemmase so interesting that he arranged (perhaps after some prodding from the company) that the Minister would come and visit, and hear the gemmase story from the company itself:



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So we had the whole club visiting us [the project]: the Minister and a lot of high-level officials of the Ministry. Our board of directors was there—that was a good thing for us, naturally—and then we told, in all its splendour, the whole story of what we thought was the role [gemmase] could play in The Netherlands, what with the environment and so on, and how far we were now with production. How we expected to have everything ready shortly, but that we needed approval, and what Agriculture was doing about this. But really, in other words, by showing off this whole story again, there was no way back. In this way, we also supported those people from Agriculture who were working on the approval, saying as it were: this must happen now, mustn't it? All the big men were there, so if the people would encounter resistance, they could always say that their bosses had heard that it had to go through. All that helped.

Telling the story to the Minister of Agriculture, externalizing it as it were, created commitments internally, with the board of directors, with the project team. And Orlans and Bentrom realized this, and exploited it.

Public acceptability was also a matter of concern for the project team. Public acceptability is important for every product nowadays, and especially if it is biotechnological (Deuten et al., 1997; Jelsma and Rip, 1995). Spokespersons for public acceptability therefore are important actors to the company. In this case, the company had to convince a Consumers' Platform on Biotechnology that gemmase was important for the consumer, and that it was safe. The environmental advantage of gemmase played a key role in the stories told to the Platform.

These interactions were actually part of a longer process, in which the company had been anticipating issues of acceptability and trying to avoid problems. Orlans explained this as follows:

I have to add that this product [gemmase] was not such a difficult product in this respect. In genetic modification, there are gradations from homologue to heterologue modification, and here everything was quite simple [because homologue, i.e. less chance of unexpected effects], so we didn't have too complex things to do [for registration]. Also, we hadn't used markers or other things which could raise discussion. So we were on the safe side in this acceptability issue.

[Deuten: Did you do all this intentionally?] We paid a lot of attention to it, from the beginning. Like let's not do it this way, because it will create a lot of problems for us. [Deuten: Were there negative experiences in earlier projects on these points?] Yes, we even had a kind of strategy in the company to build up acceptance very gradually, and preferably by starting with 'safe' ventures. So not go out and challenge the world, that would be too risky. [Gemmase] fitted perfectly in this strategy, otherwise we might not even have started the project ... Of course, we had some experience with other projects ... So you can choose the right directions. And we profited, of course, from the great advantage of the product being environmentally friendly.

### ***Setbacks and How These Were Overcome***

In the project planning, a series of activities was formulated. First, the best gemmase had to be found in an extensive screening programme.



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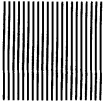
Second, on the basis of the amino-acid sequence of the selected enzyme, the DNA of the micro-organism had to be cloned. Third, a host had to be selected in which a DNA construct for over-expression had to be implemented. Finally, the production process had to be optimized. Meanwhile, application tests had to be done and a formulation of the end-product had to be developed. The planning schedule was tight, and the different activities had to be managed in a parallel way. Delays in one line of activities would cause delays in another line of activities. During the project, smaller and bigger problems and delays occurred. We shall give two examples of how management dealt with these uncertainties.

A major setback, at first not recognized for what it was, was the degradation of the enzyme when the feed with which it was mixed was pelleted. The project planning came under serious pressure. A series of earlier measurements of thermal resistance of gemmase had been quite encouraging, but now, in another set-up for making pellets, the enzyme degraded. When asked about it in one of our interviews, Bentrom said:

I think we did not want to believe it at first. [Deuten: You thought it was a measurement error?] Yes, because we had shown a number of times that pelletization resistance was good. Then you don't let yourself be thrown off balance by one experiment which indicates that thermal resistance isn't as good as you thought. So we said, let's do another experiment. As yet, there's no reason to completely change course in the project. [Reflecting.] We absolutely refused it. That is a bit denying reality. But what if you get good results twice with an enzyme, and bad results the third time, what do you do?

There was the psychological element of having lived within the framework of a story, and not wanting to give it up, since it would mean losing your road map (Wagenaar, 1997). There was also an effort at checking the 'reality'. At the time, it was not clear whether thermal resistance might indeed change in different circumstances, or whether one might perhaps control circumstances so as to minimize degradation of the enzyme. It is only after repeated attempts and assessment of their outcomes that one decides whether to 'change course' or not. During those attempts, the original story and road map remain the guideline. Fortunately, the problem with pelletizing was gradually clarified, and other ways of adding and mixing the enzyme (originally seen as less relevant) were taken up successfully. In the case of Tenax referred to already (Van Lente, 1993), things didn't turn out so well. In this case, the course was changed, for some quite unexpectedly, and the story was adjusted. In both cases, we see how narratives create inertia for a project team in a protected niche. For actors, such an attitude of trying to stick to the original plan can be viewed positively as tenacious, seeing setbacks as a challenge to the 'purpose', but also negatively, as reduced ability to respond to changes.

Elsewhere (Deuten et al., 1997), we have analysed this part of the case history as deriving from an early alliance with one selected lead user instead of a broader range of users, with whom the tests were conducted. After successful conclusion of these tests, the number of try-outs with



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other users was expanded, and it turned out that in their set-up the enzyme degraded. The dilemma for management is that early alliances are necessary, but clearly also a risk, if there are specificities (which one does not know beforehand). Although we do not have quotes from the interviews to this extent, we suggest that the project team was using a story line in which their early user had become typified as ‘the’ user, sufficient to represent all relevant users. In our second round of analysis, we shall indicate such a typification by writing **THE USER**, in capital letters to emphasize its generality. Here, the point is that typification entailed that inquiries about specificities were deemed unnecessary and other users were moved to the background. This is a general feature of typification, and we will come back to it in the next section.

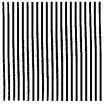
After the near catastrophe of the product degrading under regular conditions of use, the project team tried to work with more than one option—as it were creating alternative scenarios which could be taken up in case the main road map threatened to destroy the prospects of the project. Besides this particular way of reducing, or at least handling, uncertainty and contingency, other ways were visible from the beginning. Schemes and planning were important to reduce complexity on paper, hopefully becoming self-fulfilling prophecies. Experts of various kinds were consulted not just to solve a problem, but also to be aware of possible problems.

Another example of narrative reduction of complexity, which oriented (and thus constrained) action for some time, is the alliance forged with a carefully selected foreign firm, well located in the markets of animal feed additives and expected to be knowledgeable about formulation technologies and about registration procedures. While the project team and the board of directors had put high hopes on this alliance, the specific expertise of the alliance partner appeared to be of little help in this case. The project team had created a character in their story of the product development process, the ally, to play an important supporting role. In other words, they had made a typification, **THE ALLY**. It took quite some time before they could believe that this partner did not avail of superior know-how for these specific enzyme formulation problems.

When looking back on this episode, Bentrom and Orlans still find it necessary to argue that there had been good reasons for the alliance, and/or that they could not be blamed for not checking more carefully. Clearly, there is a conflict between the dynamics of evolving accounts at the time (which can be understood narratively), and the need to present a consistent retrospective account now (which is narratively necessary, because the project turned out to be successful).

### ***Stories as a Management Tool, but Part of an Emerging Infrastructure***

Bentrom and Orlans explicitly used stories to manage the project team. One of the key project management tasks is making one team out of a constantly varying heterogeneous group in which each member works on a



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small part only. To this end, Bentrom made it a habit to tell about overall developments. 'It is a bit of team building.' It creates a feeling of solidarity, of 'us together'. This leads to a shared frame, and to belief in success, a winning mood, and the willingness to put in extra efforts. Orlans' approach was to tell the 'whole story' of the project, so that team members could see their role in the whole. This approach changed how team members saw their contribution: they could put it in the wider context of the project.

When problems arose, stories were used as a way to extend individual team members' memories with institutional memories. This can help in the 'management of sense making' (Boje, 1991), which was particularly important in the last phase of the project, when production turned out to be much more difficult than had been expected. Orlans:

Then, you need to be convincing, with the team, together with this guy [coordinator of production], and say, listen, this is extremely disappointing and by now nobody believes that it will come to anything, but believe me, we've had this experience before and things will turn out right in the end. And that's how it went with the [gemmase] project . . . So, again, it wasn't the first time. That helps you to go on.

The type of story-telling is often terse (Boje, 1991). For the problems with production, Orlans said: 'I've been through that so often, it's as if it belongs'. As Schön (1983) has emphasized, 'naming' a situation or a problem as something recognizable (and which you know how it ends) mobilizes resources from past experience—if only the assurance that things will work out right in the end.

Bentrom used story-telling as a means to motivate his team. He made it a habit to report back to the team what visitors to his stand at a trade fair had said, or what was discussed during the visit of the Minister of Agriculture: 'to give them the idea that the project is not only important for the company, but also for society as a whole'. He saw this as a management tool:

What we emphatically tried to do was to create this 'sense of urgency' with the team members, so that they would put in just a bit more effort than they were used to. When stories appeared in the media about environmental problems due to phosphate in manure, I brought these up in the project meetings, as a message that our customers were really desperate for this enzyme. And, of course, we had committed ourselves to bring it on the market before a certain date. So people accept this bit of additional effort, if you have a clear product concept, so that everyone knows what should be done. My experience is that people then have no problem at all to work an hour longer each day, or come back during the weekend more often. The enthusiasm, the idea that we can really achieve it, is so great that everyone puts up with all that.

Bentrom always put an item 'Information' on the agenda of project meetings, which he used for the purpose of making team members part of a bigger whole:





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Exactly to make people aware of, and in a sense partner in, developments around the project itself. It works better, if one is not just occupied in cloning a gene, but knows what the purpose is, and what one's role is in the whole chain which leads to a new product on the market.

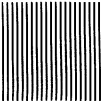
The stories Bentrom tells here are like the external scenarios constructed at an earlier stage to convince others, and in particular the board of directors, that they should support a project to develop gemmase. The difference is that he now uses events, views and stories from the outside to persuade his own team members of the importance of the gemmase project.

The comparison shows that narrative plays a role to go from project to its environment, as well as the other way around. The thrust developing in and through the project derives from the linkages across levels and their precarious stabilization. Telling the project story to third parties, elsewhere in the company, possible external allies, and audiences to be appeased, leads to reciprocal expectations and commitments, whether it is done for substantial or tactical reasons. An author writing a fictional text is constrained by the features of his characters and plot, in relation to the author–reader collusion he wants to maintain. In the 'genre' of product creation processes, there is no single author, and no master text being written. But there is a similar reduction of possibilities (and thus of complexity and uncertainty) which enables the various actors to be productive, while at the same time constraining them in certain directions. Phrased in this way, it is clear that this is a matter of narrative infrastructure.

### **Telling Yourself Forward, and Telling the Product Creation Process Forward**

A certain thrust developed over time in the product creation process of gemmase-to-be. The narrative infrastructure which emerged shaped action and interaction, and helped to create overall patterns in the mosaic of stories so that finally there emerged the gemmase story. It must then be possible to rewrite the case history in terms of characters and (evolving) plots, and so bring out its narrative character (in the broad sense). This will support, by demonstration, our general contention about the narrative character of reduction of complexity and uncertainty, and it allows us, at the same time, to identify key elements of the genre of product creation processes.

Characters in the gemmase story, typified as 'hero' or 'ally,' and phrases like 'telling yourself forward', are used as semiotic categories (in the broad sense, which we denoted as social semiotic). That is, they are not descriptions (in the modernist vein), but indications of plot and character as these emerge—but with strong implications for subsequent actions and interactions.



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The stories told by Orlans and Bentrom to the team position them as a Gideon's band. They are the heroes who have to make the promise of gemmase come true. Institutional-memory stories support this effect by reducing uncertainties: we have had this problem before; if we put in enough effort we can solve it. Stories about the importance of gemmase in the wider world have an ambiguous character: the project team leader uses them to motivate his team, but in doing so also has to set up gemmase as the hero in a story in which environmental problems are solved. A similar ambiguity is visible in the stories for the board of directors, where the project team works for its survival by positioning gemmase as the hero which solves environmental problems as well as public acceptability problems. In the interaction with interest groups, the only hero is gemmase.

This may be a general pattern, which implies that management by story-telling should be located in a broader context in which resources and allies are mobilized and barriers are overcome by versions of the story that are used inside. Management by story-telling, influencing sense-making of team members, is then not independent of the links in those stories with the wider world.

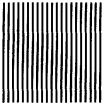
Even otherwise sensitive discussions of organizing by story-telling tend to focus on identity and sense-making, rather than including the work that is done in relation to wider worlds:

The team's identity becomes more intelligible through the story of their success as it unfolds and the more success is achieved, the more the identity will be retained and believed to be real. The identity does not remain static but it will have an appearance of stability and the team's practices and structures will provide a common sense that will be valued and protected if need be. In such circumstances, story-telling will be possible but will merely serve to reinforce an identity which provided participants with a position from which the world can be made meaningful and determinate in a particular way. (Gold, 1997)

Adding the links between the work unit and other levels of the organization, and with the wider world, the setting is recognized as part of the narrative. Thus, one can understand how the structure of the overall narrative reflects the telling of oneself (one's collective self) forward. This is particularly visible in external interactions: the internal interactions and narratives are black-boxed, and the black box is labelled with the intended product of the work ('we are the gemmase Project')—while the product itself ('gemmase') then becomes the main character in the external stories.

### ***How the Project Team Became Part of Its Own Story***

The start-up story sketched a future world in which the product to be developed turns out to be successful and helps the firm as well as customers/users, and it identifies a core group, the project-team-to-be, as the character that must be supported. Roles are specified for various charac-



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ters, who can become co-authors if they are willing to go along—which they may refuse. Such role specification and enrolling have been analysed before, for instance, the electric-vehicle world projected by Electricité de France in the 1970s (Callon, 1986a). In this case, Renault was enrolled at first, but then stepped out of this world, which hastened its breakdown.

At first, the board of directors is a key character, an obligatory passage point because of its authority and power over resources. When the board goes along, a protected niche is created for product development. The scenario for a future world has to be realized by the project team and its allies, and so a purpose is created at the same time. The purpose contains an element of general motivation, but also a story, an evolving project plan that functions as a stylized narrative guiding the various characters. Realizing the project plan creates agency: the project team will make a difference, at the same time as it will put gemmase on the map.

Orlans and Bentrom often positioned themselves as independent agents, enrolling others, mobilizing resources to their own purpose, and framing and telling their stories to that effect. But, telling a story in which you are a character yourself creates constraints as well. You become a character with a specified role in the subsequent stories of the listener/reader and you cannot permit yourself too much deviation from the expectations connected with this role.

The project team positions itself as rising to the challenges of the innovation journey, and so cannot shift tack with respect to its plans and promises without losing its identity. This effect is reinforced by the need to tell, and continue to tell, stories to the outside. If these stories are accepted, the project team is now also a character in the stories of others, and cannot free itself from the obligations these bring with them without losing credibility or otherwise dropping out of the fabric of intersecting narratives it had been contributing to for its own purpose. The burden this creates may eventually become too high and the project team might give up—as happened in the Tenax case mentioned earlier, where the project team suddenly reversed on its promising stories, to the surprise of its board of directors and some of its outside allies (Van Lente, 1993).

While the project team is the central character and has to confront the challenges, it is not alone in its heroic task. In narrative terms, there are allies and subsidiary heroes. The project team's relation with the board of directors is ambivalent. As a benevolent sponsor the board is an ally, but it is also a threat since it can withhold authorization and resources. The project team reports to the board, and makes sure it shows how it follows the project plan, or else has good reasons to deviate from it.

Relevant actors become characters in the overall story. The lead user at whose plant tests would be conducted on formulation, and in particular the behaviour of gemmase during pelletization, becomes THE USER. This is a typification which black-boxes and thus obliterates the variety of circumstances of application. Similarly, the German firm with hopefully



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complementary expertise becomes THE ALLY. In all cases, the project team assumed authorial discretion to locate the character (including the human and non-human actors it contained) as it saw fit—and was unpleasantly surprised when the character went its own way.

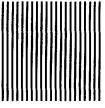
Non-human actors participate in the narrative in the same way. Gemmase-to-be is part of the cast from the very beginning. Genes of *Aspergillus* and the possibility of modifying them in particular ways turn out to play a role in acceptability of the process. Properties of the enzyme are translated into functionalities, cost-effective production in the lab and then upscaling—these are part of the standard story of a product development process, and the non-human actors are assumed to accommodate to the roles assigned to them. Again, rather than allies and subsidiary heroes, they may turn out to be untrustworthy, confusing or even act as opponents in a battle that the project team might not win.

### ***The Product Triumphant***

Specific to narratives of product creation processes is the presence of what we call, for want of a better term, dual heroes. In the start-up story, a promising scenario about a world with gemmase-to-be-developed allowed resource mobilization and the creation of a protected space for a project team with a purpose. The project team is the hero, but, to continue its quest, it has to tell stories about its eventual product: how it will become profitable, how it will help the company present biotechnology as really useful for society, how it will support agricultural authorities in overcoming waste problems, etc., etc. Such stories are necessary, but derive their power from the setting and the interactions played out in it. A narrative infrastructure emerges in which another hero is born: gemmase itself, which will stand triumphant in the end. The project team, because of its own success, will become invisible.

We suggest that this shift from the innovator to the innovation as hero will occur in every product creation process, and necessarily so because the attempt to set forward on the innovation journey inevitably involves the emergence of a narrative infrastructure which has the product-to-be-developed as the main character. In isolated stories, told on particular occasions, one or the other hero will get the limelight (cf. stories as a management tool), and the minimal plot sketched by Czarniawska-Joerges (1995) will be applicable. When the innovation project is seen as an evolving narrative, the complexities of the plot reflect the criss-crossing linkages between actors trying to position others, and being positioned by them. Because their shared reference point is the product-to-be-developed, this will take on a narrative role of its own. When the innovation is successful, it will eclipse the agent which prepared its way.

The converse happens as well, as in the case of Aramis, a failed project for new subway vehicles and guidance systems, described by Latour (1992). It is the tragic version of the 'product triumphant' plot. The innovation fails, and Aramis disappears as a character. In Latour's story, he



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fleetingly appears to Latour's alter ego, asking why he was not allowed to come to life, and accusing the alter ego of faintheartedness.

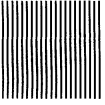
### Reflections

We have demonstrated that product creation processes can usefully be studied with a narrative approach. We have shown how complexity and uncertainty are reduced, and presented as reduced, in accounts building on each other. We let some of the actors speak, while locating them in processes in which an overall thrust was built up at the price of constraints, in which problems were encountered partly because of the way the gemmase story had been shaping up, and where a new hero was born precariously.

We also attempted to reduce the complexities of plots and characters emerging in this way, to make them intelligible and applicable to other product creation processes. For example, the identification of a story about how it all began is itself an origin story, a projection—and thus a meta-story—on the complex and contingent streams of events and interactions at the time, which attributes originating force to some actions and interactions by selectively highlighting them. Such a meta-story feeds into another narrative infrastructure, which enables and constrains the discussion of the nature of product creation processes.

In doing this, we want to reach two types of audiences: management and organization scholars (and actor-network theorists and narrative analysts), but also managers and other actors involved in product creation processes themselves.

Our rewriting the product development process of gemmase enhances understanding, but also unsettles actors. When Orleans and Bentrom read our analysis, they recognized the points we made as real and valuable—but also felt slightly uncomfortable being positioned as characters in a story, and seeing their own modernist terminology between quotes. Managers typically write (i.e. produce texts and stories) in a modernist vein, assuming their own agency, and assuming readers who will follow them in their exposition, and who can be routed and re-routed. If they recognize the possibility of another genre, that of developing an interactive narration in which they themselves are characters, they will be more flexible, and perhaps more reflexive: they can see themselves as characters in a multi-authored story, rather than prime movers who mould the world and the word to their will. We would argue that actors will be more effective that way, or at least can then avoid being buried under the weight of circumstances and reactions that they had shovelled out of sight. We would like to argue that inchoate organizational realities can be addressed better through the second genre—realizing that this argument about how to be successful is itself phrased in a modernist vein. It is because of this conundrum, how to make a difference when one realizes that making a difference does not really depend on one's own action, that we discussed the relationship of text and action, of agency and narrative.



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At a deeper level, agency of the actors is shown to be constructed through narrative. While agency as an independent source is an illusion, stories which introduce heroes and villains and thus create agency, and guide it along, have effect. In that sense, agency is a productive illusion. Some reflexivity is necessary to avoid becoming a prisoner of the illusion. The overall thrust and the narrative infrastructure are the outcome of such interacting narratives. But there is an irony here. If agency is a product of telling oneself forward, rather than the source of actions which make a difference, too much reflexivity will undermine the production process of agency, and there might not be any difference at all in the end.

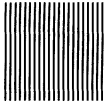
Modernist managers, pushing ahead, seeing themselves as agents making a difference, are telling themselves and others a story, rather than being effective automatically. It is the telling and enacting of the story and the interaction and linking up with other stories which make them effective. Their becoming reflexive might actually destroy their effectivity. So their illusion of agency should be kept intact?

For early scientists, a similar question was raised about the risks of their knowing the actual history of science with its vagaries and contingencies: should the history of science be rated X (Brush, 1974)? In the case of doing science, as well as in the case of doing product creation processes, the answer is yes, when business is as usual. But when it is not, or might not be, a little bit of reflexivity will be helpful.

A general reflexive lesson is the recognition of the duality of creating characters—THE USER, THE ALLY, THE PRODUCT-TO-BE, THE ADVERSARY—which are not only typifications but also actors/authors in their own right, which go their own way. While this can be read as simply saying that one cannot force others to do as one wants, the point is that actors often behave as if this were the case. The narrative reduction of complexity has a strong hold. It is through recognizing these mechanisms, and in concrete situations, that the point is brought home. Meta-stories like the one we developed in this article contribute to this recognition, and stabilize it.

A similar process-related lesson is about constraints incurred by the author of the stories through the irreversibilities that ensue, and so are, in a sense, his own doing. The unreflexive modernist, however, sees constraints as problems to be overcome by a better approach, and/or as obstacles deriving from the environment and to be put out of the way. He may well be successful, but such a 'snow shovel' approach has its risks: the self-created constraints do not disappear, but pile up and may 'bury the shoveller'.

What difference do we want to make in doing the case study and writing it up in an article? Clearly, we want to unsettle the modernist approach to product development a little bit. Modernism is not effective by itself. It needs repair work and therefore sensitivity to its own limitations, or, better, recognition of the processes that produce its eventual effectivity. 'Product champions are important'—this is a received view,



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and a view which is right, but not for the 'received' reasons. Appointing a product champion will not improve a product creation process.

Thus, the recognition of the role of narratives in interaction is important, because it offers a handle on heterogeneity and ambiguity in the life of organizations in rapidly changing environments. Directly, in specific stories and interactions, because 'narrative permits ambiguity and enjoys paradoxes' (Czarniawska-Joerges, 1995: 15), and, over time, in the overall story, because captivity in the path that emerges is decreased when streamlined reconstructions of innovation journeys are recognized as effects of narrative infrastructure.

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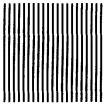


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