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Chris Atkinson
Brunel University, Christopher.Atkinson@brunel.ac.uk

David Wilson
University of Technology, Sydney, davidw@it.uts.edu.au

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IMAGES OF INFORMATION SYSTEMS DEVELOPMENT IN THE PRACTICE OF ARCHITECTURE

CHRIS ATKINSON
Department of Information Systems and Computing,
Brunel University
DAVID AVISON
Department SID,
ESSEC Business School, France
avison@essec.fr
DAVID WILSON
Department of Information Systems,
University of Technology, Sydney

ABSTRACT

This paper explores various architectural images and uses them as analogies with which to explore critically computer-based information systems development. These images include approaches, roles and practices, how they relate to the client, to other professions and trades and the built environment. These images, particularly those relating to participative and adaptive development, will be used to propose parallel emergent forms of computer-based information systems development practices and disciplinary relationships that have the potential to address the inconsistent performance of information systems and a record that includes some notable failures. As well as providing guidance to the IS profession and practice, the paper discusses implications for our teaching and the discipline of information systems in general.

Keywords: IS discipline, architecture, metaphors, analogies, IS development, practice

I.INTRODUCTION

The discipline of information systems (IS) is to some extent going through a period of reflection. The *dot.com* crash affected student numbers on the one hand and peer group assessment on the other. Triumphant talk, such as at the plenary address at ICIS 2000 which said 'We were right: they were wrong' no longer belong in our conferences (even if they had their place then). The *Communications of the AIS,* amongst other leading journals, contain numerous papers which reflect on the state of the discipline (the four AIS presidential reports (Ein-Dor [2003], Ives [2002], Vitale [2001] and Davis [1999]) are a good place to start). Such reflection is important and will leave the discipline much the stronger.

Ours is a young discipline and we can still learn much from other disciplines. Architecture is such a discipline with many parallels with information systems. In particular, it can help us in our understanding and improvement of the development of information systems, a core element of any IS curriculum and of IS practice. We are not the first to draw parallels between architecture and IS, but previous studies presented a very traditional view of architectural practice, stressing the architect/client/builder and design and build images. In our review we draw attention, in particular, to three further images, that of:

- stakeholder participant/professional development,

- self-design and construction and
- architectural landscape/gardener.

These images of construction can help us rethink the study and practice of IS development. The first two are incorporated in some, more enlightened practice, but we consider the landscape/gardener image as offering an important new way of considering IS development practice.

In this section we draw parallels between architectural and IS practices. In Sections II and III we look in detail at five images of architectural practice that contain parallels in information systems that we discuss in Section IV. This discussion enables us to suggest implications for IS development theory and practice (Section V).

Be it in our towns or cities, in the suburbs or the village, we live, are entertained, work and shop, are born and die within buildings. Collectively, they constitute our built environment. Buildings protect us, enable commerce and industry to take place, contain our political and cultural institutions, shape our lives and constitute a ubiquitous built aesthetic. Computer-based information systems (CBIS) are now equally ever-present and as indispensable to our lives, leisure and livelihoods. As with buildings, we congregate, co-operate, and communicate in defined spaces, but with computers, such spaces are virtual, rather than physical.

Just as an individual building must relate to the site on which it is founded, to buildings in its immediate vicinity and the wider built and social environments, so too do Computer-based Information Systems (CBIS) to existing technologies, people, business practices and processes (computer-based and otherwise) within and across organizations. Buildings and CBIS both exist within a complex of existing technical, human, and organizational contexts.

The creation and construction of buildings involve multiple professions working in concert. These professions include builders and engineers, contractors, subcontractors, surveyors and quantity surveyors, component and materials manufacturers, organized and freelance labor, site agents and managers. Similarly, although less established as ‘professions’, CBIS depend on multiple roles for their design development and implementation: software developers, systems engineers, applications and technologies manufacturers, requirements analysts, systems designers, and project managers. In both cases, professions convene to meet a client’s individual or collective needs, they interact with a wider constituency of stakeholders, and work to standards within a legislative framework.

The built environment contains a profession, a set of practices, approaches tools and techniques, a client relationship, and an aesthetic. The architect and the practices of architecture emerged to ensure that the clients’ needs are transformed into a building that meets their expressed and sometimes unarticulated functional needs within an aesthetic that is commensurate with the clients’ wishes and the wider built, stakeholder and legislative environments. The architect is also there to represent the clients’ interests with respect to other professions and trades, as well as such bodies as local authorities.

Such a position, profession, approaches and aesthetic are not currently present within the practices associated with CBIS development to the same extent. CBIS is founded upon an engineering/design paradigm that is possibly technically proficient but, judged by the many underperforming and failing CBIS, appears to lack the ability to cope with the complexities of the human and organizational context in which they are developed and for whose needs they are supposed to meet.

In this paper, we first explore architectural images of development in both its prominent and variant forms. We use these images to provide us with powerful insights into the practices associated with CBIS development in multifaceted and ever-changing organizational contexts. These insights suggest changes in practice that aim to improve CBIS. In particular, we draw on the conventional architect/client/builder, multi-stakeholder/architect/builder, self-design/ construction, living systems, and landscape architect/gardener images, and suggest their CBIS parallels. Whereas present CBIS practice tends to be more akin to the more conventional architectural images, we argue that the living systems and landscape architect/gardener images

are more enlightened and offer the most potential to address the weaknesses of practice in information systems development.

II. IMAGES OF ARCHITECTURAL PRACTICE

In this section, we explore a number of images of architectural practice. These images will be used later to explore their parallels in the practice of information systems development. Within each of these images, the architect's role and practices will be looked at. They include the architect's relationship with the client, other professions and trades, typical areas of application, and the associated aesthetic.

The predominant architectural image is the 'architect/client/builder' image, an image with a CBIS parallel in conventional information systems development. Alternatives to the predominant image considered here are 'multi-stakeholder/architect/builder' and 'self-design/construction'. These alternatives emphasize the role of the client in the development processes. Their CBIS parallels are various participative approaches to IS development. Further images are the 'living systems' or 'landscape architect/gardener', which emphasize the way buildings change over time in response to the client's changing needs or those of multiple clients. Contingency approaches to IS development provide parallels here, though they are not widely adopted in practice. We first consider the predominant architectural image.

IMAGE 1: ARCHITECT/CLIENT/BUILDER

This image is the most prominent one of the architect, the client, and other construction professions. It can apply just as much to the individual who wants a new house as to the new headquarters for a large corporate client. Its obvious parallels are in the more traditional approaches to IS development.

In the case of a new corporate headquarters building, for example, the client normally commissions an architect to create a design proposal. State-of-the-art building design packages [Spiller 1999] are capable of transforming the architects' 'imagineering' in the form of sketches, maquettes, models, and designs into three-dimensional virtual representations of a building, possessed of highly complex topographies. After further exploration of the client's functional requirements, the architect produces a final design.

The virtual three-dimensional architectural designs are used to carry out detailed stress and structural design analyses, win the clients' agreement on a final design, gain agreement with adjoining property owners, and comply with building and other regulatory requirements. The client, after some negotiation, then signs the architectural design in the hope that the building will be delivered on time and to cost (possibly by using a computerized project management approach).

The final detailed structural design and building specification might be subcontracted by the main contractor to a design house in India, which in turn may subcontract to design teams elsewhere, perhaps using a multi-project management package. The full design is then delivered and final adjustments are made, and the design is signed off. The construction company may then team up with a logistics company to move the corporate staff and equipment into the new headquarters.

A series of specialized subcontractors might be appointed to work with the main contractor, to complete the shell and mechanical and electrical services to client requirements. The whole project might be managed using the latest multi-program interactive PERT software. The logistics company can then move the corporate headquarters and its equipment into the new building, the final act following a whole series of stages.

IMAGE 2: DESIGN AND BUILD

A number of variations on the theme of the predominant architect and client relationship may be seen as alternative images. In some cases, the architectural role and the building role are brought together within one roof to produce a building that meets anticipated market needs. This model is called design-and-build. Usually this image can be seen in speculative house building. It can also be found in the construction of 'shed type' factory or warehousing and distribution units, often in business parks and sited for ease of access by transport. These buildings are speculative in nature, aimed at meeting existing and changing market needs.

Another version of the design-and-build image is the corporate architectural-building division. Typically, this image can be found in retailing or supermarket chains where an in-house style is developed and replicated, with variations to suit local site conditions and markets, throughout a company's chain of outlets. Such developments may be constructed by in-house builders or put out to tender. Local authorities have their version of the in-house architect. A project's progress and content are managed rigorously using standard practices, methodologies, and project management tools.

IMAGE 3: STAKEHOLDER PARTICIPANT/PROFESSIONAL DEVELOPMENT

The next two images explore how the architect's role relates to their clients. In the first alternative image, the multiple stakeholders take over part of the architectural role with the support of professional architects. It was typified by the move to regenerate the inner cities in England during the 1950's and 60's. On behalf of the local councils and in line with Government policy, planners were brought in to redesign the urban landscape. As a result, many residents in the rows of back-to-back brick terraces that made up the UK inner cities were moved out to newly-built housing estates on the edge of the cities, often far away from traditional sources of employment. Others were re-housed in tower block or four/five story deck access blocks on the sites of the old terrace housing. These new buildings followed the modernist ideas of Le Corbusier, creating his 'machines for living', urban cities in the sky, that prescribed the way people should live [Frampton and Schezen, 2002].

Within a decade, these buildings were running into serious problems, not only in that the construction methods used led to high maintenance and running costs, but also because they were detrimental to family life. Not only were whole communities split apart, but the extended families on which these working-class relationships were based broke down, exacerbated by social trends toward the nuclear family and the lone-parent family. Crime levels increased greatly and employment opportunities were few. Little money was spent on support services. The modernist urban planners dreams became places where crime thrived and social deprivation blossomed. By the 1990's, many big estates ceased to be viable places to live, especially for the old and for families. The buildings were pulled down. Their demise heralded the start of a major exercise in stakeholder participation of inner city urban development.

Instead of urban planners and architects deciding what was required, they went to the tenants, to work with them in creating a new place to live and hope for an enhanced way of living. Although a wide consultancy exercise took place, a 'hard core' of residents usually constituted the design group. It was an exercise in creating a new built environment, but also one of forming a way for people to live their lives free of crime and with a future [Ramwell and Saltburn, 1998]. The architects and planners did not just elicit the people's housing requirements and then interpreted them via the architectural fashion of the day, but engaged directly with the project's stakeholders. They supported the residents and local politicians in the design process, empowering them in fashioning and designing their own built environment, giving of their professional skills whilst subordinating their own instincts to control the project. The result was housing on a human scale, single two story brick-built dwellings, terrace or semidetached, with defensible space front and rear or low-rise maisonettes and flats for couples or single people. Architectural design tools and project management approaches were used, but it was stakeholder involvement that drove progress. The built environment was 'owned' by the tenants. It became part of a citywide vision for regenerated towns: Manchester in the UK being the most notable example. As a result, housing was more on a human scale and conducive to tenant's needs. Its introduction was also phased so that residents and professionals could learn from their successes and failures and pass results on to each new development stage.

IMAGE 4: SELF-DESIGN AND CONSTRUCTION

The Self-build Architect/Builder image takes the concept of participatory design to its limit; the client becomes his or her own architect and builder. This approach is particularly popular in France, where people traditionally build their own homes and second homes. Individuals, or more often couples, buy their own plot of land, often on a ready-made development with roads and services. They construct or renovate their own house for themselves, based on an architectural design of their own (sometimes using a self-employed architectural technician) for which they have gained building regulation and planning permission, employing a builder or subcontractors where necessary. A feature of this approach is that the people learn both

architectural design and building skills through a process of bricolage, do-it-yourself, probably along with a community of other self-builders working on the same development. This self-build community offers an environment of support, and probably competition. It also provides access to a repository of cognitive, practical, experiential and physical, even fiscal resources which the individual can draw on in getting their job done. These competencies can then be used to develop further or change their building as the need arises, for example when they grow from a couple to a family or pass on the property to others. The self-builder will most likely do the original architectural designs. They may do the drawings themselves or more likely employ a freelance designer to do them. Progress management is usually minimal. The self-build architect/builder usually devotes only spare time to the project, progress can be very slow.

IMAGE 5: ARCHITECTURAL LANDSCAPE/GARDENER

The predominant architectural and the alternative participatory architectural images take little account of what Brand [1997] calls '… the juicy problem of designing for time' or, rather, over time. To explore the changing requirements over time, we have to look to other architectural developmental images that enable buildings to accommodate change over their lifetime. We think that their parallels in CBIS can potentially improve information systems development practice.

In his influential book, 'How Buildings Learn: What Happens After They Are Built', Stewart Brand [1997] offers an analysis of the complex relationship over time between a technology and its multiple users. In a detailed analysis of the way buildings change, from their inception, through maturity to demolition, as a result of its multiple human occupants, he suggests a way of enabling buildings to learn to accommodate change. His aim is to build into the buildings the capacity to change and learn. The answer lies in focusing resources on specific aspects of the building more '…on the basic structure, less on finishing and more on perpetual adjustment and maintenance.' Alexander [1977] argues that 'an organic process of growth and repair must create a gradual sequence of changes, and these changes must be distributed across every level of scale' and this ranges from the foundations, via structure and layout, to finishing. Funding must also be available to achieve this. The secret is to have a lifetime's view of the technology and build into it a capacity that will allow it to accommodate the needs and interventions of a number of occupants, their architects and builders over time. Paul [1994] suggests that we view this image, when it applies to CBIS, as a 'living-system'. the living system gives rise to the Architectural Landscape/Gardener image in building. The architect here may be a professional and/or the garden owners, gardeners, or 'enjoyers'.

III. DIMENSIONS OF THE ROLE OF THE ARCHITECT

In this section, we delineate several dimensions to the role of the architect. These dimensions are used in subsequent sections to analyze the role of the information systems developer. The dimensions to the role of the architect include the relationship with the client, other stakeholders, trades and professions and the building itself. In the discussions of architectural images in Section II, the architects were of different types. Predominately, they were independent professionals commissioned by a client. Sometimes, in the stakeholder or the self-build images, for example, they shared the architectural role with the clients or even been replaced by them. At other times, in the design-and-build image, for example, the architectural role is speculatively oriented towards an anticipated market.

The architect's status generally was that of the graduated, professionally trained, and accredited professional, though in some of the alternative approaches, they have been informed amateurs. Sometimes they are portrayed as heroic visionaries. Sometimes, as in urban architecture, they are seen as the villain that must be contained by giving some of the architectural role to the client. In the design/build image, their status is that of corporate employees, yet in the case of the self-builder, they are amateurs. Their roles are predominately design/interpretive, taking a client's expressed or unexpressed needs and turning them into an appropriate, architecturally functional, and aesthetic design, working in partnership with engineers and builders to translate these requirements into a satisfactory built artifact. They achieve their goal through the use of usually proven, but sometimes innovative, design approaches that are increasingly built into computer aided design (CAD) tools and techniques. They represent their client's interests, often contractually, with other professions and trades.

Architectural partnerships offer in-house engineering design services. In the heroic, the self-build and participant amateur, and landscape architect images, they develp an intimate relationship over time, often psychologically and emotionally, with the artifact. They are also judged by their results. Their status within the profession and in the market for potential clients depends on their successes and failures. The architects' relationship with the building is predominately one-off, they are present at its inception and construction, but not over the building's lifetime. Only in the self-builder, the landscape architect/gardener, and to some extent the participant architectural roles, is there an ongoing relationship with the building over time.

In these images, the buildings ranged from the grandiose corporate and public artifacts, created by the architectural 'hero', to the mundanely domestic speculative housing and industrial or retail corporate sheds designed and developed by in-house employees. Public housing resulted from coalitions of professional and amateur architects and the self-design role of the amateur. Finally, intimate organic relationships formed between the growing and evolving garden and the landscape architect.

Table 1 summarizes the architectural dimensions of each image. The architectural dimensions in this short discussion include :

- Type of architect
- Architect's status
- Architect's relationship with the client or clients
- Architectural built forms and aesthetics
- Architect's professional role and practices
- Architect's roles and relationship with other professions and trades and their roles
- Architect's relationship with the building under construction.

These dimensions, together with the architectural images set out above, are used in Section IV to explore current and potential approaches and roles to information systems development.

IV. ARCHITECTURAL IMAGES AND INFORMATION SYSTEMS DEVELOPMENT

In an earlier paper [Avison & Wilson 2001] the architect/client/builder image was used as an architectural image to explore the professional disciplines of information systems and systems engineering and their relationships within the CBIS development processes in and between organizations. We return to it here, because

- it delineates the major components of any CBIS project;
- it is the current archetype for CBIS development against which other approaches must be measured; and
- we use the other architectural images to critique it and offer alternative approaches to CBIS development.

Table 2 illustrates the architectural image with its CBIS equivalent in terms of the role of the IS developer and the approach, tools, and techniques deployed.

Table 1: Dimensions of the Role of the Architect

Architect Dimension / Architectural Image	Architect's status	Architect's professional role and practices	Architect's relationship with the client or clients	Architect's relationship with other professions and trades	Architect's relationship with the building produced	Architectural built forms and aesthetics	Approaches, tools and techniques
Image 1: **Architect, Client, Builder**	Heroic High status Professional Peer approbation or opprobrium	Design building to client requirements Meet regulatory requirements Appoint/manage building trades and professions Ensure building is constructed as per requirements	Commissioned Professional	Produce approved architectural designs that the building can be constructed to Ensure clients' needs are contractually met	Accrues market/peer kudos from building if successful Propiertory relationship toward successful prestige building Satisfaction in the design	From grand corporate or civil building designs to individual housing for clients High aesthetic, even avant-garde values aspired to	Maquettes, sketches, CAD design and development integrating tools architectural and engineering/ building project management Standard or leading-edge CAD packages or tools for project management
Image 2: **Design-and-Build**	Employee within a company	Design buildings to meet employer and market needs and manage construction	In-house professional to speculative or corporate client	Liaising with in-house building team or appointing external contractor	Creates successful market product or not Accrues employer credit accordingly	Popular even bourgeois aesthetic forms	CAD design architectural and construction packages or off-the-shelf designs
Image 3: **Stakeholder Participant/ Professional Development**	Professional advisor to stakeholders' architectural role	Support stakeholder design and specification of their built environment	Client partially in architectural role and local authority employed professional	Creating building designs, liaising with in-house building department and/or appointed contractor	Creates a building, also a home and enhances social environment Addressing social issues	Popular forms of housing in line with community stakeholder perspectives	Design approaches support participation by tenants working with professional architects

Image 4: **Self-Design and Construction**	Lay architect with some advice from professional	Self design their own housing	Client is the architect	Client is the builder contracting/ organizing subcontractors	Creates a home as well as a building Develops personal building skills	Self-defined aesthetic of the householder Avant-garde to popular	Self-drawn designs (possibly with assistance of architect)
Image 5: **Architectural Landscape Gardener**	Longstanding partner with gardener or garden owner	Interpreting clients' ongoing needs and continuous innovation	Longstanding commission/ relationship with the client	Landscape architects working in close relationship with in-house gardeners in long-term relationship	Long-term intimate relationship with garden and owner Kudos with other gardeners	Gardens keeping in step with aesthetics of house, in a changing climatic & seasonal environment	Sketches and in-house gardening practices New practices imported form other gardens

TABLE 2: ARCHITECTURAL IMAGES OF INFORMATION SYSTEMS DEVELOPMENT

IS Dimension / Architectural Image	IS Developer's status	IS Developer's professional role and practices	IS Developer's relationship with the client or clients	IS Developer's relationship with other professions and trades	IS Developer's relationship with the building produced	CBIS built forms and aesthetics	Approaches tools and techniques
Image 1: **IS Developer Client/Builder (Systems Engineer)**	'Heroic' high status IS professional Peer approbation or opprobrium	Design CBIS to senior manager's requirements Meet regulatory requirements Appoint/manage SE, software professions, project manager Ensure CBIS is built top-down to senior manger's requirements	Commissioned professional	Elicit, approved information requirements and specification that the CBIS can be built to Ensure clients contractual needs are met Manage or orchestrate other professions involved	Accrues market/peer kudos from CBIS if successful Propertorial relationship towards successful prestige CBIS Satisfaction in the design	From grand corporate CBIS designs to small applications	SSADM, Waterfall Jackson approaches using CASE tools
Image 2: **Design and Build**	Employee IS developer within a company or IS procurer within company	Design CBIS to meet market needs Specify, procure manage CBIS application	In-house developer to speculative or corporate client In-house CBIS department	Working with in-house CBIS team or contractor Managing CBIS application provider	Creates successful market product or not Procures and manages CBIS application	Popular CBIS aesthetic formsApplication provides its own aesthetic	CASE ISD design packages or off-the-shelf designs. Procures off–the-shelf packages to specification
Image 3: **Stakeholder Participant and Professional Development**	Professional advisor to user stakeholders CBIS developers role	Support user and stakeholder, specify and design/procure their application	Prospective CBIS user in the IS developer role Professional IS developer creates IS&T architecture and standards	Creating for themselves CBIS, liaising with in-house CBIS organizational developers dept and/or contractor	Creates both a CBIS and business solution Addressing organizational issues in situ	Popular forms of CBIS in line with organizational front-line user and stakeholder needs	User participation in working with IS professional to develop CBIS – Prototyping, ETHICS

Image 4: **Self-Design and Construction**	Lay IS developer with some advice from CBIS professional	Self design of their own CBIS	User is the IS professional Acquires personal CBIS skills in development	Client-builder contracting organizing subcontractors	Creates solution to a business problem that includes CBIS.	Self-defined aesthetic of the user from avant-garde CBIS to popular design	Self developed IS designs (possibly with assistance of professional IS developer)
Image 5: **Architectural Landscape Gardener**	Longstanding partnership between the IS developer, the business owner and all those who work within the partnership	Working across organization to meet business needs Continuous CBIS/business component development	Longstanding commission and or relationship with the client organization	IS developer in a close long-term relationship with in-house or contracted SE/programmers	Long-term intimate relationship with organization, users and owner Kudos with other IS developers	Creating a CBIS component aesthetic in tune with users' requirements and business process change	New business component approaches or Multiview, SISTeM, WISDM

IMAGE 1: ARCHITECT/CLIENT/BUILDER

In this image, the building represents the information system. The architectural and building processes, Avison and Wilson [2001] suggest, are commensurate with the traditional information systems development life cycle. The roles of the various professionals who enact it when undertaking CBIS development are:

- CBIS user/manager (the commissioning client)
- Information systems analyst (architect)
- Project manager (architect's site agent/builder's construction manager)
- Software engineer (structural/civil/services/drainage engineers)
- Programmer/coder (builder and their employees or subcontractors).

Documents are created using CAD, project management tools, and techniques, plans and specifications. The building documents and the information systems development equivalent include:

- Architectural sketches and maquettes (concept proposal)
- Project plan (project plan)
- Detailed architectural drawings (requirements definition)
- Building working design drawings (design specification)
- Construction plan (implementation plan)
- Construction and monthly progress reporting/costing/variances (implementation documentation).

In this image, the development of CBIS is a professionally driven endeavor, commissioned by the 'user' client. The user's one-off requirements are captured at the beginning of the project. These requirements, with some fine-tuning, are then encapsulated in a design specification, which is then implemented by the software engineers, programmers, and project managers, to produce the finished CBIS application. Installation, with user training, then takes place. The contract is then signed off and a maintenance contract agreed. CASE and project management tools are often used. These tools may include within them a structured approach, such the waterfall model, SSADM, Yourdon Systems Method, Jackson Systems Development or Information Engineering, along with project management approaches, such as PRINCE. These approaches are used to orchestrate and provide tools to support all or parts of the CBIS development process. Details of these approaches can be found in Avison and Fitzgerald [2003].

Whilst this image may be appropriate in certain circumstances, such as safety-critical systems, for example, the problem with this type of approach is that it produces a very inflexible solution to often one-off top-down managerial requirements or formalized organizational objectives [Paul 1994]. In practice, such solutions often fail to accommodate the needs of multiple stakeholders within the organization and lack the adaptability to meet ever-changing organizational requirements. This approach leads to significant problems, as many CBIS failures will testify [see, for example, Lyytinen and Hirschheim 1987; Sauer 1993; Beynon-Davies, 1995; and Introna 1998].These problems would suggest that this particular architectural image of IS is not always, and may never be, the solution to gaining on-going organizational leverage and added value over time from CBIS. Alternative architectural images point the way to a greater understanding and means of addressing these problems.

IMAGE 2: DESIGN AND BUILD

The design and build image takes three forms:

1. The creation of technologies designed to meet, as with a house, the well-defined needs of users within specific market niches. Examples include packaged applications with which individuals may write their own wills or enable companies to manage employee salaries. They are standard operational products whose success or failure is measured by their ability to meet current and evolving market needs. The role of the IS professional lies in using means, such as

user focus groups, to define an application's functionality and ensure continual improvement. The systems engineering role is that of developing the CBIS to the IS professional's specification. A sophisticated CBIS version of this image is the creation, probably within an industry or a large corporation context, of plug-and-play information components or business components.

2. The in-house design and build of applications that usually serve well-defined operational business processes or management reporting. Tillage systems and stock control systems are examples of this type of CBIS. These systems are usually based on well-proven technologies. They can act as feeders into other applications, such as customer resource management or stock management systems. The information systems analysts are required to know business operational and managerial processes intimately. They will probably work closely with business process development professionals. Because these systems are crucial to the organization, the software engineer and programs must ensure that the CBIS are robust and well proven, yet capable of change.

3. The user's (the equivalent of a house purchaser) point of view rather the CBIS developer's point of view. The image here is that of a procurement by an organization, either by its IS department, senior management, or an end-user, of an off-the-shelf application. These applications range from a human resource management package to an enterprise resource planning system. This approach brings out the way the application demands, to a greater or lesser extent, the reconfiguration of business processes and practices, and thus impacts existing cultures and power relationships within the organization [Truex, 2000].

IMAGE 3: STAKEHOLDER PARTICIPANT/PROFESSIONAL DEVELOPMENT

The architectural images explored so far give rise to CBIS development approaches that are professionally driven and top-down or market driven. However, many CBIS developments within organizations using this approach led to failure precisely because they are top-down and ignore the needs of frontline staff. The classic example is the London Ambulance (LASCAD) System [Beynon-Davies, 1995, Introna, 1998] in which the ambulance dispatchers, as well as being in dispute with the management, were not fully engaged in the processes of development. The result was both a poor performing application and ultimately its rejection by the intended users, who returned within days to using the old manual system. Many other CBIS developments ignored the prospective user or stakeholder [Lyytinen and Hirschheim 1987; Sauer 1993]. The London ambulance system eventually successfully overcame the problems by involving these very same dispatchers in the development process [Fitzgerald 2000]. Success was achieved by an in-house information systems professional familiar with a 'user' focused prototyping approach, accompanied by committed senior management that created an organizational environment in which this approach could thrive. This newer LASCAD system is a success and received an award from the British Computer Society in 1998 for excellence. ETHICS [Mumford, 1995] is one methodology which emphasizes participation.

IMAGE 4: SELF-DESIGN AND CONSTRUCTION

The CBIS development approach equivalent to the self-build image is the in-house creation of bespoke software or the purchase and modification of an application by managers and staff within a department to meet their own self-identified business information needs. The chief information officer (CIO) and his/her staff might work closely with the management team to produce a CBIS solution to their self-defined business problem, providing a professional design and implementation service if required [Sauer and Yetton, 1997]. The IT department's role here lies not in imposing a top-down solution, but in supporting the business department team in best meeting their information needs within a specific business context. The CIO with there is developers will, nevertheless, set down the technology and application software standards for the whole organization and also put in place a scalable and extensible IT infrastructure. The CIO may also participate in defining a set of global business objects and services that the self-builder would be required to use in any local application development. The latter role is the self-build equivalent of the building regulations, road layout and services provision by a developer and local authority. One possibility under this heading would be the user developing an application using a spreadsheet or database package as a software tool to aid the process. Information systems and software engineering practices based on stakeholder participant/professional development and self-build images offer alternatives to that of the architect/builder. The

alternatives emphasize the need for professionals to provide their skills in a way that facilitates user participation in addressing organizational problems through CBIS and other means.

IMAGE 5: ARCHITECTURAL LANDSCAPE GARDENER

Whilst offering alternative images to the top-down client/professionally driven approach to CBIS development, the self-help and participatory/multiple stakeholder approaches do not automatically deal with the problem of change and adaptability, characteristic of the dominant architect/builder. As frequently evidenced in practice, the participatory development process might be a one-off exercise.

Paul's [1994] response is to proffer the concept of CBIS as 'living systems'. This response is very similar to the way that Brand [1997] and Alexander [1977] suggest that buildings adapt and learn with each occupant's interventions and continual maintenance. In his discussions of this concept, Paul uses the organic garden and gardener image in which CBIS are constantly developed and cultivated, not on a grand scale, but in local areas, one 'flower bed' here, another functionality there. His CBIS development image is of a garden changing organically through constant and localized interventions over time rather then as a whole reengineering process, typified by the 'slash and burn' strategies of business process reengineering and enterprise resource planning implementations. In this amethodolgical approach [Truex, 2000], CBIS evolve with an ever-changing organizational social complexity that is '(a)…emergent and not *a priori* given…' and (b) whose '… regularities are constantly shifting and evolving…' [Lycett and Paul, 1999]. Such social situations found within organizations cannot be predicted by a 'once-and-for-all' requirements specification. Based on this 'living systems' concept, CBIS would have the same evolutionary capacity as the organizational social world that they serve, The CBIS would achieve this capacity '… through an architecture that allows [the CBIS author] components to be removed, replaced and reconfigured in a more dynamic fashion' over time [Lycett and Paul, 1999]. Dynamic change is achieved through the 'structural coupling' of the CBIS with its ever-changing social context 'allowing for structural plasticity between the technology and the social' dimension within the organization over the long term.

V. IMPLICATIONS OF ARCHITECTURAL IMAGES FOR FUTURE IS DEVELOPMENT

The images of information systems development derived from the various architectural images summarized in Tables 1 and 2, offer a number of insights into the IS discipline and role of the IS professional.

1. The images enable us to identify different practices, roles, and statuses for professionals associated with CBIS development and their clients.

2. The images suggest that forms of CBIS development practices are contingent upon diverse organizational contexts.

3. The images offer an opportunity to put forward a migration pathway for future approaches to CBIS development that address some of the issues associated with current practices founded on the prominent architect/client/builder image.

The pathway starts from this most prevalent image of a professionally driven, top-down approach of both architectural and informational design and development, to images that can accommodate multiple users and stakeholders involved in continual development over time. In this closing discussion, we explore these insights.

ARCHITECTURAL IMAGES OF INFORMATION SYSTEMS PROFESSIONALS AND THEIR ROLES

CBIS development, as Avison et al. [2001] point out, is a discipline with a set of professional practices that is about 30 years old. The architectural images of information systems development presented here, nevertheless, put it on a par with a discipline and set of professional practices that are at least three thousand years old. The discipline of IS is now indispensable to modern life, as architecture was for many generations and societies. Both disciplines are evolving in a similar way. CBIS development practices and tools, although in their infancy, are showing the same evolutionary pathway as architecture, being both bounded and dependant upon developments in the underpinning sciences, available materials, technologies, design tools, and construction techniques.

As with architecture, the CBIS 'style de jour' will be driven more often than not by current professional fashion than by actual functional need, be it for Greco-roman columns or Customer Resource Management applications. Similarly, an aesthetic will be dominant within a client organization, be it for postmodern buildings or 'GUI' front ends. For the client and user of the building or the IS application, functionality and cost are always major factors. Yet other issues are also important; for example, whether the technology is custom built or ready made for the market, or whether the solution is majestic or mundane. IS professionals advise their clients on whether to go for in-house, external development or located outsourcing CBIS options in a similar manner to that of architects advising their clients on location, build, buy, or rent options.

Rather than a single model, the roles and the status of the CBIS practitioner and the architectural practitioner are shown here as diverse. Divrsity is a strength, not a weakness: situations, people and problems are also diverse. Comparisons of CBIS development with architectural practices exposed a wide range of models for the information systems professional. These models range from the heroic commissioned professional to the salaried in-house employee, from the remote expert who lays down the design to the mentor and facilitator helping users meet their own information requirements. Through a variety of relationships they achieve these goals whether from the one-off short-term with a high status client or a long-standing relationship with a community of business people.

The information systems professional, like the architect, provides the essential technical design function, together with a wide range of services within a relationship commensurate with achieving their client's informational needs whilst at the same time addressing the wider interests of the many organizational stakeholders.

ARCHITECTURAL IMAGES OF INFORMATION SYSTEMS PRACTICES, APPROACHES AND TOOLS

The practices and approaches to information systems development revealed through architectural images are also diverse and context dependant. In CBIS development, the range is from the top-down highly structured approaches such as SSADM, Yourdon, and Information Engineering approaches used by the commissioned professional to the more flexible contingency approaches, such as Multiview [Avison and Wood-Harper, 1994], SISTeM [Atkinson, 1997, 2000] and WISDM [Vidgen et al., 2002] that engage multiple clients and users in the processes of CBIS and organizational development. We see appropriate variety and flexibility in approaching IS development reflecting different contexts as a sign of a maturing discipline, not one 'catch all' prescriptive approach, in the same way that architecture uses different approaches to construction.

However, architecture and building practices, apart from formalized project management approaches, are not 'fascinatied' with methodology that can found within much of information systems development [Avison and Fitzgerald, 2003, Truex, 2000]. Architectural design and building development tend to be based more on established professional practices, matched to the needs of the client and their context of use rather than the formalized processes of the systems development life cycle, which underpin most CBIS development methodologies. This difference is probably because buildings and structures are not as fundamental a constituent of organizational business processes as are CBIS. As long as buildings provide the necessary space, services and facilitate people flows, they do not need to meld as intimately in with human activity as CBIS. Nor are buildings as complex a design or development task as CBIS projects of a commensurate scope. Nevertheless, parallels abound. Contingency approaches (e.g., Multiview, SISTeM and WISDM), whilst still methodology frameworks, are more reflective of architectural and building practices than traditional IS approaches. In many of the architectural images, computer aided design (CAD) tools are deployed. These tools are mirrored by the use of computer-aided software engineering (CASE), designer and developer tools within information systems development. The architectural images (Sections II and III) show both similarities and disparities between the building practices and those of CBIS development. Nevertheless they do reinforce the idea that IS professionals perform many roles analogous to those of the architect, whilst the software engineer and programmers roles are comparable to the builder, with project managers in support.

ARCHITECTURAL IMAGES OF FUTURE CBIS DEVELOPMENT

As discussed in Section IV, Lycette and Paul [1999] point out that CBIS development based on the architect/client/builder image has a propensity to continually 'disappoint'. We argue that it is much more interesting to look at the alternative images of architecture for IS development. Arguing through the 'lens' of the landscape architect/gardener image, the main reason for this disappointment is the incapacity of CBIS and current conventional development approaches to accommodate to social changes within organizational contexts. This inability is particularly true in those contexts where there are multiple users, changing business needs, and a diversity of stakeholder interests. Following this image, CBIS development and the role of the IS professional are akin to the relationship between the organizational garden, with its ever-changing lawns, beds and borders. The flowers are reflected in the various objects that make up our developing CBIS 'garden', and these objects can be fed and replaced. We see this architectural image as likely to give the most impact to IS development practice.

A combination of the user/stakeholder and the participant/professional development image might also be appropriate. This combination suggests that CBIS professionals develop, using appropriate approaches, the CBIS components and provide the underpinning technical and business architectures. However, it is the business people who are proactively involved with technologists to address business problems. The IS professional would have a facilitating role in this process. This would be a feature of a living organizational system in which continual problem solving is orchestrated by contingency approaches encompassing both the CBIS and human dimensions.

Contingency approaches accommodate environments containing interactions in networks of humans and technologies [Atkinson, 1999; Callon, 1986; Checkland, 1982; Bloomfield et al., 1992; Latour, 1987; Vidgen et al., 2002; Walsham, 1997]. The characteristics of such approaches are:

- Adaptability to ever-changing organisational problem situations over time
- Adaptability to different user and developer skills, education, experience and other characteristics
- Ability to cope with various contexts, from complexity and ill-structuredness to more simple and structured
- Integration of both human and technical development
- Tools and techniques from various disciplines
- Ability to encompass competing paradigms ranging from the technical-rational to the socio-political and from reductionist, hard thinking to systems, holistic, soft thinking
- Ability to encompass functionalist, interpretive, objective and subjective perspectives.

As we suggested above, Multiview, SISTeM and WISDM are examples of contingency approaches. These approaches, once established within the organization, potentially become never-ending socio-technical problem-solving and learning processes, involving a multiplicity of stakeholders. The use of contingency approaches establishes, within organizations, processes of continuous development, living systems, and not one-off instances of grand designs. They also address human and business issues by involving multiple constituencies across business processes, cultural, political, strategic, and fiscal changes. These approaches offer opportunities for organizational learning about how to develop technologies and to accommodate continuously-changing contexts of our gardening or living systems image.

FINAL REMARKS

This paper set out to explore a variety of differing images of information systems development. These images are based on architectural and building practices. This exploration reiterates the suggestion, propounded by Avison and Wilson [2001], that we may view the role of the IS professional in CBIS development as analogous to that of the architect and the software engineer to that of the builder. However, on inspecting current construction practices, we revealed many images and relationships of the architect and builder/engineer with their clients

and found their parallels in the IS world. The images also show that the user of the technology may also be its architect and builder, with or without the support of professional expertise and facilitation, and with or without formalized CBIS methodologies, techniques, and tools.

It is argued here that research to date suggests that many CBIS developments based on the prevailing architect/client/builder image (the traditional IS development life cycle) continue to underperform or fail. This approach is incapable of accommodating complex long-term organizational change. We propose an alternative architectural image, the living system inherent within the landscape architect/gardener. Contingency approaches to IS development provide its parallel in the CBIS world.

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REFERENCES

Alexander, C. (1977) *A Pattern Language: Towns, Buildings, Construction*. New York: Oxford University Press.

Atkinson C. J. (1997) Soft Information Systems and Technologies Methodology, SISTeM: A Case Study of the Electronic Patient Record, *Requirements Engineering* (2), pp.1-22.

Atkinson C. J. (2000) The 'Soft Information Systems and Technologies Methodology: an Actor Network Contingency Approach to Integrated Development' *European Journal of Information Systems*, (9) pp. 104-123.

Atkinson C. J. (2002) The Multidimensional Systemic Representation of Actor Networks: Modelling Breast Cancer Treatment Decision Making, *Proceedings of the Thirty-fifth Hawaii International Conference on Systems Science.*

Avison, D. E., G. Fitzgerald, and P. Powell, (2001) Information Systems Teaching, Research and Practice, *Information Systems Journal,* (11)1.

Avison D E and Wood-Harper A T (1994) *Multiview: AnEexploration in Information Systems Development*, Henley on Thames: Alfred Waller.

Avison, D.E. and Wilson, D. (2001) A Viewpoint on Software Engineering and Information Systems: What We can Learn from the Construction Industry, *Information and Software Technology,* (43), pp 795-799.

Avison D. E. and Fitzgerald, G. (2003) *Information Systems Development: Methodologies, Techniques and Tools*, London: McGraw-Hill. 3rd edition

Avison D E and Fitzgerald G. (1999) Information Systems Development, in W.L. Currieand R. Galliers (Eds.) *Rethinking Management Information Systems* Oxford: Oxford University Press.

Brand, S. (1997) How Buildings Learn: What Happens After they are Built, Location? Weidenfeld Nicolson.

Benyon-Davies, P. (1995) Information Systems 'Failure': The Case of the London Ambulance Service's Computer Aided Despatch Project, *European Journal of Information Systems,* (4)3, pp171-184.

Bloomfield B.P, R. Coombes, D. J. Cooper, and D. Ray, (1992) Machines and Maneuvers: Responsibility Accounting and the Construction of Hospital Information Systems. *Accounting, Management and Information Technologies* 2 (4) pp. 197-1.

Callon, M., (1986) "Some Elements of a Sociology of Translation: Domestification of the Scallops and Fishermen of St Brieuc Bay," in Law, J (ed.), *Power Action and Belief: A New Sociology of Knowledge?* London: Routledge, Keagan, Paul.

Checkland, P. B. (1982) *Systems Thinking, Systems Practice*, Wiley, Chichester.

Davis, G.B. (1999) AIS President's Report – 1998, *Communications of the Association for Information Systems*, (2)11, August.

Ein-Dor, P (2003) AIS President's Report - 2002-2003, *Communications of the Association for Information Systems*, (12),8.

Frampton, K. and R.Schezen, (2002) Le Corbusier: Architect of the Twentieth Century, Harry N. Abrams.

Hirschheim R, K.Heinz, K.Lyytinen, (1995) *Information Systems Development and Data Modelling* Cambridge: Cambridge.University Press

Ives, B (2002) AIS President's Report: 2001-2002, *Communications of the Association for Information Systems*, (9)4.

Lyttinen, K. and Hirscheim, R. (1987) "Information Systems Failures - A Survey and Classification of the Empirical Literature," in *Oxford Surveys in Information Technology*,(4) pp. 257-309.

Lyytinen, K. (1988). Stakeholders, IS Failures and Soft Systems Methodology. *Journal of Applied Systems Analysis*, **(**15), pp. 61-81.

Fitzgerald, G. (2000) The London Ambulance Service Computer Aided Dispatch (LASCAD) System, Swindon: British Computer Society.

Introna, L. (1997) *Management Information Systems and Power,* Basingstoke: Macmillan.

Latour, B. (1987) *Science in Action,* Cambridge, MA:Harvard University Press.

Lycett M. and R. J. Paul. (1999) Information Systems Development: A Perspective on the Challenge of Evolutionary Complexity. *European Journal of Information Systems* (8)2, pp 127-135.

Mumford, E. (1995) *Effective Requirements Analysis and Systems Design: The ETHICS Method*, Basingstoke: Macmillan.

Paul R. J., (1994) Why Users Cannot 'Get What They Want' *International Journal of Manufacturing Systems Design,* (14), December pp. 389-394.

Ramwell R. and Saltburn, H (1998) *Trick or Treat? City Challenge and the Regeneration of Hulme North*, Preston: British Housing Association.

Sauer C., Yetton, P.W. and Associates (1997) *Steps to the Future: Fresh Thinking on the Management of IT-Based Organisational Transformation,* San Francisco: Jossey-Bass.

Spiller, N. (1999), Digital Dreams, Architecture and New Alchemical Technologies, London: Ellipsis.

Truex, D. (2000) Amethodical Systems Development: The Deferred Meaning of Systems Development Methods, *Accounting, Management & Information Technologies*, (10), pp. 53-79.

Vidgen, R., Avison, D. E., Wood, R. and Wood-Harper, A. T. (2002) *Developing Web Information Systems.* UK: Butterworth-Heinemann.

Vitale, M (2001) AIS President's Report: 2000-2001, *Communications of the Association for Information Systems* , (7)16.

Walsham G. (1997)Actor-Network Theory and IS Research: Current Status and Future Prospects. *Information Systems and Quality Research* Proceedings of the IFIP TC WG 8.2 International Conference on Information Systems and Quality Research, Philadelphia PA.

ABOUT THE AUTHORS

Chris Atkinson is Senior Lecturer in Information Systems in Brunel University Department of Information Systems and Technology (DISC). He specialises in creating methodologies, tools,

and techniques and their associated theoretical frameworks for carrying out research and development into integrating IS&T with human organisational change. He worked extensively in health care, specialising in combining changes to multi-professional clinical practice with clinical information systems development. He is exploring the integration of Structuration Theory with Actor Network theory as framework for underpinning this work. In a previous professional role he was a civil/structural engineer working with and within major international architectural practices and public sector institutions. He received his doctorate in 1985 from Lancaster University.

David Avison is Professor of Information Systems at ESSEC Business School in Paris, He is also visiting professor at University of Technology, Sydney, and Brunel University in England. He is joint editor of the *Information Systems Journal*. So far, over twenty books are to his credit. He published four books in 2002 including the third edition of the text Information Systems Development (with Guy Fitzgerald). He published a large number of research papers in learned journals, edited texts and conference papers. He is vice chair of IFIP technical committee 8 and former Chair of IFIP working group 8.2 and past President of the UK Academy for Information Systems. He served as chair of many international conferences and will be joint program chair of ICIS 2005 in Las Vegas. He researches in information systems development and on information systems in their natural setting, using action research and other qualitative research approaches.

David Wilson is Associate Dean (Education) and associate professor within the Faculty of Information Technology at the University of Technology, Sydney. His teaching and research interests are in project management, software quality assurance, and information systems management. David gained 10 years of practical experience in the development of management information systems before moving to academe in 1982. David was Editor of the Australian Computer Journal for five years and is a past Chairman of the Software Quality Association (NSW). He is on the programme committees of two international software quality conferences and presented a number of papers on software quality and software process improvement at international conferences.

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