

Intentions, practices and aspirations: Understanding learning in design

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This paper is about learning in design and how can we measure this learning. The work reported here is based on a study of the actual practice of procurement, design and construction of a number of clients who repeatedly commission work of a similar nature. The paper sets out the background of a project entitled LEAF (Learning from Experience—Applying Feedback) which developed a generic model to assist organisations in understanding their situation. The discussion develops the LEAF evaluation model and explains its use describing all its parameters.

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To what extent do organisations involved in design learn from their experiences and how does this learning take place? There are several reasons for asking this question. Design can be seen as an attempt simply to solve a local problem or to improve a particular situation. However the design world would argue that design is itself also a process of discovery, of learning and even a form of research. In fact previous designs form one of the most important sources of knowledge for designers who depend heavily on the re-use of ideas as part of their process^{1,2}. Clients who repeatedly commission design expect learning to take place and designs to improve on previous attempts. But do clients and their designers learn as much as they might from design experience and what might be the obstacles to such learning? In recent years in the United Kingdom the Research Assessment Exercise conducted by the Higher Education Funding Council has had to come to terms with design as a form of research³. This has not been an easy process with some involved even arguing against the idea that design could or should be seen as a form of research⁴. However this is now generally accepted with the word ‘design’ appearing twice in

1 Lawson, B R ‘The context of mind’ in **P Lloyd and H Christiaans** (eds) *Designing in Context*, DUP Science, Delft (2001) pp 133–147

2 Goldschmidt, G ‘Creative architectural design: reference versus precedence’ *Journal of Architectural and Planning Research* Vol 15 (1998) 258–270

3 Lawson, B ‘Design as research’ *Architectural Research Quarterly* Vol 6 (2002) 109–114

4 Yeomans, D ‘Can design be called research?’ *Architectural Research Quarterly* Vol 1 (1995) 12–15



the HEFC extended definition of research as used in the most recent exercise in 2001.

So just how do we learn from design? This is a complex question and a disturbingly common answer seems to be that we often learn far less than we should. The work reported here is based on research into design processes in architecture carried out for clients who are frequent commissioners and procurers of relatively similar projects. It is by looking at such work that we might perhaps expect to discover most about learning from design experience.

1 *Design as Procedure*

There are many ways of viewing design. One view that has been popular in phases over the years is to see it as a sequence of activities. Many such maps of the design process were developed during a period of particular enthusiasm for such ideas some 30 years ago. Examples included industrial design⁵, engineering⁶ and architecture^{7,8}. At that time it was also common to talk of design *methods* and to publish recipe books of techniques that it was assumed could be fitted into this prescribed sequence of activities^{9,10}. It was also about that time that in Britain the Royal Institute of British Architects (RIBA) started to publish its now famous map of design in stages, still in common use today.

Very little of this work was based on actual evidence. It was largely assumed that design would, or indeed must, proceed in more or less discrete phases moving from briefing, through analytical phases and synthetic phases to evaluation and presentation. It all seemed so sensible and logical! Indeed in the spirit of the times design was seen as a process that could and should be laid bare in the manner of the scientific method. Thus it could be open to inspection and argument with what we now call 'stakeholders' able to question and contribute.

Since then the literature in the Design Studies field has become noticeably more evidence based. Experimentation and investigation gradually began to take place¹¹. Today we talk less of design *methods* and more of design *processes* and of design *thinking*. The problem-solving paradigm of design has been challenged by the paradigm of reflective practice championed by Schön.¹² One of the Delft Symposia demonstrated just how far this evidence based approach has developed with every contribution constituting a different analysis based on the same set of video design protocols¹³.

And yet we find a contemporary revival of the idea of design proceeding through identifiable and more or less discrete phases^{14,15}. We now find

5 Archer, L B 'The structure of the design process' in **G Broadbent and A Ward** (eds) *Design Methods in Architecture*, Lund Humphries, London (1969) pp 76–102

6 Clegg, G L *The Design of Design* Cambridge University Press, Cambridge (1969)

7 Markus, T A 'The role of building performance measurement and appraisal in design method' in **G Broadbent and A Ward** (eds) *Design Methods in Architecture*, Lund Humphries, London (1969) pp 109–117

8 Maver, T W 'Appraisal in the building design process' in **G T Moore** (ed.) *Emerging Methods in Environmental Design and Planning*, MIT Press, Cambridge Mass (1970) pp 159–202

9 Jones, J C and Thornley, D G *Conference on Design Methods* Pergamon, Oxford (1963)

10 Jones, J C 'Design methods reviewed' in **S A Gregory** (ed.) *The Design Method*, Butterworth, London (1966) pp 295–310

11 Lawson, B R 'Problem structure displays in computer aided architectural design', in *Ergonomics Research Society Annual Conference*, Cranfield, (1971)

12 Schön, D A *The Reflective Practitioner: How Professionals Think in Action* Temple Smith, London (1983)

13 Cross N., Christiaans H. and Dorst K., (eds) *Analysing Design Activity*, Wiley: Chichester (1996)

14 Macmillan, S, Steel, J, Austin, S, Spence, R and Kirby, P 'Mapping the early stages of the design process — a comparison between engineering and construction', in *Proceedings of the 12th International Conference on Engineering Design ICED 99*, Munich, Germany (1999)

15 Kagioglou, M, Cooper, R, Aouad, G, Hinks, J, Sexton, M and Sheath, D *Final Report: Generic Design and Construction Process Protocol* Salford University, Salford (1998)

process maps abounding again and the good old RIBA one is still there doggedly plodding on! Such maps of design are now even supported by software. An elaborate example would be the structured technique of ADePT (Analytical Design and Planning Technique)¹⁶ for planning and managing design and PlanWeaver as a web based software application for managing design activities and integrating the processes of design and construction that uses the ADePT technique.

Again there is relatively little evidence to support the assumption that such models are accurate descriptions of actual practice. Rather more often they seem to be prescriptions for it. This is in many ways entirely understandable. Today more than ever before, design is a team activity. Designers in real practice usually must relate not only to all their specialist consultants but also to their clients and hopefully the users too. Design is often surrounded by legislative controls and by cost and time constraints. Zeisel has warned of the communication gaps between clients and designers and their users¹⁷, and Lawson has discussed the problems of the different roles played by the stakeholders in design¹⁸. We have seen the emergence, particularly in architecture, of the ubiquitous project manager, who it is assumed can somehow bring order, predictability and control into this creative and chaotic melange¹⁹.

It is of course entirely understandable that those who pay and brief designers should want to be able to see the process at work. They would like to be able to predict when it will be complete and to see intermediate milestones. Ideally perhaps they would like a structured set of decisions to be taken, each one logically building on the previously agreed conclusions with the outcomes at each stage cast in stone never to be revisited or challenged. It is perhaps even more understandable that consultants, managers, contractors and manufacturers should want to know when and how information will flow throughout the process. It is still more understandable when huge sums of public money are spent on major projects that there should be some accountability. Stories are legion of such projects being delivered late and over budget and even being abandoned.

So we fully recognise here that descriptions of the design process are inevitable to meet these needs and demands, even if those descriptions tend at times towards the prescriptive. However a major danger remains. That danger is that we come to believe these often glossily published and professionally endorsed maps as accurate descriptions of design practice. As a result practice is forced into a straightjacket from which it cannot escape and which may not necessarily lead to better design outcomes.

The design process field has also understandably found it difficult to moni-

16 Austin, S, Baldwin, A, Li, B and Waskett, P 'Analytical Design Planning Technique (ADePT): an IDEFOv model of the detail building design process Vol' *Design Studies* Vol 203 (1999) 279–296

17 Zeisel, J *Inquiry by Design* Cambridge University Press, Cambridge (1984)

18 Lawson, B R *How Designers Think* third ed, 3rd ed Architectural Press, Oxford (1997)

19 Allinson, K *Getting There by Design: An Architect's Guide to Design and Project Management* Architectural Press, Oxford (1997)

tor real world design practice. Even Donald Schön's now famous paradigm breaking intervention into the field is largely based on evidence not gathered from real practice. His most well known, brilliant and highly influential study of thinking in architectural design is based on a discussion between a student and her tutor! Major architectural contracts last far longer than the most ambitious research applications to our major research funding bodies. Longitudinal studies of design processes in actual practice are thus extremely difficult to conduct both methodologically and financially.

The literature is full of examples of these process maps, some of which are applicable to any organisation in the construction industry such as the RIBA Plan of work²⁰ and the Process Protocol developed by Salford University and Alfred MacAlpine Construction Ltd²¹. Others are designed specifically to describe design activities for a particular organisation such as the BAA Project Process²², the Project Gates at London Underground Limited²³, MAPP (Manchester Airport Product Procedures)²⁴ and so on.

2 *Some evidence: the IPA model*

We have recently completed a study of the actual practice of building design as commissioned by a number of major clients. For the reasons given above we relied mainly on a retrospective study using six recently completed projects, supported by less retrospective studies of two live projects. The projects were selected ranged in valued from £187 K to £250 m and were selected to be generic for each of the three clients commissioning them. Data were gathered through a combination of techniques including structured interviews with personnel involved in the projects representing clients, users and members of the design and construction teams. Data was also collected through examination and analysis of formal documentation (such as procedures, minutes, reports, etc) and, in the case of the live projects, through meetings and workshops. Although the sample size is restricted here to only eight projects our results were remarkably homogenous giving us considerable confidence about our conclusions. The project known as LEAF (Learning from Experience, Applying Feedback) was funded by DETR and EPSRC under the MCNS (Meeting Clients Needs through Standardisation) LINK programme in collaboration with three major national clients and two firms of architects.

We have simultaneously been developing tools for capturing real world design processes with minimal intervention²⁵ and are hoping soon to be able to conduct more longitudinal real-time studies which will be the subject of a later paper. The project described here however involves studies made of organisations that repeatedly conduct projects of a similar nature.

20 RIBA *Plan of Work* Vol. regularly updated since 1960, RIBA, London (1960)

21 Kagioglou, M, Cooper, R, Aouad, G, Hinks, J, Sexton, M and Sheath, D A Generic Guide to the Design and Construction Process Protocol Salford University, Salford (1998)

22 BAA. *The Project Process Handbook*, British Airports Authority (internal publication), London (1995)

23 LUL. *PDP: Project Development Process — key process DD-006-A3* London Underground Ltd — first published 1993 revised in 1994 and 2001, London (2001)

24 MAP. *MAPP: Manchester Airport Product Procedures Manual*, Manchester Airport Plc, Manchester (1998)

25 Cerulli, C, Peng, C and Lawson, B 'Capturing Histories of Design Processes for Collaborative Building Design Development: Field Trial of the ADS Prototype' in B de Vries, J van Leeuwen and H Achten (eds) *Computer Aided Architectural Design Futures 2001*, Kluwer Academic Publishers, Dordrecht (2001) pp 427–437

It was primarily directed at understanding how learning from experience takes place through design. How does knowledge gained in one project get transferred to other projects? We have found that even with organisations that construct similar projects, there may be little transfer of knowledge even with elaborate procedures in place, sometimes supported by sophisticated information technology.

Despite carrying out relatively similar projects yet the same mistakes are repeated over and over again on every project, every time!— design team member.

The work reported here, following on from several other projects has enabled us to develop a three-dimensional model of the situation. Since we are particularly interested here in how knowledge transfers, or does not do so, between projects we have found ourselves interested in the world beyond the conventional boundary of the design project. The first dimension then to our model is a temporal one and enables us record whether events take place during, before or after a project. Whilst most of the design process maps we have discussed simply concentrate on the project phase, we include both pre-project or gestation phase and post-project or building occupation phases.

In the LEAF project we have seen much evidence of documented procedures assumed to take place in design and based upon sequentially demarcated activities. We have however not necessarily found that events accurately map onto these procedures in practice. From this work we have come to realise that there are at least three views of how design proceeds or should proceed. We call these ‘Intentions’, ‘Practices’ and ‘Aspirations’.

In our studies ‘Intentions’ are represented by procedures and protocols published by the organisation in such places as their Intranet, staff meeting documents, quality control manuals, administrative templates, health and safety procedures, design guides, office manuals, legislation procedures and other similar documents. Our evaluation of ‘Practices’ largely relied upon interviews, observation and workshops and examined how people actually worked in terms of delivery, managing projects, sharing information, communicating, dealing with variations and changes and so on. Our analysis of ‘Aspirations’ relied entirely in data gathered through interviews and workshops to discover how people would like define and execute their own responsibilities and their aspirations for the organisation as a whole. We thus concentrated here on what changes they would like to see and how they felt such changes could be brought about.

We argue here that most process maps and procedures are more appropri-

ately seen as an attempt to describe sequences of activities in the design process representing the organisation's policy or 'intentions'. However we found in our study that 'practice' is often significantly different. Surprisingly, we found that many of these maps and procedure manuals are left unused on the shelf regardless of the considerable time, effort and knowledge invested in them.

These procedures have to be simplified to be more effective. They ought to be designed to be used as guidance through the main critical stages of the project, but in their current state many have been left on the shelf. — in-house project manager.

Organisations' investments in these maps are based on their assumption that following a well-developed map is a recipe for an improved output. However, as our project progressed, it became increasingly clear that tools and checklists were of limited value in achieving improvement, and are not in themselves necessarily any guarantee of success. Steele, Austin and Macmillan argued that these maps may not even reduce the time taken to complete a project²⁶, and Barrett warned that projects with excellent procedures might still fail in practice, just as much as projects with no formal procedures can provide successful results²⁷.

Organisations may be matching or not their 'intentions' and 'practices'. That is to say they may be carrying out in practice what their documented procedures require, or they may not. They may also be aware or not of this situation. However a third view of the design process now becomes apparent, which is that which we call 'aspiration'. In many cases our data showed that those who work on the ground may not only have a set of procedures (intentions) they are expected to follow, and a set of normal practices which they actually do, but also a further view, which is what they would like to do if they could. Again at the organisational level there may or may not be awareness of the existence of the 'aspirational' view and of its detail. In summary then we have three major views of how design might proceed.

- **Intentions**—*What the project teams are supposed to be doing.* Represented in the policy or procedures, guidelines or recommendations and other corporate documentation whether these are in published form or electronic format.
- **Practices**—*What the project teams are actually doing.* Represented by actual practice, achievements, outcomes, experiences and implementation of activities by the project teams.
- **Aspirations**—*What the project teams would like to be doing.* Represented by the aspirations, wishes, wants of the project team members as revealed by interviews and focus groups.

26 Steele, J, Austin, S, Macmillan, S, Kirby, P and Spence, R 'Interdisciplinary interaction during concept design', in *Fifteenth Annual Conference of the Association of Researchers in Construction Management*, Liverpool, (1999)

27 Barrett, P and Stanley, C *Better Construction Briefing* Blackwell Science Ltd, Oxford (1999)

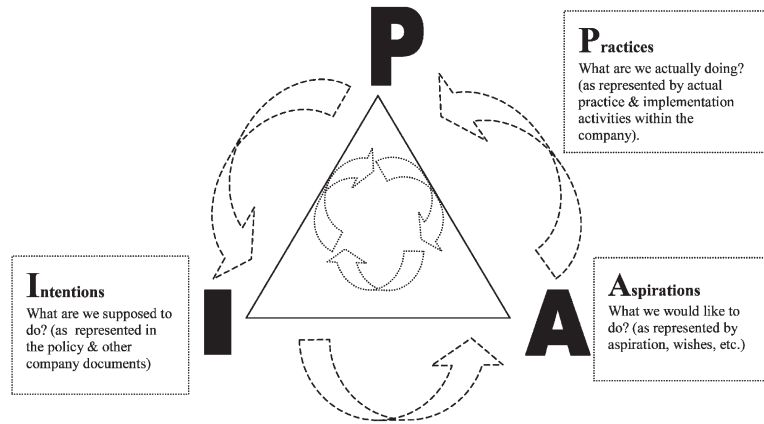


Figure 1 The IPA Learning from experience model

3 The LEAF project evaluation model

Before returning to the use of this IPA model we need to complete our generic model of project evaluation. Since the LEAF project was particularly designed to discover the extent to which learning took place in such organisations and situations, we also went on to describe several major areas in which learning might take place. This learning might be about the ‘processes’ as we have described them here. However in the case of architectural projects it might equally be about the actual end ‘products’ of the process. Traditional post-occupancy analysis focuses on the materiality of the components and systems of the building. How well do these actually perform and how closely do they match expectations? Finally, but by no means least we might ask how an architectural project impacts on the ‘performance’ achieved in the main business of the organisation for which it is constructed. For example in work we have been involved in recently on hospitals we have been able to show that new projects may indeed be able affect patient health outcomes including reducing patient treatment times²⁸. Our generic model then is designed to evaluate these three Ps (Process, Product and Performance)²⁹.

The 3Ps are integrated into our learning from experience IPA (Intentions, Practices, Aspirations) model (Fig. 1) to form the complete framework of the LEAF Feedback Layers model (Fig. 2) that we established in the LEAF study. Encompassing these three aspects together provides a framework that does not only evaluate the ‘process’ and its actions, but unlike many other models and maps, measures both the actual end ‘product’ and the impact of the ‘performance’ of the design on the client’s business:

- **Process**—How well was the process of design, construction and procurement undertaken? Did the team work effectively and evaluate the

28 Lawson, B R and Phiri, M
‘Room for improvement’ *Health Service Journal* Vol 110 (2000) 24–27

29 Phiri, M, Worthington, J and Leaman, A Briefing a Continuous Building Programme — Factors for Success Institute of Advanced Architectural Studies, The University of York, York (1999)

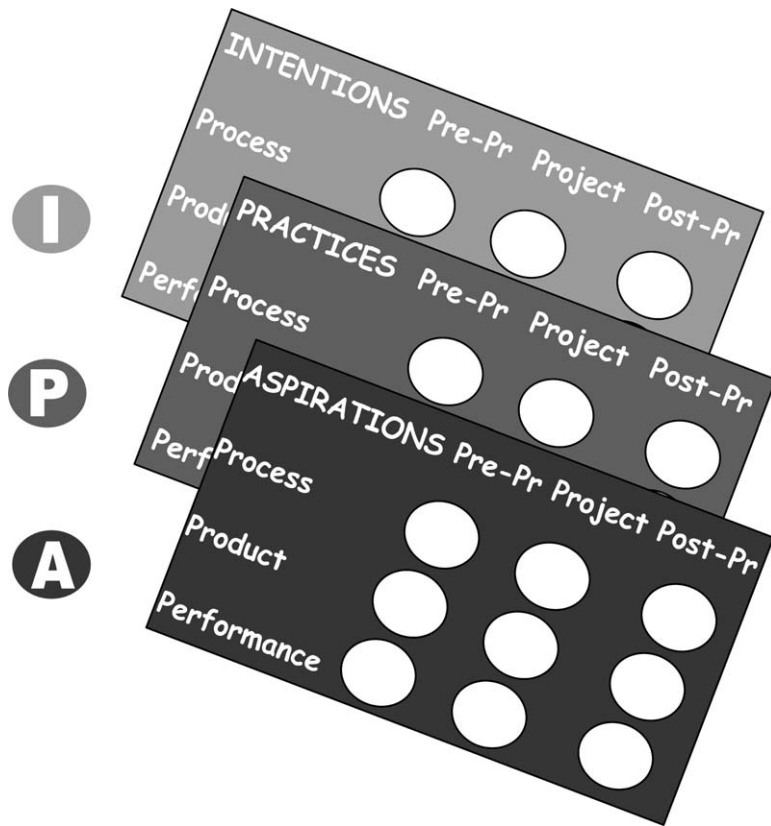


Figure 2 The LEAF Feedback layers model representing 3Ps (Process, Product, Performance)²⁹, Project stages (Pre-Project, Project, Post-Project)³⁰, IPA feedback layers (Intentions, Practices, Aspirations)

process of commissioning, procuring, briefing, design and maintaining the buildings themselves?

- **Product**—How well do the physical systems and components of the building work? How well do the buildings do their jobs and deliver their service, what are their strengths and weaknesses according to their structure, layout, flexibility, environment, setting and location?
- **Performance**—How did the building impact on the clients prime business? How do the buildings help or hinder their staff to perform their duties. Is the prime business enhanced in terms of quantity or quality?

3.1 Use of the model

Evaluating a design project using this model draws attention to the relationships between the various dimensions and their states. In particular it enables us to see that process is not entirely independent of product or performance. We can also see the relative effects of these three over time. Process matters critically during the project stage and to a slightly lesser extent in the pre-project stage. However these two phases are short in terms of the expected lifetime of the designed object, certainly in the case of

³⁰ Latham, S M Constructing the Team: Final report of the government/industry review of procurement and contractual arrangements in the UK construction industry HMSO, London (1994)

architecture. It is here of course in the post project lifetime of use that product and performance factors have their major effects.

At the end of a project, we normally land up with a product that costs us more to run. Because the people who design and build projects are only interested in the capital figure to meet their budget requirements as the major factor of success which in order to achieve, they would have made a lot of compromises while the cost of running the building will be much more over a much longer time period.—in-house operational staff.

In recent years in the UK both the Latham³⁰ and Egan³¹ reports on the construction industry have tended to concentrate on reducing process times and capital without fully considering the possible impact of this on lifecycle product costs and the impact of hurried design on the performance effects on the client's core business.

We find that in large-scale construction commissioned by regular clients with highly organised 'intentions' as revealed by process models that the process can be dominated by these commissioning clients. The design team is characteristically briefed by those who commission and pay for the construction, whose members are process oriented and least likely to be able hear the voice of those who will actually use or occupy the building whose members are performance oriented.

As end users, we feel that we are generally ignored, we do have a very small voice and little involvement, the times we have got involved, we tend to feel ignored, because we are perceived to be low priority and less important.—in-house operational staff.

Blyth and Worthington argue that this apparent neglect of users is probably due to architects feeling that they can themselves represent the users' view. This is probably a result of architects frequently having little access to actual users and becoming used to assuming that as building users themselves they have similar wishes and needs. Such assumptions are however unlikely to be accurate since they are not made in the light of the actual use of the building³². In work done for NHS Estates we showed that patient representatives and senior managers put research into the therapeutic value of hospital architecture at the top of their agenda. However the directors of estates who actually commission and brief hospital architects wanted to see research done into methods of procurement and showed little or no interest in the contribution of the new building to the performance of the NHS³³.

It was under the banner of standardisation that the funding became avail-

31 Egan S J, *Rethinking Construction: the Report of the Construction Task Force to the Deputy Prime Minister*, John Prescott, on the Scope for Improving the Quality and Efficiency of UK Construction, Department of the Environment, Transport and the Regions, London (1998)

32 Blyth, A and Worthington, J *Managing the Brief for Better Design* Spon, London (2001)

33 Lawson, B 'Healing architecture' *The Architectural Review* Vol CCXI No 1261 (2002) 72–75

able to carry out the LEAF project. Again the model shows the possibility of standardising not just product but also process. In our study of clients repeatedly commissioning similar projects we found much evidence of standardisation of process. However this standardisation was revealed by the Intentions view and not necessarily matched by actual Practice. We also found considerable evidence that Aspirations were different again. Clearly then only when both completed 'practices' and 'aspirations' need to be continuously reviewed and evaluated against the organisation's procedures represented by the 'intentions'. By doing this, we can reveal common features or successes worth repeating or pitfalls to be avoided. This abstract model can be usefully incorporated in the organisation's documentation and corporate standards as lessons learnt, recommendations or as the firm's way of doing things (the brand, culture, etc).

Another question suggested by the model concerns the timing of project evaluation. What stage of the building cycle is more likely to yield the most information and the most successful results? We found that many of the organisations we studied put remarkably little resource into the pre-project and post-project stages.

There is not enough time given for the organisation to prepare for, set up and run evaluations. We would like to have more time at the early stage of the project.—in-house project manager.

There was no feedback at the post-project stage. We wish to have follow up meetings after going operational.—in-house operational staff.

Where procedures included evaluation this was most usually at the post-project stage but poorly resourced. Since the pre-project stage is also poorly resourced we found little use was made there of evaluation from previous projects. Organisational culture becomes very important in its impact on actual practice. Such a situation leads to a general disregard for the whole business and value of evaluation. This is compounded by a poorly organised motivational drive since those who must conduct evaluations are unlikely to benefit from them and indeed may even be asked to reveal their own mistakes or inadequacies. By contrast then conducting evaluation of recent relevant projects in the pre-project stage reverses the motivation and benefit pay off. However this runs counter to the current culture of demanding faster track design processes.

We also find that the whole project culture of many organisations involved in design may work against learning here. The project is a remarkably effective way and powerful way of organising and focussing resources and this is now taken as standard practice in design and client organisations.

As a result we find typically little resource lies outside the project teams which could be used to transfer learning from one project to another. In a way this recommendation has a parallel in the recent developments in educational theory. Here the emphasis has moved from teaching to learning. It is no longer assumed that just because teaching takes place that learning will follow. Similarly design organisations should no longer assume that because information is recorded that lessons would be learned from this in future.

3.2 The IPA model

Finally we return to the relationship between Intentions, Practices and Aspirations (Fig. 3). Once an organisation is sensitive to all three of these views and not simply the single Intentions view, new possibilities for learning open up. It might be thought that an organisation would be in a virtuous state if all three views were in synchrony. Ideally we might feel that an organisation clearly articulates to others what its intentions are, that it carries them out in practice and that all concerned are in full agreement and support of these procedures. However further reflection on this would reveal the need to take account of the inevitably changing world both inside and outside the organisation.

Such static synchrony is therefore unlikely to remain satisfactory. At the

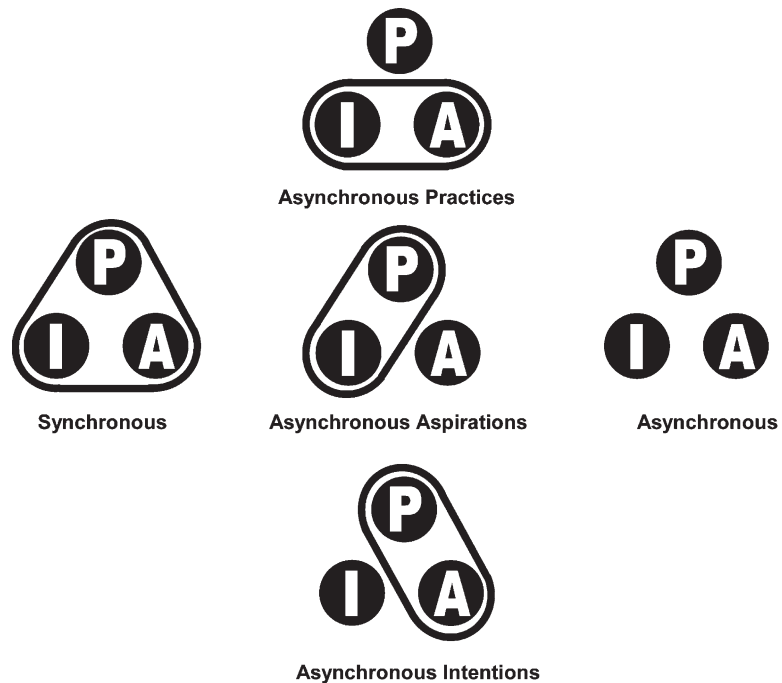


Figure 3 Five different situations for an organisation.
Key: I, Intentions; P, Practices; A, Aspirations

other end of the spectrum it hardly seems sensible for an organisation to be comfortable with a totally unsynchronised state. In between these two extremes there are a further three possible states under the IPA model. In these three states one of the three views out of step with the other two. Each of these theoretically presents different dangers not only for the organisation but also for other trying to work with it. We are beginning now to conduct further work to examine all of these states of the IPA model to discover their actual impact on the design process and its outcomes.

However our existing data already reveal an emerging picture of how this seems to work. For example the unsynchronised practices or aspirations states make an organisation difficult to collaborate with. Here other design team members are trying to relate to the published intentions but finding actual practice does not match this. By contrast an unsynchronised aspirations state leaves an organisation in internal difficulty with staff constantly unhappy with practice which may be slavishly following intentions. Such a state suggests a top down management out of touch with its workforce. We have found such a state to be disturbingly common in large organisations. Again by contrast the unsynchronised intentions state suggests an organisation that is happy with its practice but publishing information likely to mislead those who would collaborate with it.

We have now developed a series of tools to enable organisations to reveal to themselves just where they currently sit on this IPA chart. The tools also enable them to define where they were in the past, to suggest where they might like to move to in the future and to explore what actions might be needed to make the desired changes. We are in the process of testing these tools in practice and hope to publish a further paper on the tools and their use. Here however we concentrate on how this model enables us to ask questions about the characteristics of good practice and successful organisations. Are there virtuous and non-virtuous patterns of behaviour within this chart? Is good learning associated with certain patterns of movement between these states either in terms of direct or timing? Whilst we might hazard some guessed answers to these questions we need much more data recording projects and organisations than our existing sample and again we hope to publish this data in a future paper.

Such data will then enable us to explore more fully the various sets of published Intentions that now abound as design process maps. A common failure and reluctance to use process maps is evidenced by the frequently observed gap between 'intentions' and 'practices' in the projects and organisations studied in LEAF. These case studies demonstrated that people frequently feel reluctant to use maps and procedures unless they feel a sense

of ownership, but prefer to rely on their own past experiences as a procedural guide. Maps and procedures should perhaps be perceived as the means not the goal; they can only offer guidance throughout the main critical stages of the project. They can only be effective when people are willing to buy-in, and can clearly see real benefits from using them. We observe that this chimes with current good practice in business models as described by Schrage who argues that innovation is not about rigorously following 'the rules of the game', but about rigorously challenging and revising them, which requires improvisation³⁴.

34 Schrage, M *Serious Play*
Harvard Business School Press,
USA (2000)