Organisational culture and XP: Three case studies

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Organisational culture and XP: three case studies

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Abstract

We explore the nature of the interaction between organisational culture and XP practice via three empirically-based case studies. The case studies cover a spectrum of organisational cultures. Our findings suggest that XP can thrive in a range of organisational cultures and that the interaction between organisational culture and XP can be complex & subtle, with consequences for practice.

1. Introduction

eXtreme Programming (XP) is carried out by teams, each working in a particular organisational culture. An organisational culture encompasses a range of factors, from beliefs, attitudes & values, and behaviours; to the organisational structure in terms of other individuals and groups with whom the XP team interact; to the physical and temporal setting in which the team operates. This organisational culture interacts with XP, shaping practice.

Based on empirical studies of XP practice, we present three case studies, which cover a spectrum of organisational cultures, in order to explore the nature of this interaction between organisational culture and practice.

We begin by describing the nature of the empirical work before discussing in more detail what we mean by organisational culture. We then describe each of the three case studies and conclude by discussing the implications for practice.

2. Empirical work

During the last three years, we studied three mature XP teams, each carrying out the 12 XP practices described in the first edition of Beck's book [1]. Following preliminary visits, each team was studied for a period of a week with further follow-up meetings. Our approach was ethnographic [2, 3], observing the natural setting of practice without control, intrusion or experiment. Practice was documented via field notes, photographs/sketches of physical layouts, copies of various documents and other artefacts, and records of meetings, discussions and informal interviews with practitioners. Our analysis of these observations sought to understand practice in its own terms, discounting prior hypotheses, assumptions and presumptions. So, for example, the choice (in the next section) of the dimensions of organisational culture that we report on is as much grounded in practice as in some *a priori* categorisation.

3. Organisational culture

XP in practice is contingent; shaped by (and also shaping) a range of factors: from application domain, team size & composition, team characteristics, and programming language through to organisational culture and national culture [4: 45-6]. Each of these factors has significance (see [5] for example). In this paper, we concentrate on organisational culture, by which we mean its expression in dimensions such as:

- the organisation's behaviour and the insight this gives on beliefs, attitudes & values [6];
- the organisational structure within which the XP team is situated and the nature of the XP team's interaction with individuals and groups in this wider organisational structure;
- the physical and temporal setting of the organisation: how the physical setting is organised and arranged in relation to work and the organisation of the day in relation to work;

Much of the thrust of this paper is that organisational culture and its interaction with XP practice is complex and not amenable to straightforward categorisation. Nevertheless, the categorisation used by Constantine [7] and also by

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Cockburn [4] is useful in considering the spectrum of possibilities. The categorisation is into four culture types: *hierarchical* (central command and control), *random* (little or no central command and control), *collaborative* (consensus-based command and control) and *synchronous* (where work is co-ordinated with no explicit evidence of command and control).

We now present each case study, beginning with an account of the organisational culture from the various dimensions and then discuss the impact of the organisational culture with XP. This organisation is somewhat artificial but has utility in presenting the 'facts' before the 'impact'.

4. Case study A

Organisation A was a large multi-national bank. The XP team we studied was located in the bank's imposing London office and comprised some dozen developers using all 12 practices to develop applications in Java to support the bank's management of operational risk. The XP team were a small part of the bank's software development activities. For example, the London office had many more software developers working on different applications using conventional, plan-driven approaches.

4.1. Case study A: organisational culture

4.1.1. Case study A: behaviour, beliefs, attitudes & values

The bank had many of the characteristics of an hierarchical organisational culture. There was a clear top-down management structure, within a rich corporate structure of core businesses and departments, which everyone (including XP developers) was aware of, acknowledged and oriented to in working life. For example, the XP team manager explained the particular shape and direction of the operational risk software development and its implementation by reference to senior management decisions as well as by reference to technical considerations. The XP team itself was organised into two sub-teams, each of whom had a developer who was the sub-team manager; one of these individuals was the overall team manager.

There were formal procedures, policies and rules governing many aspects of working life. For example, it was a rule that certain walls. could not be used for posters or notices. The bank had a clear dress code, including a smart-casual 'dress down Friday' code. All staff took this seriously as did the organisation. For example, on Friday, there was a large notice in the entrance area reminding staff of the 'dress down' code, with photographs of what was acceptable and what was not, and the message that abusing it would lead to losing it.

From our observations and other evidence, such as corporate statements and documents, we surmise that the beliefs, attitudes & values of the bank were those typical of a large corporate body: a clear and confident sense of corporate vision and identity; a belief in the leadership role of its senior management; an aggressive corporate attitude in a changing marketplace; a commitment to the customer as its key preoccupation; a belief in systematic approaches and planning; and a willingness to value (and reward) individuals who align themselves with these corporate aims and goals. Indeed, the bank has ambition, creativity, commitment & responsiveness as its stated core values.

4.1.2. Case study A: organisational structure and the XP team

The rich organisational structure had consequence for the XP team in two ways connected with the on-site customer practice.

First, the on-site customer was a role carried out by two individuals with domain expertise in the institution's methodology for the management of operational risk: the applications, in a sense, would capture appropriate aspects of the bank's expertise in the management of operational risk. Although they worked closely with the XP team (attending iteration planning meetings & retrospectives, discussing & clarifying issues with developers, taking part in coffee breaks, etc.), they were not formally part of the team: they were 'business' and the team was 'IT'. They were not co-located with the team.

Second, the individuals carrying out the on-site customer role were not, however, the end-users of the applications being developed. The end-users had, in some cases, yet to be appointed or were geographically remote in locations outside the United Kingdom. The end-users were also temporally remote in the sense that corporate structures and policies built in a delay of several weeks between delivery and user acceptance testing.

4.1.3. Case study A: physical and temporal setting

The physical setting for the team was within a very large open-plan floor with row upon row of workstations, each with a small desk-level partition separating it from its neighbour. Figure 1 shows the overall effect. Generally, the workstation settings were seen as 'personal' each with its own chair. There was a

limited number of 'free' chairs – discussions were assumed to take place in the various small meeting rooms sited around the perimeter of the floor.

Figure 1 The overall physical setting for Organisation A

The team had adapted this setting to XP by removing the desk-level partitions to facilitate pairing. Figure 2 shows the overall effect. However, space constraints meant that the two sub-teams were physically dislocated, their being about three rows of workstations between them. The open-plan setting (and corporate policy) made the provision of the information radiators [4: 84], typical of XP and other agile methods, difficult and the team had improvised with a series of portable devices.

Figure 2 The physical setting for Organisation A – pairing

The bank had set, but not rigid, hours of working, with most staff at the desks by around 9 am and staying there to after 5 pm. The bank's tradition of conventional, plan-driven software development meant that there was an acceptance of weekend working when the project was sufficiently high profile.

4.2. Case study A: organisational culture and its impact on XP

We now discuss the interaction of the bank's organisational culture in terms of the three dimensions.

The beliefs, attitudes and values of the bank were such that it took an ambiguous attitude to XP, being both sympathetic and non-sympathetic to XP. Many of the bank's values were sympathetic to XP (ambition, creativity, responsiveness, the emphasis on the customer) and the promise of XP to deliver working code in a responsive and timely fashion was very attractive. The bank took pride in its introduction of XP with senior software development management presenting the organisation's experience at various XP and agile practitioner events. However, there were other values that were not so sympathetic to XP. The emphasis on systematic approaches and planning meant that XP was viewed as somewhat exotic. This was noticeable in the attitude of the other occupants of the floor to the XP team and their adaptation of the physical setting – they were seen as somewhat 'strange and different' in their creation of a shared space and the employment of practices such as pair programming and daily stand-ups. It was also evident in the attitude of the XP team, who felt that although XP was regarded as a success – it had delivered on crucial projects – it was vulnerable should it ever be less than completely successful. The emphasis on systematic approaches and planning also affected the team as a background preoccupation with progress. For example, stand-ups would sometimes underscore the monitoring and chasing of progress, pair programming would strive to commit to give a visible sign of progress, and concern was expressed at a retrospective about the amount of technical debt being incurred (for example, by deferring refactoring). The team also felt constrained by procedures and policies in developing XP at a variety of levels. The proscription against the use of walls for information radiators was an irritation. The team were aware of the demands of sustaining XP over long periods and would have liked to have explored the use of approaches that gave developers the regular opportunity for some individually-focussed work (such as the 'gold card' days of [8]) but they felt that the corporate culture would not permit such an approach. Similarly, the issues to do with user acceptance testing (see 4.1.2 above) were another

frustration which stemmed, in part, from corporate structures and policies.

The organisational structure had consequences for the XP team in terms of the on-site customer role. The bank had a strong tradition of conventional, plan-driven software development with all its expectations of how sponsors, stakeholders and users interact with software developers. The on-site customer was a significant stakeholder with proportionate responsibility for the overall success of the development. As we noted, the on-site customer was not part of the XP team and did not necessarily subscribe to the underlying values of XP, particularly sustainability (expressed in the 40-hour week practice but see also [9] for further aspects of how XP values sustainability). As such, the on-site customer expected – and took part in – weekend working as a high profile project neared its deadline. The XP team were, of course, also a significant stakeholder and were committed to the success of the development but valued sustainability. So, whilst the XP team had worked weekends, there was a tension between the desires of the customer and those of the XP team. The XP team felt that 'more means less' in this respect and the issue was raised at a retrospective. The interaction with the end-user was also a source of tension: the team actively disliked having to re-visit code that they delivered some weeks ago simply because user acceptance testing had only just been carried out. Re-visiting code in this fashion also seemed to be another factor in the background preoccupation with progress.

At first sight, the physical and temporal setting was not particularly sympathetic to XP. However, our observations indicate that the reality was somewhat different.

The adaptation of the physical setting was not ideal, particularly with the two sub-teams being dislocated. However, each sub-team setting created an environment of physical adjacency that was very supportive of XP, achieving many of the characteristics of the open bullpen advocated by Beck [1]. Pair programming was suffused with conversation; peripheral awareness [10] and *ad hoc* discussions were facilitated (although the limited number of 'free' chairs was sometimes a frustration). Whilst, the issue of information radiators was an irritation, the work-arounds employed by the team gave a palpable sense of team identity and pride. These work-arounds also achieved their purpose in providing visible means for reflecting and organising the what and how of the work in hand. Such shared orchestration of activity via a board of some sort has been noticed elsewhere in different settings, such as that of patient care activity by nurses in ward settings [11].

We have already noted one adverse issue related to the temporal setting (weekend working, above) but, otherwise, the team were able to operate the 40-hour week practice within the expected hours of working.

5. Case study B

Organisation B was a medium-sized company producing content security software for document comparison, verification, security, and integrity in multi-authored work environments. Their sales have involved over half a million users in more than 50 countries. XP was their sole software development approach: they had abandoned conventional, plan-driven approaches at the instigation of their Chief Technical Officer (CTO). The XP team we studied was located in the company's UK office in a converted warehouse in the East End of London. The team comprised some twenty developers, using all 12 practices and writing applications in C++.

5.1. Case study B: organisational culture

5.1.1. Case study B: behaviour, beliefs, attitudes & values

The company had many of the characteristics of a collaborative organisational culture. Of course, as a medium-sized commercial company, there was a management structure but it tended to be a flat structure rather than deeply hierarchical. For example, senior management, in the guise of the CTO, would frequently visit the XP team area for *ad hoc* discussions with team members. During our study, we witnessed team meetings addressed by the CTO (and other senior management) explaining shifts in company strategy and ensuring buy-in by developers. The XP team was managed but the individual had the role title of 'development team coach' rather than 'manager' and spent considerable time supporting, facilitating and orchestrating activity rather than explicitly managing or controlling activity. Although the XP team organised itself into sub-teams, the development coach 'managed' all the sub-teams – there was no downwards replication of a management structure.

There was only minimum emphasis on formal procedures, policies and rules for managing aspects of working life. There was no formal dress code and all developers dressed casually: T-shirt, shorts and sandals was perfectly acceptable. Where appropriate, the CTO followed this dress code, wearing jeans and T-shirt.

From our observations, we surmise that the beliefs, attitudes & values of the company were those of a small innovative company that emphasised lean, responsive, open and collaborative ways of working. In many respects, the company had the characteristics of Senge's Learning Organization [12], with a commitment to shared vision, openness and localness (achieving control without controlling). There was an emphasis on supporting the individual and the team so that they could work effectively on high-quality products. The London office had an open and accessible design with no sense of crowding. There was a well-appointed, modern dining area and kitchen, with everything that was needed for making drinks or light snacks, that staff were encouraged to make use of as they needed. Showers and lockers were available for staff who chose to cycle or run/jog to work. Considerable space and furniture was devoted to settings that facilitated meetings and the sharing of ideas and views. In his presentation to the XP team, the CTO emphasised the high quality, design, vision and value of the product, making analogies with Apple's iPod – as something clean, beautiful and simple that focussed on their 'insanely loyal customers'. However, whilst they might lack the overt emphasis on corporate identity and presence of Organisation A, this organisation was also a commercially aggressive company that had faith in its senior management and was not afraid to make hard decisions dictated by commercial reality. However, unlike Organisation A, we did not observe any background preoccupation with progress within the XP team.

5.1.2. Case study B: organisational structure and the XP team

As with Case Study A, the organisational structure had consequence for the XP team in relation to the on-site customer practice. The company's marketing product managers worked closely with a range of customers (users) of its content security software to determine product requirements and make a judgement as to the 'sweet spot' that would be the product features. However, these product managers did not carry out the on-site customer role. The on-site customer role was carried out by *programme managers* who worked with marketing product managers but were firmly part of the development team. They had expertise in both the market requirements and positioning of the company's various products and the needs of the software development that would create those products. Programme managers organised a considerable amount of the detail of software development within the sub-teams: generating stories and acceptance tests, determining priorities, etc., as well as running the planning meetings and daily stand-ups.

In addition to the programme managers and their on-site customer role, the XP team also included testers who had considerable experience of the ways in which customers used the software products and saw themselves as testing 'the story in context'.

Outside of the XP team, there was a separate quality assurance (QA) team. This quality assurance team was an important component in the way the company met the requirements for ISO 9001 compliance that it required for its selling into the pharmaceuticals sector.

5.1.3. Case study B: physical and temporal setting

The physical setting for the team was on the top floor of the two storey building; accessible via a central staircase and a glass-sided elevator. The space was large and open-plan with seven rectangular tabled areas. Each tabled area had four workstations in twos, back to back, organised for pair programming. There was considerable space between each tabled area and there were also two separate round tables for discussions or small meetings. Adjacent to this open area was a large, well-equipped conference room. Several small, separate office cubicles were arranged along one wall. Each had a computer, phone, etc. and were intended for use by the developers for personal activities such as email and phone calls. The floor had a high, vaulted ceiling with skylight windows and there were large windows on the gable-end walls. The walls were bare brick with several XP and Agile Alliance posters (from Object Mentor, who helped in the transition to XP) on display. One wall had a large opening (knocked through from one of the original warehouse walls) without doors – this led into a matching area which housed quality assurance as well as small offices for use by marketing. The whole effect was of an open, airy working environment. Figures 3 and 4 show the overall effect.

Figure 3 The physical setting for Organisation B – tabled areas with workstations

Figure 4 The physical setting for Organisation B – elevator, staircase and discussion table

The company had a flexible approach to working hours, accommodating different patterns of work and travel. Many people were in considerably before 9 a.m. but arriving at 10 a.m. was not a cause for comment. Many people worked considerably beyond 5 p.m. but leaving around 4 p.m. was also not a cause for comment. Staff were free to take breaks and/or make use of the kitchen as and when they chose.

5.2 Case study B: organisational culture and its impact

The company's beliefs, attitudes and values were such that it provided a very sympathetic environment in which an XP team might flourish. The commitment to shared vision, openness and localness; the support for the individual and the team in working on high quality products; and the emphasis on collaboration are all factors that powerfully support XP. It is noteworthy that the decision to move to XP was taken by senior management – the CTO – after frustration with conventional, but unstructured, approaches. The company took pride in XP, and in the fact that they had achieved ISO 9001 compliance without compromising their commitment to XP.

The impact of the organisational structure centred mainly around the on-site customer role, carried out by programme managers. On the basis of our observations, this was an effective and productive role: the programme managers were co-located members of the team, providing the needed authority and domain expertise to support the process of turning stories into working code. However, our observations also suggest that the programme managers were markedly developer-focussed, as shown in their discursive repertoire [13]. In contrast, the discursive repertoire of marketing product manager was evangelistic and market-oriented. Marketing product managers worked closely with programme managers to understand the needs of the company's customers and to translate those needs into stories. This was done via sit-down meetings of 30 minutes to around an hour, as well as via shorter *ad hoc* discussions throughout the day. We speculate that this relationship between market-oriented product managers and developer-focussed programme managers was effective, in part, due to the open and collaborative nature of the company and its physical setting. Such an approach might not work so successfully in other organisational cultures.

There is one other aspect of the organisational structure worthy of note with respect to XP and that concerns the QA team. In discussions with the XP team, it became clear that they were regarded in much the same way as the XP team of Organisation A: as strange and different, out of kilter with the *zeitgeist* of software development in the company.

At first sight, the physical and temporal setting was particularly sympathetic to XP. However, our observations indicate this judgement needs to be qualified with three caveats.

First, despite the large open space with meeting/discussion tables and 'personal work' cubicles, virtually all work took place around the tables of the workstations. For example, we saw no use made of the two separate tables for discussions or meetings or of the 'personal work' cubicles. However, we saw innumerable *ad hoc* discussions take place around workstations, as team members sought help, offered suggestions, clarified stories, questioned acceptance test detail, and so on. This was facilitated by the physical adjacency of the tables and by there always being several 'free' chairs.

Second, we saw little evidence of the use of information radiators. This was not surprising in one

sense, since the company used a custom-built computer documentation tool to record, communicate and progress stories, rather than index cards. The tool captured the detail of each story: the estimate, a brief description, the customer acceptance test, who was working on it, progress through development, integration, pre-quality assurance testing, etc. However, in another sense, this was surprising in that we did not observe any obvious surrogate for the shared orchestration role of such information radiators. Indeed, at a follow-up meeting, we learnt that the development coach had subsequently introduced a story board and made greater use of index cards to counter what he saw as the tendency of the computer documentation tool to emphasise monitoring and progress chasing.

Third, although the flexible working hours supported the 40-hour week practice, we observed that developers were curiously reluctant to take breaks away from the intensity of pairing. Very rarely would a pair leave the workstation and make use of the kitchen to take a break. Rather, drinks or whatever would quickly be obtained and work would resume at the workstation. This was a source of concern to the development team coach who felt that breaks away from the workstation would be more beneficial in the long run.

6. Case study C

Organisation C was a small start-up company developing web-based intelligent advertisements for paying customers. They had used XP from start-up and XP was their sole development approach with just one team, located in their open-plan office in north London. The team used all 12 practices and wrote applications in Java.

6.1. Case study C: organisational culture

6.1.1. Case study C: behaviour, beliefs, attitudes and values

The company had many of the characteristics of a random organisational culture, which is typical of start-up companies [4: 106], with little or no central command and control. Other than the bare minimum of official company roles (such as CTO and managing director), the company consisted of the XP team of eight developers, along with four marketing personnel, a graphic designer and an IT infrastructure person. In essence, the team *was* the company and the team's culture *was* the organisational culture. It was an organisation centred around the individual and the team; emphasising respect and responsibility, actively encouraging the preservation of the quality of working life, and with faith in their own abilities to achieve the goals they had set themselves [9]. The XP team had no designated manager and, whilst certain individuals tended to carry out some roles (such as encouraging the taking of breaks), there was a strong belief in the collective decision making process of the team.

6.1.2. Case study C: organisational structure and the XP team

Given what has been said about the nature of the company, there was a minimal organisational structure. Essentially, the organisational structure was that of the XP team and the marketing personnel. The role of on-site customer was carried out by the four marketing personnel, who dealt directly with individual paying clients on a regular basis. They were not formally part of the XP team and were located at the opposite end of the large open-plan office to the XP team.

6.1.3 Case study C: physical and temporal setting

The office was open-plan, having an overall long rectangular shape with a walkway through the middle. Figure 5 shows the overall effect.

Figure 5 The overall physical setting for Organisation C

This open-plan layout was organised into a number of areas, chiefly on the basis of differences in furniture and its layout but sometimes by means of half-height partitions. The pair programming area – the developers' area – was situated towards the end of the walkway and had desks shaped specifically for

programmers to sit two to a machine. Figure 6 shows one of these desks.

Figure 6 The physical setting for Organisation C – pair programming desk

The developers' area was also enclosed by means of half-height partitions. The wall of the area had a notice board dominated by various information radiators. Adjacent to the developers' area was desk space for the infrastructure support person and for the graphic designer. Close to the pair programming area was a stand-up bar of monitors, used for checking the status of live servers, running tests on different target platforms, as well as for other activities such as personal email and web surfing. Behind the bar of monitors was a well-equipped kitchen where people would bring and leave their own food.

At the bottom of the walkway was a large open, communal area for meetings, etc. with tables, chairs and a large sofa. At the other end of the walkway to that of the developers' area was an area occupied by the marketing team. They sat at rectangular desks, facing each other.

The company had a flexible approach to working hours, accommodating different patterns of work and travel. People would arrive up to about 9.30 am (in time for the daily stand-up) and most people would leave between 5 pm and 6 pm.

6.2 Case study C: organisational culture and its impact

The company's beliefs, attitudes and values were those of XP. Indeed, as [8] makes clear, the company and everything about it, was intentionally designed around XP. This commitment was to XP as an intensely technical activity *and* also to XP as an intensely social activity with explicit values, such as communication and respect, and explicit principles, such as humanity and reflection [14]. In a very real sense, the company and the team regarded XP as about social organization: how people organize themselves to develop working software in a manner that is effective in terms of human values as well as in terms of technical and economic values. This committed vision was successful: the XP team was (and remains) one of the longest-running XP teams in the world.

This success was not without its burdens. The random organisational culture and the ideological commitment to XP raised issues of sustainability and the 'social health' of the team. These issues manifested themselves in a variety of ways. Relatively early on, the team recognised the demanding nature of pair programming (and other practices) and introduced some activity that focussed solely on the individual. To that end, two days a month were given to each individual – known as 'gold card' days – where one could carry out some individually-focussed work that was of value to the company. It is worth noting that the team's paper [8] describing this approach has the subtitle *I am not a load factor - I am a free man.* However, there were still worries over the 'morale fibre' of the team and a session where members (anonymously) wrote their problems, fears and issues on cards raised some hard-hitting concerns about dysfunction within the team [15: 290]. Team members found these concerns particularly challenging, given the team's emphasis on the transparent nature of XP processes and on collective decision making. These concerns were progressed, in part, by the introduction of retrospectives, which addressed organisational and social issues as well as technical concerns. In particular, a special retrospective was organised devoted to the 'social health' of the team and run by a qualified social worker [15: 293-296]. This proved effective in both underscoring the basic vigour and well-being of the team and in encouraging members in discussing and progressing difficult issues.

The impact of the organisational structure was minimal insofar as there was little organisational structure beyond that of the XP team. However, the on-site customer role of the marketing team is worthy of comment. The direct involvement with the client brought clarity and authority to the generation of stories and to planning meetings. However, the role of marketing personnel demanded that they respond quickly (minutes rather than hours) to requests from clients. Usually, such requests necessitated consultation with developers. The frequency of such interruptions proved distracting. The solution explored was that of an 'exposed pair': each day a pair of developers was identified who could be interrupted if a client had an urgent request.

As might be anticipated, the physical and temporal setting was highly supportive of XP. For example, our observations record that regular and communal breaks were taken in the morning, afternoon and at lunchtime. During the planning game, all breaks were taken together, but once coding started only lunchtime was taken together. These regular breaks were perceived as being important to one degree or another by all members of the team. The team recognised the effects of the intensity of pair programming by never releasing code into the main system after about 5pm. Experience had shown that the biggest problems had been caused by releases at that time of day.

7. Conclusions

Perhaps the most striking thing that emerges from the three case studies is the ability of XP to thrive in radically different organisational cultures, interacting with the organisational culture in a manner that can be subtle on occasion. For example, the interaction between the culture of Organisation A and XP was complex, both supporting XP and being less-than-sympathetic to XP. Each case study also had some clear surprises – interactions that were less than straightforward. The physical setting of Organisation A worked far more effectively than might have been imagined at first sight. In contrast, the physical setting of Organisation B was not exploited by the XP team in quite the way that might have been intended. This was also true of the temporal setting insofar as the team were reluctant to take breaks away from the workstation setting. The commitment of Organisation C to an organisation that was whole-heartedly an XP organisation seemed to cause the team to lack confidence in their 'morale fiber' [15: 289] on occasion.

The behaviour, beliefs, attitudes and values of the organisational culture had consequences for all three teams. Organisation A was ambiguous in its attitude to XP, seeing it as something with significant potential for meeting the bank's needs but also as something that did not necessarily fit easily into a mature and confident corporate culture. XP remained something of an experiment that perhaps succeeded in part because it was an experiment. We have already noted that there were some limits to what the XP team could and could not do. We speculate that significant expansion in the use of XP within the bank would also require change in aspects of the organisational culture. Organisation B had a very positive and supportive attitude to XP. Indeed, it could be argued that some form of agile method would be the natural choice for the company in terms of the way people organize themselves to develop working software to meet the needs of the market place. Organisation C had a total commitment to XP as a way of working life. This did bring with it some problems but we would see these as inevitable in a small start-up company committed to some new way of working, rather than indicative of problems with XP *per se* as an organisational culture. Indeed, the team's commitment to XP allowed them to begin to address these issues in a way that some other approach would not have encouraged.

The detail of the organisational structure had consequences for all three teams. Notwithstanding the issues on weekend working, the on-site customer role worked well for Organisation A. However, we speculate that this, in part, may be a consequence of the particular application and the use of domain experts (experts in the methodology for the management of operational risk). Other applications with other institutional roles being used for the on-site customer may not work so well in a corporate structure with many stakeholders. We have already mentioned the particular approach of Organisation B to the on-site customer role and its reliance on the open and collaborative nature of the organisation. It is unlikely to be an approach that would work for, or would relevant to, either Organisation A or to Organisation C. Similarly, the approach of Organisation C to the marketing staff and the use of an 'exposed pair' would not easily translate to either Organisation B or to Organisation A. Organisation B actively welcomed such 'interruptions' and Organisation A had individuals in the role of the on-site customer who were of significant status in a corporate organisation and might not readily accept their need to consult with developers being curtailed in any fashion.

The issues around physical and temporal setting showed the importance of facilitating the key social aspects of pairing: conversation, peripheral awareness, *ad hoc* discussions and so on. In addition, they showed the need to attend to detail (the 'free' chairs issue of Organisation A) as well as the possibility of mismatch between expected behaviour and actual behaviour (the lack of use made of discussion tables and away-from-the-workstation breaks in Organisation B).

We did not study an XP team in an organisation that had a synchronous culture: one where work is co-ordinated with no explicit evidence of command and control. The example of synchronous work given by Constantine [7], and cited by Cockburn [4], is that of the construction of a barn in the film *Witness*, where a group of people come together and assemble a barn. There is no explicit command, control and co-ordination; minimal conversation; and each individual

carries out appropriate actions at appropriate times. We consider that XP itself has some aspects of such a synchronous culture with practices such as collective ownership, simple design and refactoring. However, XP has explicit co-ordination via practices such as the Planning Game, on-site customer, 40-hour week, etc. And conversation permeates XP.

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