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Stiff surprise –

coping with surprising discoveries

in product development processes

by

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Abstract

An incident in a product development project is analysed to see how participants cope differently with surprising situations. This generates cognitive variety in the project team which means that the situation is complex for the individual team member, but also that it is difficult to trace, here and now, causal chains on a collective level. The analysis is made possible by the authors being permitted to videofilm project management meetings and project members responding, individually, to play-back of a video sequence from a meeting they attended with the attached question"What is going on here"?

Introduction

Product development projects, be it in an alliance setting (Gomes - Casseres 1996) or otherwise, have become complex arenas of creativity and discipline. This is due to many reasons like progressing technology, concurrent engineering to shorten time to market, and strict cost control to hit targets in strategic market niches. The margin of error is slim (Cooper 1995), but rewards to superior performance may be great, which indicates that there is a bonus for good situated management in such projects. However the individual engineer, in all likelihood a specialist in some technology may find the fragmentation introduced by all the co-ordination committees and disciplining devices frustrating. Not only are responsibilities multiple but also the requirements different as the same proposal is presented in different fora. Gomes-Casseres (1996) arrives at the conclusion that alliance-based project with strong central leadership tend to get better technical solutions while more diffuse alliances are more successful in the market. Inside a given company the project will be embedded in a specific context of functional department, often with basic research projects the results of which are fed into the product development projects at times that may be most unsuitable from the project point of view. Also there is information from the customer complaints department that may generate improvement projects in the Quality department. Even cost review meetings under the auspices of Cost Engineering may supply ideas from similar solutions in other products. The opportunities for incidents are numerous that might change the intended path of the project and thus the working relations between specialists in a project. One industry with this kind of criss-crossing pressures is the car industry with its overcapacity in production, intense pressure for radical change of engine technology for environmental reasons, but also with strong restrictions of taste and tradition in individual markets still under the influence of fashion exhibited in media-boosted "salons" in many metropols of the world.

How the individual engineer or manager is able to cope with this organised chaos can hardly be studied in other ways than through recordings of micro-processes. Improvements may be found by offering the participants opportunities to reflect upon recorded recent incidents in their own practice. (It would be unrealistic, wouldn't it, to propose that a project should have a Human Resources manager with the right to shout "Time out!" now and then to give people an opportunity to be reflective practitioners (Schön 1983)). Seeing and hearing the own group in action has been found to be a powerful method to stimulate reflection. It is also interesting to note the group

discussion after it has been shown to the participants how the same sequence is understood quite differently by the participants even if they indicated that they were in agreement in real time.

Study micro processes to detect emergent practices

The ontological perspective of this study is that proposals or claims ("figure") are understood against an experiential background ("ground"). Such backgrounds differ between team members partly due to specialisation but also due to learned organisational practices (ways-of-working). Meaning is generated when individuals work out implications (Grice 1989) of what is said (or otherwise communicated) in a specific figure-ground constellation. But members can modify their interpretation through communication ("Do you see what I see?") arriving at a common understanding (decision/commitment/promise) that may be translated into collective action.

How the group arrives at collective action may safely be assumed to be influenced by many factors like individual skills in the specific discipline and in oral presentation, attention levels of other members, Career ambitions, stress and fatigue, as well as complexity of task, and leadership. Moscovici & Doise (1994) have shown how groups arrive at collective judgement on fairly complex issues through "group polarisation". In more structured situations, like project group meetings their theory would predict that participants compromise to reach agreement under the pressure and structure that are typical in such situations, but that they are not likely to change their mind through the discussion. After the meeting they would return to their original beliefs according to them. Moscovici & Moise do not study the process of arriving at a common position in detail, but the explanation that a group tends to arrive at extreme positions (in relation to the original opinions of participants) instead of at the medium is that people with extreme positions tend to argue more intensely and more personally (p. 87).

Things may be different in groups of professionals where participants have specialities and have worked together for some time. One can expect that roles have stabilised and the style of the project leader has had some effect on the ways of working of the group. There is also a background structure of departments and loyalties of individual members which cannot be bracketed out. We want to be able to show how professionals accomplish collective action through debate and discussion, including creative as well as disciplining moments (Jönsson et al forthcoming) and thus we have to study the micro

processes of communication in appropriate meetings. Furthermore we cannot study what goes on in the minds of the participants but we can register what is said with audio/video recordings. We can also elicit the help of participants in interpreting/justifying the arguments put forward in recorded meetings by replaying sequences to individual participants and asking them "What is going on here?"

The stage for this drama is the bi-weekly meeting of the Project Management Group (PMG) of a year model car project. The PMG is the apex of the project organisation where decisions (on technology, time, cost) are taken. There are about 25 members of the PMG. Most of them are "system task" (ST) managers in the project which means that they are in charge of a set of "design task" groups (DT) that constitute the system task areas like Engine, Body, Chassi and Installation, Interior, Electricity, etc. There are also representatives of areas of a less technological character like Business Area X (responsible for sales of this car), Production (does not like too many variants), Quality, Accounting, Technical Documentation, After Sales etc. As mentioned every ST is broken down into DTs (like "brakes", "doors"). The best way to break down a project is a constant topic of discussion. As this is written there are experiments under way with more flexible organisation where teams of the different knowledge areas are located together in an open office layout to encourage concurrent communication across specialities. This means that the functional departments, who have a legitimate interest to keep family identities of components across the product portfolio, lose some of their grip. Also what was earlier considered projects to realise a given specification of a car has increasingly been shifted towards a self-contained business project. The task of the project is to develop a business concept rather than to solve the technical task of developing solutions according to specification. This means that market related arguments become legitimate and more prominent in what was before a genuine engineering culture (Kunda 1992). The project where the evidence reported below was captured was set in the transition period from engineering according to specification to a business development view, but the institutional setting was the traditional one - the project is on contract with the mother organisation.

The project leader, an "engine man," - this year model will install more powerful engines - has signed a contract with the Board of Directors to deliver a design with the contracted properties, at the contracted time, and at the contracted target cost. He has a far-reaching delegation of authority to run the project, but he likes to lead the project" by

participation" in the technical discussions wherever they take place. Therefore the Quality manager of the project is chairing the meetings; moving them down an agenda that contains numerous points, all with a few allocated minutes and a designated presenter. This is a decision making meeting, not a technical seminar, and all items must be well prepared and to the point. But alas! The time schedule breaks down every time because people (and especially the project leader) cannot help getting involved in discussions. So instead of the scheduled 2 - 2.5 hours the meetings drag on for 4 hours or more in spite of the fact that the pace is exhausting, breaks are few and the amount of information passed across the table per minute is quite large. There have been discussions since the start about what could be done to make the PMG meetings more effective. The Dutch members often talk about the lack of discipline among the Swedish design engineers. One way of improving meeting efficiency would be to radically reduce the PMG group to the core team of the project (project leader, deputy project leader, Quality manager and Project Co-ordinator) plus the engineer(-s) concerned from issue to issue. This has been dismissed since the engineering culture of the company (Volvo Car Corporation) has been to organise product development in a way that will keep everybody informed about the progress of the different parts of the joint project in order to run a co-ordinated project by responsible individuals taking the necessary contacts and allow parallel problem solving. Concurrent engineering has been used since before the name was invented as has target costing. Time to market has been shortened considerably even if there are late changes due to late market information or because creative ideas come up. The company is a niche producer of premium cars which makes it an essential strategy factor to keep designs open as long as possible in order to stay tuned to progressive customers. All this requires intensive communication, in meetings and outside.

The project (and, consequently the PMG) is embedded in a large number of disciplining structures which impinge on its freedom of action. The contracted budget is released in 10 portions (Quality gates) depending on whether the project fulfils the prescribed progress in quality and timely delivery of solutions at the respective gate. If the requirements are met "the gate" is opened and funds released. In real project life it is not feasible to stop a project just because a problem with one of the engine versions has not been solved on time. So, a project may be only partly past a "gate". None-the-less the gates set the rhythm of the project. There are also regular cost review meetings (CRMs) to monitor whether target costs are met. An increasing number of suppliers actively

participate in the development of components. Departments (like the Engine Department, which is probably the most "macho" department) have R&D of their own which now and then generates results which the department is eager to include in cars as soon as possible. There is a large number of co-ordinating committees at different levels dealing with issues concerning the alliance partner (Mitsubishi Motor Corporation) and with the planning departments of the joint venture (50-50 owned) production company (NedCar).

It is a complex context by any measure and engineers coming down to Holland from the different departments of the mother organisation expecting to work in the "Volvo-way" are in for all kinds of surprises. Colleagues from the other partners (NedCar and Mitsubishi) have their own ways-of-working and their own notions of what constitutes professional behaviour. Mitsubishi is an accomplished "lean production" organisation. NedCar has been successfully slimmed down to a high level of efficiency over the last few years (doubled production volume and halved personnel, while managing fairly well to produce two competing cars, designed by each of the two owners, on the same assembly line within a budget set by the two owners/customers).

The individual in such a complex environment can apply several coping strategies; one is to protect one's own area of competence from intrusions by never intruding on the territory of others; another is to build social networks and expand energy in anchoring one's proposals by informing concerned parties beforehand and listen to their advice. A problem that tends to shift attention toward the former strategy is the fact that there is frequent personnel turnover in and between projects. One reason is that the organisation wants to improve organisational learning from project experience. Since several projects are run in parallel in search for ever shorter "time to market", and not in sequence as one used to in the old day, it is not sufficient to write a white paper after the project is finished on "lessons learned". Instead the company tries to transfer knowledge by overlapping project personnel. As a consequence the individual engineer has difficulties keeping track of where he (this is a male world!) is, which is in contradiction to the aim of keeping all members well informed by having them participate in PMG co-ordination meeting. By listening to the other presentations one is supposed to know what is going on and the individual is able to relate his own actions to those of the others. The problem is that car projects are very large and there is so much information. Information overflow might lead to the use of stereotypes as a strategy of coping by reducing the amount of

information to integrate (Schroder et al 1967). The more established an engineer is in the project and in the environment the more complexity can be absorbed and dealt with simply by using the social network and known sources of knowledge to circumvent obstacles. But sometimes old sins strike back....skeletons fall out of the cupboard. Then norms have to be re-established or designed de novo. The rules of the game of a project constitute its ways-of-working and this is the basis for framing issues and presentations, to get decisions that move the project ahead.

In the spirit of ethnomethodology (Garfinkel 1967, Agar 1986) and "micro-realism" (Czarniawska 1999) we have followed two car projects carried out in relation to a alliance around a joint production company for two competing car companies (Mitsubishi and Volvo) in Holland. Extensive interviewing, participant observation and videorecordings of meetings provide a rich empirical material from which a small sample is analysed in the following. From videorecordings of meetings short sequences were played back to participants individually with the question "What is going on here?". Answers in the form of interpretations and explanatory background information was audio-recorded and transcribed. We have found that the video sequences are powerful stimuli to elicit descriptions of relevant context that gives meaning to the conversation in the meetings ex post. However, we have also found that participants tend to interpret/explain "what is going" on differently, seemingly related to their experiential background and their degree of participation in the exchange shown in the video sequence.

Hoopes and Postrel (1999) argue that the capability of a company to integrate the different activities and competencies involved in a product development project will have effects on the competitive strength of that company. The belief in organisational integration to be the driving force generating superior performance has found solid backing in 30 years of empirical product development studies. Typically these studies have focused on structures and procedures used in different product development processes and correlate those with performance in terms of quality, speed. engineering hours etc. . Clark and Fujimoto (1991) is an example with data from the car industry. The consensus, as summarised by Hoopes and Postrel (1999), is that the important integrating aspects are:

a) "thick" communication among concerned specialities early in the project

b) a need for 'boundary-spanning' individuals with interdisciplinary knowledge as well as organisational clout,

c) a search for solutions to problems should be system-wide rather than local.

In each product development practice there will be a set of rules of project management designed to secure that such integrating aspects are taken care of. Still communication failures occur. Hoopes and Postrel (1999) identified "glitches" ("unsatisfactory result on a multi-agent project that is directly caused or allowed by a lack of interfunctional or interspeciality knowledge about problem constraints" p. 843) as one type of communication error (when "shared knowledge" is missed). The others integration mechanisms are "co-operation" and in "co-ordination". The first is defined in terms of individuals' motives, incentives and institutions, while the second is defined in terms of 'technology', i.e., dispersed data, communication capacity, stochastic error, plans and protocols etc. It is obviously difficult to separate errors in these three integration mechanisms but Hoopes and Postrel chose to focus on "glitches" which were identified through ex post interviews of participants in a soft-ware development company (217 projects in one year). Their procedure for identifying glitches (beside two participants from different functional areas naming the event as a cause of error) is illustrated in the following flow chart of glitch syndromes (after Hoopes and Postrel 1999, p. 858)

1. Does one party know knowledge item "k" while others do not?
        (No -> no glitch over "k"/yes -> go to 2.)

2. Is "k" a critical item?
        (No -> no glitch over "k"/yes -> go to 3)

3. Is an integrating practice used that might communicate "k"?
        (No -> glitch over "k" (1)/yes -> go to 4.)

4. Is "k" raised as an issue?
        (No -> glitch over "k" (2)/yes -> go to 5.)

5. Is "k" understandable to the initially ignorant party?
        (No -> go to 6./yes -> no glitch over "k")

6. Does initially knowing party realise that other party is ignorant?
        (No -> glitch over "k" (3)/ yes -> go to 7.)

7. Does initially knowing party raise an alarm?
        (No ->glitch over "k" (4)/yes -> no glitch over "k".)

We have four types of glitches;

(1). When the integrating mechanism that could have transferred the knowledge "k" is not used (11 cases identified).

(2). When "k" is not raised as an issue even if there were procedures in place to do it (0 cases).

(3). When those who possess knowledge "k" do not realise that the other party is ignorant (7 cases).

(4). When those who know "k" choose not to sound the alarm (2 cases).

It was found that over all multi-group projects of one year 17 % of total cost was caused by extra man-months due to glitches. These results denote a step forward, beyond the counting of co-ordinating mechanisms in use which was typically used earlier, but they cannot be generalised and there is bound to be overlaps between the categories of integration mechanism errors.

When it comes to mapping the causes of error (in the glitch case) it is interesting to note that no case was found in this company where co-ordination procedures "missed" a critical item. Mostly glitches were due to time pressure (procedures not used) or that the project worked together with outside partners with other ways of working. Points (3) and (4) above stand for situations where knowledge is "sticky" (Hippel, 1994), i.e., when information is tacit and cannot easily be transferred (for example the ignorant party could only be informed after elaborate education in an area where he or she is not a specialist). The knowledgeable person gives up before even trying. It is just a hunch anyway.

Interesting in the perspective of interaction between the three types of integration mechanisms is that to the extent that an organisation is able to co-ordinate (that is specify work and time schedules) there may be an opposite effect in the suppression of creativity.

We claim that there is another step to take in the analysis of the effects of integration mechanisms and the need to complement them through studies of process. We cannot observe what goes on in the minds of participants but we can observe communication project meetings (the purpose of which is to integrate activities and check that the other mechanisms are working. Obviously a large amount of data must be collected if the

communication process concerning all "glitches" is to be mapped. This is tedious work but in time we may possible have the knowledge to diagnose "glitch syndromes" early enough to avoid their effects (or at least avoid repetition).

It is, however, likely that the syndromes will be different in different environments. Hoopes & Postrel (1994) did their study in a software development company where properties of a functioning product is fairly well defined and projects fairly small in terms of "engineering" hours, and in number of specialities. In a car project, such projects are among the bigger ones among all industries, it is also difficult to trace effects due to the fact that goal dimensions may include criteria like "joy of driving" which obviously is more difficult to measure than "safety".

Our video material from two year model car projects in an alliance setting includes one sequence that may serve to illustrate how a glitch may be discovered and how difficult an estimate of the consequences may be. Such difficulties add to the complexity of the situation as seen by the individual which may generate the use of stereotypes (with detrimental effects on propensity to cooperage) or increased reliance on co-ordination techniques (with detrimental effects on collective problemsolving and creativity).

The sequence
The project is charged to develop next year's model of a car that has been on the market for a couple of years. This sequence from a project management meeting originated in a progress report from the Quality department about the situation concerning road noise in the current year model. Auto companies subscribe to customer complaints statistics and collect continuously information from their service organisation as well as from the production department and from the testing department. Such information is analysed and improvements are channelled into new projects, but they also occasion Quality department projects to investigate causes and initiate remedies as soon as possible ("running design changes"). One such quality department project is charged to find ways to reduce noise. Adam, who is responsible for Properties in the project and a NVH (noise, vibration, harshness) expert is also leading that project. Since his findings are directly relevant to the year model project he is reporting on the current status of that study. This happens fairly late in the meeting, more than 3 hours have passed, and people (about 20 participants) are exhausted.

This is an important point for the project since the main push of the project is to install more powerful engines which will increase speed and the significance of road noise. Adam, the properties man, is through presenting what has been done and is in the process of talking about what will happen next in the series of tests with different configurations of wheels, tyres, and softer bushings in front and rear wheel suspensions – Bert, the deputy project leader is supporting with inserted background information - when Charles, the project leader, discovers something that calls for an explanation... Why does the car have bushings that are stiffer than specifications today?

The sequence is first reproduced as transcribed and then the comments of participants when reviewing the sequence is reported.

Sequence "Stiffness", PMG, 19 February 1997, 17.22 - 17.25

Legend:

Lines of the conversation are numbered 1 - 35

Pointed brackets, <....>, denote comments on what goes on beside talk

Squared brackets, [1....]1, denote overlapping talk

PPQC stands for the sub-department in production that is in charge of quality assurance in production.

Adam <pointing at a diagram on the white board>:
1   .... in order to improve somewhat here,

Bert <talking to Charles>:
2   ..and parallelly,[1..]1 in week thirteen the final results.. all the
3   tests will be done by (test unit) .... then we will have the
4   total....including all the tyres.... because they have only measured
5   the Pirelli tyres yet

Adam:
6   [1not audiable]1

Adam:
7   and in[2 that week..]2

Charles:
8   [2 in what]2 configuration... with the 12 thousand?

Bert:
9   ..with the 12 thousand

Adam   < still standing at the white board, pointer in hand>
11   with the 12 thousand as well as <raising his finger> with the
12   corrected rear wheel suspension bushings. Because the rear
13   wheel suspension bushings are far from spec. as well <pause>
14   So that is the first part of it

Charles:
15   uhum

Adam:
16   but what we want to do... let's say .. to go back to how it was a
17   long time ago..

Charles:
18   How come we have the wrong bushings in production... David (in charge of Chassi
and Installation)...
19   Do you have any idea of that... isn't PPQC aware of this?
<putting chin in hand, Michel, across the table, already has chin in hand>

David   <at a low voice>
20   ....probably not....

Bert:
21   Eric (representing Production Planning)!?

Charles:
22   Fred (representing Purchasing)?

Bert:
23   Fred?

Charles   <turning to Fred>:
24   It is very strange for me here that we have the wrong stiffness
25   of the bushings today... 19 thousand in stead of 12 thousand
26   Newton per something.. hehe.

Fred:
27   Reject parts?

Charles:
28   Yeah! That's my question! Why are they not rejected?

Fred:
29   Rejected? I don't know. This is new to me!

<pause>

Adam:
30   That is a relevant question, but that is the fact...

Charles   <looking at Adam>
31   Yeah, but,,,of course... we can get any properties of the car if
32   we...

<Rapid discussion, short questions and answers, at the other end of the table among the Production representatives, barely audible, "Are you aware of that XX? I can check! You should check both! Together! Is "test unit" ...using the xx- method? Yeah! It is normal procedure..." ending with Gus (Prototype building) saying: "There has been a lot of questions on how to measure...">

> Adam:
> 33   No.. but.. please
>
> Charles   <raising his hand in the direction of Adam to recognise that he is right>:
> 34   Let's not... okay.. We will get a check on this..
>
> Gus:
> 35   There is an analysis on...

- end of sequence -

What is going on here?

Adam (Properties) reports (supported by Bert) on the work of the task force on road noise. It has been mentioned that the bushings for the front wheel suspensions are much harder then specification and that generates more noise than necessary. But it has also been pointed out that the conclusion of the work done so far is that changing the bushings is not likely (based on simulations) to give much improvements in terms of noise reduction. The action program to be set in motion consists of several actions, each expected to provide a few decibel improvement. The meeting has just discussed the wheel suspensions in combination with different tyres indicating that there might be some improvement there. Bert says that tests with all kinds of tyres will be finished soon (lines 2-5 and when Charles asks about which configuration are used in those tests (line 8) Adam says that it will be with bushing stiffness of 12 thousand Newton /square cm plus a corrected rear wheel suspension because that is also far from spec. (lines 11 –14). Then Charles asks how come that we have bushings far from spec. in production today. Why are they not rejected? (lines 18-19. Since he does not get an answer, he turns to David who is responsible for (Installation) handing over the project to Production fit for production to specification. He does not know. Fred and his colleagues from Production cannot answer, but they are embarrassed. There is accusation in the tone used by the inquirers and nobody has an easy answer. The accusing eye of the project (project leader and deputy project leader together) stops at Fred who tries to gain some time to think by

asking a question to confirm that he got it right, and says that this information is news to him. Adam feels the atmosphere getting sour and tries to keep focus on the issue which is what to do about it now that we know that the bushings are too stiff (line 30), and then gets the meeting going again with his "No... but.. please" (line 33). Outside the sequence itself Charles ends the exchange by stating that this should be checked and by emphasising that he wants to make damn sure that this kind of production outside specification does not happen to his project.

An interesting aspect of this exchange is that the meeting is thrown into a detour but regains its direction. Adam is reporting on his project, but Charles associates to routines and gets caught up in the mystery how this can happen. It is not part of the project since because it is already in production. Adam knows that there is not much to gain by changing the stiffness of the rubber bushings used anyway and wants to get on with his project report. Fred and colleagues from Production are caught by surprise.

Interpretations by participants (speakers).
This exchange is described by many commentators as confusion and the analysis will show 1) an interesting background and 2) severe communication problems. First the comments by the participants when this video-sequence is shown to them individually c.a. 2 months after the event are summarised with the active participants, who are expected to be more detailed in their comments, and then participants who were not active in this particular exchange. The participants were shown the sequence as the last in a series of 6 sequences with the question "What is going on here?". The answer was audio-recorded and transcribed. The initial response to the What-is-going-on-question usually occasioned follow-up questions asking for clarification of what was said earlier.

Charles, the project manager, labels this a job 1 matter ("Job 1" being the original design of the car that constitutes the starting point for further developments in the year-model projects). The basic problem is the balancing of handling and noise. With stiffer bushings the car is easier to handle, but the road noise level is higher. Early in job 1 there was a discussion between the alliance partner and Volvo representatives on properties and the Japanese chose a stiffer bushing (for better handling) and Volvo chose a softer bushing (for less noise). Charles, being an engine man himself and harbouring a preference for handling, especially with those new turbo engines being installed, is a bit uncomfortable when commenting on this sequence. He has a memory of an early "properties meeting"

where a "handling" camp was arguing with a "noise" camp lead by Adam about the Volvo position. The original specification that came with the platform from the Japanese partner was a 19.000 Newton/cm stiffness. Then there was a compromise on 12.000 for Volvo's part while the partner stayed with 19.000, but for some reason the supplier continued to deliver 19.000 and Purchasing could not discover the mistake because the drawings and specification were not changed to 12.000. Now the problem has been corrected and the softer bushings are being introduced as fast as possible as a running change. It was discovered after the meeting that the root to the problem in this sequence was that the specification has not been changed to 12.000 Newton per square cm as was decided earlier. Instead it continued to say 19.000 and thus Purchasing, the supplier as well as Purchase Quality Control have all done their job. The culprit is some engineer in David's unit who has forgotten to change the specification (engineering change release not entered into the proper database). Charles sense of uncomfort may be due to the fact that he might have signalled that he did not like the compromise and "the culprit" may have acted in that spirit.

The series of names mentioned on lines 18 - 23 follow the line of responsibility. David is responsible for specifications. If he has done his job, then Fred, who is responsible for purchasing and the contacts with the supplier is responsible, and if he has done his job then it is the plant, probably Production Control (Eric), since they are responsible for inspection of incoming goods. The noise problem also is more sensitive for this project because by the fact that this more sporty year model cars have rather extreme, low profile tyres.

Adam (who sometimes hears his surname jokingly pronounced in a distorted way to sound like "noise") sees the sequence as an example of communication problems. He gives the same background from job 1 as Charles where there was a clear decision - to use the softer bushings - in which Adam participated and where the suppliers were committed. An interesting aspect of this is that in the beginning the alliance partner put priority on handling and the stiffer bushings. But then when Volvo started to change they followed and changed priorities from handling to noise but they stayed with their own solutions and it turns out that now, in one of the bushings they even have softer material than Volvo. Adam believes that people, Swedes, have simply failed to introduce the decided changes in the specification. Now, a week before the interview, a PEC (Product Engineering Change) has been sent out to return things to the solution that was

intended in the first place. As to the noise problem this does not contribute much to the solution. It is a matter of complex, high frequent road noise which is especially problematic in Sweden with its cruder road surfaces. This is not a new problem. There was a discussion from the beginning with Japanese partner that this wheel suspension could not live up to European noise standards, but they wanted the car quickly to market so there was no change to begin with. Then on top of that there has been decisions in this project to switch to larger wheels and low profile wheels which add to the problem.

About the exchange itself Adam regrets that the meeting got derailed from pursuing what to do now and instead focused on who is responsible. He also recognises that he was not clear enough in his presentation. Then there was a lot of discussion and one becomes passive trying to follow what is being said, and in that way one loses the initiative. Adam feels that he could have made a better contribution to keep the discussion on track. Philosophising about his role as noise specialist he claims that he feels that he does not get very good feedback in general on his presentations (probably because he is the expert), and as a consequence he turns vague and when he does get a reaction he often has to make quick decisions on the spot about what further information to present and then he tends to loose the audience.

Bert, the deputy project manager first points out that this car is charged to be leading in its class on many properties so there has been a task force on noise. Then he explains the problem of balancing between handling and comfort and states that the tests have confirmed 12.000 Newton stiffness as a good balance. Also it is clear that Purchasing and the supplier have not made any mistake since it says 19.000 in the specification. The interesting thing is how these 19.000 got there in the first place. Maybe there are different kinds of measurements involved (Note that Gus tried to introduce this explanation towards the end of the sequence). It easily happens that people mean different things with the same expressions when several parties interact. This has to be analysed. The bushing problem is now solved, but it is only one out of 40-50 points that the NVH (noise, vibrations, harshness) task force is working with.

David, responsible for Chassi and Installation, first asks if the sequence was from a TMG (the meeting where technical problems are discussed) indicating that this kind of discussions should not take place in the PMG (which is a decision making meeting where all the details must be worked out beforehand). Then he brings up the balancing

between handling and comfort and that obviously the change to softer bushings was not properly documented in the specification. He also points out that measurements are a bit ambiguous here. It is possible to "measure oneself inside" the specifications given on the drawings. There has been follow up discussions with suppliers and measures taken. The change (to softer bushings) is implemented, but it has not had much impact on noise. On the other hand the supplier has come up with better ideas, different rubber mixes, which will give greater stiffness in other dimensions. This is an area where you are never ready. New things come up and you want to implement them.

Eric, representing the Production Control department of the joint venture, points out that in some cases the quality check is done by the supplier. He does not know in this case. He was surprised by the statement that there were parts used in production which deviated from specification. He had not heard about it in spite of the fact that Production Control follows up on production items as well as project items. Anyway this issue should not have been brought up in the PMG, because it is outside the project. Even if it effects the project it should be discussed separately. Volvo should have spoken directly to the quality department to establish facts and take appropriate action.

Fred (Purchasing) points to the confusion that arose when some people said that the bushings were outside specifications. Purchasing took the challenge and checked the systems and there were no remarks. Fred had talked to Adam after the meeting and asked him to give more information about when this deviation from specification happened. No rejections have been registered. The matter was going to be investigated. But there has not been any feedback. The point seems to have disappeared since it has not reappeared in later PMG meetings. Maybe they have direct discussions with the suppliers. Another explanation may be that they took the point to the special task force on noise, and then Fred is not informed since he is not a member of that team, a colleague is representing Purchasing there. The information may have gone a different route. Fred is reacting as an outsider in spite of the fact that there was an accusative tone towards Purchasing (which organisationally belongs to the joint venture) to start with. He portraits himself as outside the information flow. A year later he had left Purchasing for another job.

Interpretation by participants (non-speakers).

The project co-ordinator (who keeps the minutes on decisions) points out that this is really a detail matter which generates confusion by the way it is presented. After the meeting it appeared that the discussion was mistaken. There is no good analysis to start from. Somebody kicks off the ball and everybody is getting into the discussion and it goes in circles. Charles cannot make a statement because he does not understand the problem (Why are the bushings in production outside specification?). So he kicks the ball towards Fred and Fred is now irritated because it is the first time he hears about it. So it is a very serious situation. David, who is the owner of the bushings (specifications), doesn't know but he is very cautious not to make any wrong statements. It is a waste of time, 25 people sitting there, to bring up issues like this. "Afterwards it appeared that this whole accusation was wrong. Apparently we have a noise problem, but not on the basis of this accusation." The project co-ordinator tells a story to illustrate the dangers of bringing unprepared problems on the table: "You are talking for half an hour and you get an action point and then put it on the action list. Then after two meetings the action point is gone because nobody remembers what it was about, because there was no real point in it."

"Interior," points out that this concerns the complete vehicle requirements, which the task force on noise works with, and tests show that we have a large deviation on low frequency noise and confirm that the stiffness of bushings in the wheel suspensions, front and rear, are outside specifications. An interesting aspect is that the alliance partner has exactly the same problems with the same supplier. There must be something in their process which does not give "conformity of production" as they call it. The problem is now solved in the sense that the noise group which is working at headquarters and chassi also at headquarters have changed the specifications to lower the dynamic stiffness of the bushings. Now the quality check on incoming goods have the right specifications. Six-seven different stiffnesses have been tested.

This problem should have been discovered in sample checks in the inspection of incoming goods, but they are probably undermanned and as long as there are no problems they will let them go direct in production. They prioritise problem spots in their work. But the suppliers are also contracted to deliver goods inside specification. The problem should not have been discovered by us.

Interior has a functional interest in comfort and has been in the alliance setting since the start. He likes to show that he is well informed and has the connections to "fix" things. He has been observed as a shrewd negotiator in cost review meetings.

"Body" has been in the alliance setting from the start and is well "networked." He draws the conclusion that the situation was a bit chaotic to start with. Everybody is not knowledgeable about everything and unit managers make changes that other unit managers are not aware of. There is time pressure, everything must be done in a hurry and situations like the one in the sequence emerge. It seems like Adam had inherited a problem there. We have many components from the alliance partner platform and in the beginning the joint venture engineering department did some design work. "Properties" came into the organisation later. We did not have a proper check on the product from the beginning. This kind of surprises happens with Body and other units as well. These aspects was never sorted out in the meeting.

"Electricity", has to be on the alert through meetings because many changes initiated by other units. He is surprised; if such deviations from specifications were discovered how come that Purchasing did not know about it? If there is time this kind of things should be checked before they are brought up in a PMG meeting. It might be that a deviation has been accepted before but cannot be accepted in this project (because of faster cars?).

The Electricity manager associates this incident with the fact that electricity is spreading more and more all over the car and how this should be dealt with in terms of organisation of the electricity unit's ways of working. Electricity has to have a very broad knowledge of the car and broad contacts because cabelage and micro processors are effected by almost all changes. He is not informed on what has happened with this issue after the meeting (and that is why he seems to be a bit uncomfortable about this sequence?).

The project accountant feels that the discussion here is on a technical level. It is a side-track from what Adam was really talking about. Fred gets the question on whether he is buying the wrong bushings and the only thing he can say is that he will check. The accountant knows that there has been a decision after the meeting not to introduce these new bushings because they did not give any improvement.

Quality Assurance reacts to the generality of the discussion. The PMG is not the right forum for this kind of discussion. In the PMG you are supposed to think about the project, and this has nothing to do with the project since it is about a component already in production. If anything it is a running change. By the way it is remarkable how long it has taken to come to terms with this old story about the noise. The task force has reviewed all potential problems and come up with this bushing problem among many others. As far as Quality remembers the result of this was that there was no change but a return to the old solution.

Reflecting on the structure of the exchange in this sequence and other sequences Quality points out that in the PMG, the decision meeting, all participants are supposed to think in terms of the whole project. (It is in the TMG meeting that one could focus the discussion on a specific technical issue). But when you look at it it seems like most of the time the discussion is between the presenter and the project leader and the deputy. The others do not take part (except when they are directly implicated as in this sequence?). In this sense the project does not seem to do a very good job to engage all specialities in the project management discussion.

"GDI", a Frenchman who is in charge of installing a new engine that has been added to the project after it started and, thus, by being under strong pressure to "catch up", is especially concerned with time. He comments on the sequence in terms of procedures. On the one hand it is good that issues like this are brought up so it can be determined who "owns the problem". He points out similarities to another noise situation. It seems like this kind of situations are brought about by Adam making too long presentations that become too technical. A more effective way would be for Charles to "take the ball," pass it to the right person, and tell him to come back with an answer. By and large it is a fairly good solution that emerges in the sequence. Fred will check. The problem has been placed with somebody.

Communication and surprises.
This sequence illustrates the problems with surprises in meetings. The matter at hand is really a detail and the conversation turns to the stiffness issue almost by accident. A list of activities to reduce noise is being presented and on one of the minor items Adam happens to mention that the test with different brands of tyres will be done with the "corrected" rear wheel suspension bushings. This causes Charles to ask why we have the wrong bushings in production in the first place. The people responsible for production

and logistics are challenged to respond and since they do not know they are embarrassed. Hence the vivid discussion between lines 32 and 33. The incident seems to remain most clearly in the memory of the project co-ordinator and Fred. They think about it as an accusation, while the project people, e.g., Adam, Charles, and Quality Assurance, think about it in terms of the history of the noise problem. It should be noted that when Adam tries to intervene in the discussion with his "No..but..please!" (line 33) Charles seems to realise immediately that this discussion is not leading anywhere and that the proper thing is to check the facts. Adam, in his comments, regrets that the meeting got hung up at this point on finding out who was responsible rather than talk about what should be done next.

If we look at this incident from the perspective of the three integration mechanisms that Hoopes and Postrel (1999) mention:

Co-ordination (the planning technology applied, procedures and systems),
Co-operation (the motivation of individuals, incentives, team spirit, leadership),
Knowledge Sharing (distributed knowledge is mobilised when and where it is needed),

we find that all three mechanisms are implicated. The project co-ordinator, who by definition will think in terms of co-ordination starts his comments with a statement that a presentation at a PMG meeting should be backed up by a proper analysis of the problem (and then there will be a decision which will be carried out as intended). This is the rational thinking while implementing of plans in accordance with established procedures. But the project co-ordinator soon shifts to the chaos that emerges when the discovered deviation gives reason to "accuse" people of being responsible, who feel embarrassed by the deviation as well as their ignorance. This effects the team spirit and those who feel accused, and are unable to answer because they have not been forewarned and given a chance to find out what was wrong, are likely to feel as outsiders and as a consequence assume a defensive role. A decrease in the propensity to co-operate will carry with it a disincentive to share knowledge.

The frame against which the exchange is interpreted gives different meaning to what is said. The project leaders and Adam together with several others (all Swedes) comment in terms of the history of the noise reduction project and the people with more distinct functional roles (Dutch and French participants) tend to comment in terms of allocation

of responsibility. The implications worked out from these frames will differ. The first category of actors are likely to see the exchange as an invitation to participate in problem-solving, while the second category will see the exchange as an unfair accusation of culpability in a problem that is more likely to be due to unprofessional management of the project than to negligence from their side. Both categories are likely to be dissatisfied with the response from the other side and integration will suffer.

In sum it may be concluded that this exchange did not improve the working relations between Volvo and joint venture production plant even if the whole process is unintentional:
- Adam emphasised the deviation from specification issue by pointing out that the rear suspension also had too hard bushings
- Charles started the "accusation" theme by a rather innocent question to David about causes of the deviation from specification.
- David ducked the issue instead of saying that he will check and come back with information.
- Burt interferes by pushing the question further down the responsibility hierarchy
- Fred is forced to say that he does not know

All four of the first speakers could have ended the exchange by returning the discussion to the noise track by stating that this should be checked. Adam said in his comments that when you stand up there as a presenter and a confused discussion starts you become sort of paralysed by the effort of following what is said. The others should have taken upon them to cut the discussion short since it was obvious that facts were missing. Allocating blame without an agreed factual basis is risky.

The event could be classified as an example of breach of co-ordination procedures since somebody failed to enter the decided change of stiffness of the bushings into the specification of the car. It could also be classified as breach of co-operation norms in that the questions on causes of the deviation were raised without warning and could be perceived as unfair accusations. Finally it could be classified as an example of knowledge sharing going awry. The whole point on the agenda was intended to inform project participants on the status of a significant quality project with implications for this project (due to the extreme wheels and tyres). The bushing issue went wrong because the project leader surprised the group by catching on to a detail (that might not have been a detail

had not Adam, supported by Bert, claimed, a minute before the sequence starts, that still softer bushings is not going to improve the noise level) and asking for information on causes. The point on the agenda from which this sequence is taken is an extensive report on the status of a quality project with a great quantity of relevant information on causes of noise and recent results of simulation studies of what design changes might save e decibel here and a decibel there. The technical complexity of the presentation may have thrown several participants into a situation of information overflow where, according to Schroder et al (1967), the capacity to integrate information had been severely impaired. As a consequence of overwhelming complexity it is likely that individuals in their coping fall back on stereotyping, which will cast the request for information in a frame of allocation of blame.

The project leader may be excused that he directed his first request for clarification of why there is a deviation from specification now to David a central member of the project and the one who is formally responsible for specification and preparing the new model for production.

A note on method and empirical evidence.

Hoopes and Postrel (1999) identified "glitches" (errors in knowledge sharing) through interviews ex post with participants in multi-group projects to develop computer software. The criteria were convincing, multiple sources claiming that results of the project were unsatisfactory due to inadequate knowledge sharing, but it is still judgement after the fact. They claim that this method of capturing data on glitches on the project level is an improvement over the method used by, e.g., Clark & Fujimoto (1991) who count frequencies of use of different organisational practices and correlate these frequencies with project success. This is no doubt true, Hoopes & Postrel show convincingly that "glitches," i.e., errors in knowledge sharing, cause considerable extra work (they provide an estimate of 17 % for the case they studied), and they have provided a logical model that identifies 4 types of glitches. Still there is another level of evidence to catch which has been illustrated in this report. What is going on in the project meeting as glitches and other communication problems appear? The use of video to catch the data as discussion and problem solving occur shows how complex the situation seems to be for the participants. The problem Hoopes and Postrel have of judging what effects a glitch might have in terms of extra work in relation to the planned work volumes (without glitch) even though a conservative estimate still is a

counterfactual estimate. The glitch did happen and work was not done according to plan (and the plan might be overoptimistic anyway). Furthermore the managers estimate the extra cost on the basis of what they know at the time of the interviews. In the "real time recording" of the judgement the first issue is whether we have a glitch or some other problem in the first place. Playing back the video sequence to the participants allow them to reflect on antecedents and consequences. The problem is that they choose different causal chains (one may point to the manner of presentation, another to procedural issues and a third to technical aspects) which generates cognitive variety within the group and complexity for the individual. There is polyphony in the data and one can only speculate that the manner of leading the meeting with frequent summaries of what the discussion has produced may be a key issue in linking integration mechanisms to project performance.

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