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Communities and Conversation Support: Rethinking the Design of Organizations and Information Systems, Learning from Pattern Languages

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Communities and Conversation Support: Rethinking the Design of Organizations and Information Systems, Learning from Pattern Languages

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ABSTRACT

Information systems development can be framed as the construction of built information environments. In the design of these built environments, structures both in the social realm (of organizations and communities) and the information realm (computer-supported conversations) are not easily separated.

In the design of built *physical* environments, Alexander addresses both the social realm and the physical realm by means of a pattern language. This approach can be applied to built *information* environments. Through an understanding of scope, content and influence of the physical realm onto the social realm, parallels can be drawn to how a pattern language might improve the design and construction of built information environments.

In the field of built physical environments, urban planners, architects, and builders successfully use a pattern language to communicate coherently. In the field of built information environments, we propose that a pattern language become a lingua franca for organization designers and information systems designers.

Keywords

Conversations, Communities of Practice, Computer-Supported Cooperative Work, Design, Information Systems Development, Pattern Languages.

THE DESIGN OF INFORMATION SYSTEMS FOR BUSINESS ENTERPRISES NEEDS TO RESPECT A SOCIAL SYSTEMS CONCEPTION OF BOTH THE ORGANIZATION AND ITS INFORMATION SYSTEMS

Many Information Systems Development Methods Adopt an Organismic View of Organizations

Specification of work practices to develop supporting information systems can be done either by the people in the daily practice of doing the work, or by information systems specialists who have specialized expertise in capturing practices. In the process of abstracting these specifications from multiple business users, something is lost. The loss may be the result either of not involving users fully in the information system design process, or of conducting the work in terms so that the users don't sufficiently understand design possibilities, trade-offs and consequences.

In Ackoff's categorization, this would be described this as an organismic view of business [2], where a single person can become a "brain of the firm." This is contrasted with other conceptions of a business: as a mechanism, ecology or social system. These systems are distinguished in terms of purposefulness. A system may act purposefully (i.e. exercise choice) as a whole (as do an organism and a social system), and it may act purposefully in its parts (as do an ecology and a social system).[1]

Herrald would characterize this organismic view of the business as "we say, you do" [16]. Decisions about the design of work, and the information systems that support them, are made by managers, supervisors, or headquarters staff. The function of the worker is to execute procedures. The function of supervisors is to inspect the work as in compliance with procedure.

CSCW Tends to Favor an Ecological Perspective, Focusing on how Practices Emerge in Response to Design

An organismic conception leads to information systems designed "from without" work teams. Members of the CSCW community would point out that these representations are simplistic views of the real work, and do not exploit the valuable knowledge available "from within" the work team about what practices are actually used [7].[2] By ignoring the true nature of human, social practice, the resulting information system fails to exploit the inventiveness, initiative and enterprise of members of the business.

Although often retaining a scientific equivocality with respect to whether views of work from within or without should be preferred,[3] CSCW has tended to favor the more ecological perspective "from within," focusing on the detailed accomplishment of work and emergence of work practices by purposeful people engaged in that work. This view is consistent with Ackoff's categorization of an ecological system: choice is in the parts, and emergent in the whole.

Business Enterprises Should be Thought of as Social Systems, in which there is a Creative Tension Between the Organismic View of Leaders and the Ecological View of Empowered Workers

In the "theory of the firm," economists ask: why do firms exists — as an alternative to having all transactions in a market conducted by individuals. In this view, a business enterprise is undoubtedly a social system. As a whole, it exists for a purpose. If some parts of the enterprise do not contribute towards (or interfere with) this overall purpose, efficiency can be increased by conducting that function outside the bounds of the firm [2].

Information systems developers need to also adopt the social system concept of the enterprise.

Information Systems Development Involves Designing a Built Environment for a Social System whose Members Become Occupants of that Environment

The system being designed when we conduct information systems development is a socio-technological system. When information systems are being developed, the system that is being designed has both social components and technological components. There are multiple perspectives at play. The socio-technological system involves interactions between individual people and the technology, which from a design perspective is the domain of Human Computer Interaction. Interactions between people may be mediated by technology (the domain of Computer Supported Cooperative Work). They may be mediated by other people (the domain of Organization Design and Management Science). And they may be mediated by physical space (the domain of corporate architecture). Moreover, interactions between people involve not just peer-to-peer collaboration of the kind addressed by groupware (informal networks), but those either within a hierarchy of authority (formal organization), or within networks of accountability for outcomes and bounded, empowered coordination [16].

The design of information system should be considered less from the perspective of constructing mechanisms, than constructing part of the built environment that the enterprise's people occupy. Information systems influence work practices as much as does the physical built environment, and in similar ways. For example, in the same way that the physical shape of the built environment may foster or inhibit economic and social well-being [17], structure imposed by information technology may contribute positively or negatively towards the goals of a larger social enterprise [24].[4]

It would be valuable to be able to discuss the built information environment and its effect on its occupants as a single system, using vocabulary that has connotations in both the social and the information systems realms. This vocabulary should be accessible both to actual and potential occupants and those involved in system construction, bridging the conceptual gap between several realms of practice.

THE DESIGN OF BUILT PHYSICAL ENVIRONMENTS BENEFITS FROM A PATTERN LANGUAGE THAT DESCRIBES BOTH OCCUPANT-TO-PHYSICAL AND OCCUPANT-TO-OCCUPANT INTERACTIONS WITHIN THE PHYSICAL ENVIRONMENT

Probably the classic attempt to provide a shared vocabulary for a domain of the built world is Alexander's "pattern language" for towns, buildings and construction [3,4].

In Relating Concerns on Many Levels of Scale, a Pattern Language can be used to Dissolve Boundaries Between Disconnected Practices

It is somewhat striking that within a single pattern language Alexander includes patterns of such a large scale as Independent Regions (1),[5] The Distribution of Towns (2) and City Country Fingers (3) with patterns of such a small scale as Small Panes (239), Half-Inch Trim (240), Soft Tile and Brick (248) and Things From Your Life (253).

The main reason for including patterns on several levels of scale seems to be to make accessible to people other than professional architects, urban planners and builders a coherent means for reasoning about the built world as a whole. The achievement of quality within the built world requires a reintegration across separate disciplines if the built world can be dealt with as a whole. In his later work, Alexander addresses the larger building culture, including funding flows and contracts governing the design and building process [5]. In particular, he calls for the re-merging of roles of architect and building manager.[6]

Alexander groups patterns within the pattern language roughly into the following levels [3, xix-xxxiv]:

- town patterns (1)-(94) that define towns or communities, which "can never be 'designed' or 'built' in one fell swoop"
- building patterns (95)-(204) that give shape to individual buildings and groups of buildings, "which can be 'designed' or 'built'"
- construction patterns (205)-(253) that tell you how to construct buildings based upon the shape outlined in terms of building-scale patterns.

Since each individual pattern is itself defined primarily as relationships connecting patterns on larger and smaller scales, there are rich interconnections between patterns in the three groupings. Thus these groupings are probably more to turn the pattern language into a more

comprehensible whole than to provide a clean classification scheme.

Quality of the Built Physical Environment, on all Scales, is Related to the Interaction of Patterns of Events in the Social Realm and Patterns in Physical Space

Alexander describes the general principles underlying his pattern language [3] in a second volume [4], demonstrating that the language is considerably more than an assembly of useful pieces.

In particular, he emphasizes that the quality of the built environment is ultimately about relationships between patterns of events within the social realm and patterns of relationships between the elements of physical space. "... patterns of events are always interlocked with certain geometric patterns in the space. Indeed, as we shall see, each building and each town is ultimately made out of these patterns in the space, and of nothing else: they are the atoms and the molecules from which a building or a town is made" [4, p.x].[7]

In assembling the pattern language, Alexander and his colleagues sought to promote good patterns at the expense of bad ones. Some patterns promote events and life while others do not. Alexander calls patterns that promote life "living patterns." The pattern language [3] documents over 250 such patterns and the ways that they support each other in creating living places.

Patterns of Spaces and Boundaries are Required to Address Specific Issues of Public, Private, Intimacy, Visibility, Ownership and Identity

As examples of patterns where social and spatial elements interact, the following patterns encourage certain kinds of encounters and awareness to occur on a regular basis and for certain events to be visible to a broader public:

- Master and Apprentices (83) recognizes that "the fundamental learning situation is one in which one person learns by helping someone who really know what he is doing," and so structures space so that apprentices and masters work in connected physical spaces.[8]
- Private Terrace on the Street (140) creates a connection between the public space of the street and the common yet private realm of a building, allowing an awareness of each space from the other. Various geometric arrangements may make the two spaces relatively asymmetric, allowing the street to be more visible from the building than vice versa.
- Public Outdoor Room (69) is an identifiable but loosely defined space that is visible to many yet capable of supporting an interaction between people who may just be hanging out. Its wide visibility allows others to see who is there, and to decide whether to come and join in.
- Communal Eating (147) recognizes that "without communal eating, no human group can hold together." A common, regular event not focused on the immediate subject of work builds a community, and allows for things of less immediate concern to be discussed and explored.

More specific patterns create space for people to develop certain forms of individual or group identity. They include:

- Couple's Realm (136) makes sure that a couple has its own space that is psychological distant from their children, allowing them "the closeness and the special privacy which a man and wife need together."
- Children's Realm (137) allows children to release their energy, passing from their own bedrooms to the street in which they play without disrupting the rest of the household.
- Farmhouse Kitchen (139) embraces the fact that one of the most valuable common events, and thus functions for common space, is eating together. As such, it incorporates cooking and dining facilities more centrally into the common spaces of a house.
- Common Land (67) for a small group of houses "makes it possible for people to feel comfortable outside their buildings" and "acts as a meeting place for people." It is semi-public while nevertheless clearly belonging to its surrounding houses.

Alexander's focus on the role and value of relatively public, shared space between buildings is apparent in many patterns that seek to create common areas within and between buildings. We will return to this focus on creating and maintaining a commons when we consider the built information environment.

While Deemphasizing the Materials of Construction, Patterns do Show the Role of Basic Construction Outcomes such as Boundaries, Translucence and Connections Between Spaces

With the pattern language, Alexander goes to great lengths to shift the emphasis of discussions of the built physical world away from its construction elements, materials and processes and onto the way in which the relationships between elements support patterns of events within the social realm.

Compared to other architectural approaches, the pattern language deemphasizes materials, construction and even precise physical geometry.

Nevertheless, from the perspective of the geometry of physical space, most patterns ultimately come down to arrangements and uses of space and barriers to achieve various configurations. Spaces may be partitioned from each other, or they may be connected. Barriers may be only translucently connected by barriers that are partial, such as windows that block sound and passage but not light.

As we shall see, the importance of boundaries, translucence and connections between spaces central to Alexander's view of the built physical environment will be central as we discuss the built information environment.

THE DESIGN OF BUILT INFORMATION ENVIRONMENTS CAN ALSO BENEFIT FROM A PATTERN LANGUAGE TO DESCRIBE PERSON-TO-MEDIATING-TECHNOLOGY AND PERSON-TO-PERSON (THROUGH THE MEDIATING TECHNOLOGY)

Quality of the Built Informational Environment Results from Correspondences Between Patterns of Events in the Social Realm and Patterns in Virtual Space

We assert that the kinds of problems to be solved in the built information environment are closely related to the kinds of problems that Alexander's patterns solve.

Built physical environments support patterns of social events through the construction of physical structures. Built information environments also support patterns of social events through the construction of communications structures.

The *Conversation* Construct is Introduced to Emphasize that Built Information Environments Consist of Shared Information Spaces, Boundaries, Transactions, and Forms of Translucence

The basic shape of the built information environment are essentially the same as those of the built physical environment. Information systems have been characterized in terms of shared information spaces [6], boundaries between those spaces [31], transactions between information spaces, and means for achieving translucence [12] across information spaces, which include accounts of various kinds [33].

We emphasize that these are the elements of the built information environment by introducing a construct called a *conversation*.

We define a (computer-supported) conversation as a circumscribed region of virtual space grouping virtual resources for use by a specified group of agents. In using the term "virtual space" we are drawing an analogy between how people use physical space and how they structure their use of information technology. On the one hand, people gather resources into shared physical spaces. For example, a room may contain posters, writing on white boards, papers and books all pertaining to a software development project. Similarly, a virtual space supported by information technology groups virtual resources for some purpose. On the other hand, people partition physical space into realms with differing degrees of exposure or intimacy, varying from public to private. As Clement and Wagner have pointed out, human communication, be it in physical space or through information technology, consists of similarly fragmented spaces, in which choosing not to articulate something within a given space can be as valuable as articulating it [9].

In emphasizing the grouping of virtual resources, we are expanding Suchman's view of plans as "resources for situated action" [32] to apply to all pieces, and computer-supported representations of, information. Our focus in designing both organizations and software is on carefully identifying and broadly designing situations, and key resources available to people within those situations. We then seek to leave people free (empowered) to choose how to act within those situations [27]. Virtual resources may include information, means for structuring information (such as an information model) and maintaining its integrity (such as operations that maintain the invariant of the information model), user interfaces (forms and dialogs) that present the information in useful ways, and means for navigating to other related conversations.

The conversation construct is intended to support the full spectrums between computer- and socially-enforced conduct, and from high to low enforcement. Elsewhere, from a software engineering point of view, we have discussed how conversational genre provides many of the clues required to determine how each conversation should be implemented in technology [28].[9]

Conversations reflect the shape of the built information environment as follows:

- conversations have very clear boundaries which are usually only visible from the inside. Users can only become aware of a conversation through explicit reference to it within another conversation in which they participate;
- the informational environment is not a single connected space, meaning that connections between conversations must all be made explicitly. Open spaces between conversations cannot exist except as explicitly created, additional conversations;
- conversations can only be entered by people under rules maintained by software, which may be under the control of other users;
- the informational environment has no free notions of translucence and distance, meaning that the kinds of limited awareness of what others are doing that comes from proximity in a shared physical space requires careful engineering [12].

We propose conversations as a basis for patterns about the built information environment precisely because we believe that they reflect the shape of that environment.

Patterns are Required at Least on the Scales of Individual Conversations, Communities of Practice and Constellations of Communities

The built information environment supports not just individual work but:

- interactions within workgroups;
- interactions across different areas of a large enterprise;
- interactions between enterprises;
- interactions in the public spaces beyond enterprises.

Intuitively these kinds of situations correspond to Alexander's concerns with towns, individual or small groups of buildings, and detailed construction.

We currently prefer to limit our explorations to conversations, groups of conversations, and to the positioning of individual conversations or groups of conversations with respect to communities of practices.[10]

An understanding of the social realm seems to be more crucial to the design of information environments than physical environments. Firstly, many valuable social structures that have their own information needs are not directly supported by dedicated realms in physical space. Certain groups will only convene in general purpose meeting rooms and rely upon dedicated conversations in the information environment for sharing resources. Secondly, information technology is applied to much more detailed aspects of human practices than is the built environment, including such things as forms, classification schemes and formal interaction protocols.

Research into human knowledge systems is still new. However, Wenger's system of concepts centered upon the notion of communities of practice seems to bring an appropriate level of detail and structure for discussing the position of conversations with respect to social structure [34]. A community of practice is a locus of learning and for the negotiation of the meaning of organizational events to the members of the community. It may be an internally differentiated space, including not just full members but several forms of legitimate peripheral participation [25] within the community. Legitimate peripheral participation may provide space for newcomers to learn how to become a part of the community, or for the participation of people who will only ever participate peripherally. Most individual people are multi-members, participating in different ways within several different communities.

While Wenger focuses on communities of practice, he indicates that there are many possible forms of community. Communities of practice are defined in terms of a shared repertoire of practices, mutual engagement, and a joint enterprise. Various forms of community can be defined in terms of various levels of three modes of belonging: through engagement, alignment or imagination. An example of a community defined primarily through imagination is a nation or the followers of Star Trek. These examples demonstrate that communities and, for that matter, conversations, may involve members within a single corporation, between corporations, or completely outside corporations.

However, what we require is an approach to designing large social systems and their built information environments. The design of large social systems such as a large business enterprise can be thought of as the design of a constellation of communities [34] to design, provide and integrate a set of modular organizational capabilities [16]. The primary means for achieving this are [34]:

- through imagination, create a sense of the larger shared enterprise, as a Reason-for-Being or mission statement
- through alignment, by means of defined outcomes such as organizational roles and outcomes negotiated with customers
- through engagement, by fostering communities of practice around desired outcomes.

The creation of communities by means of imagination, alignment and engagement, and whose enterprises are outcomes defined by others is demonstrated by Storck and Hill in their work on strategic communities [30].

Issues of Public, Private, Intimacy, Visibility, Ownership and Identify Lead to Specific Patterns of Conversations and Connections

Alexander provides an overview of his pattern language for the built physical environment as a "Summary of the Language" [3, xix-xxxiv]. The sketch is presented in descriptive narrative with groups of patterns named and listed at appropriate points in the narrative. It is broken down into the three sections mentioned above: patterns outlining towns or communities, patterns roughly outlining buildings or groups of buildings, and patterns for providing the details necessary to construct a buildings based upon the outlines.

Alexander's first group of patterns describes properties of the build physical environment that cannot be achieved by design or built as a whole. These patterns cover such things as economic and governmental regions, what to do with common land, the mix of business, residences and open space, and so on.

We feel a need to establish a similar large context within our pattern language, to situate the more detailed patterns. We draw heavily on Jane Jacobs theories of the necessary coexistence and complementarity of two moral systems centered on survival by give and take (guardianship, politics) and by trade (commerce) [18]. We suspect that Jacobs' presentation of the very different moral precepts appropriate for these two systems of survival would lead us to propose qualitatively different patterns to govern the built information environment supporting these two kinds of systems, and for interactions between the two. We also need to deal with various kinds of commons spaces as a response to the disconnectedness of the built information environment. Marketplaces might make use of a smaller pattern such as *Positive Reputation System* (see [24]). Companies such as eBay and Bibliofind provide markets connecting consumers to small businesses such as antique and used book dealers. Web portal and search engine providers such as Yahoo! and America On Line provide a commons, however commercialized, for navigating through large sections of the information environment.

Once this context is established, we need to deal with the formal and informal structures of enterprises, starting near the top of the enterprise. A business enterprise has formal organizational elements to ensure enterprise-wide responsibility to environments in which the enterprise operates. These typically require dedicated communities

such as supervisory boards, public relations teams, employee relations, a watch over capital markets. Each of these, and other, organizational elements consists of communities of practice and corresponding built information environments. Styles of achieving the corresponding organizational outcomes will vary by region, each of which may have its own pattern (sub)languages for handling these outcomes. To the extent that an enterprise operates in many regions, it may require distinct, yet well interconnected communities for achieving each kind of outcome within each region.

Top level structures and communities also define corporate strategy and policies, and ensure a coherent identity and mission across mutually enriching enterprise capabilities and offerings. Strategic issues are normally handled by corporate executives who constitute a formal leadership community. However, the investigation of certain strategic issues may be delegated to temporary teams who are assembled for that purpose only, while others are in place more permanently and with a rotating membership [30]. In each case, these patterns involve both communities and supporting built information environments. Note that each of these communities is likely to consist of widely geographically dispersed members, and so perhaps relies more heavily upon the information environment than the physical environment.

There are also many forms of more tactical, formal and informal organizations. These forms of organization, of which leadership communities are special cases, are perhaps defined more in terms of a specific joint enterprise (developing or supporting a specific project, product, customer) or a shared repertoire of practices. Communities defined in terms of practice are a particularly interesting case since similar practices (for example, Java programming) may be required to define many corporate outcomes (projects, customers, products), while a single outcome may not require enough practitioners to create the critical mass for a community to develop.

As such, the fostering of communities to develop practices presents a particular opportunity for the built information environment.

Alexander's concern with the common land between the buildings of communities and towns seems to make sense of many forms of organizational communication. Things like company magazines and intranets offer the opportunity to share news of customers and competitors, reports of activity within the enterprise. Even employee stock options and share ownership strengthen a sense of belonging. A rich and well connected internal commons promotes a sense of corporate identity and individual belonging through imagination.

There is a potential for many patterns that support a commons frequented by company employees, seeking to create a sense of belonging though imagination. They form commons in the sense that they are necessary even though they exist between conventional forms of work. They do the work of maintaining a sense of common purpose and identity throughout the enterprise. While they may also create connections across the enterprise and so lead to new opportunities for forms of engagement, this is not their primary purpose.

Information placed in common enables connections to be made across the company, and to ensure mutual awareness in dealings with external parties. It may be placed in employee, project, product or customer directories. These are all forms of conversation that need to be enterprise wide. Since the maintenance of such commons information is additional work for all employees, they often need to be maintained by dedicated communities of practice. They might also be maintained through formal protocols built into the information environment. For example, the conversation that tracks the company's relationship with a particular customer might be automatically updated each time that someone copies information from it into another conversation.

Lessons from Computer-Supported Cooperative Work come in at the level of communities and relationships between communities. It is at this level that patterns can be "designed" or "built" since they define the individual communities and spaces between communities for which it is easy to assemble a design team.

The members of a community of practice contribute to a joint enterprise, learn from one another, build up a shared repertoire of practices, stories, and other resources, make sense of the world together by chatting, and are (at least in principle) always accountable to and willing to help each other.

A community needs to be supported by inward looking conversations, through which the members of the community ensure a smooth flow of work throughout the community [7], maintain sufficient awareness of what others are doing to learn from them and help learners and other members, and build up a common repertoire such as stories. These conversations usually need to be ready-to-hand at all moments to ensure an appropriate level of social translucence [12]. The ethnomethodological concern with accountability underlies these and the following patterns [11,33].

The members of a community, both individually and as a community remain accountable to other constituencies beyond the community. They may produce summary accounts either for a conversation or a community. Some accounts may be produced simply through the doing of work [15], while others may require explicit articulation work [9]. The importance of being aware of what things are articulated within which conversations, and who may view those conversations is highlighted in [C1].

Note that an account may itself be represented as information, and that there are choices about into which conversation it should be introduced. Indeed, some accounts, such as one for reporting within a formal hierarchy of authority, may require specific conversations in

their own right, as well as specific interventions in conversations that specific people are known to attend to bringing news to their attention.

As part of a larger enterprise, communities and their members have a responsibility to learn and collaborate with members of other communities. These patterns acknowledge the fact that there are natural limits to the size of a community [34], and as such for learning to take place on a larger scale it must be carefully managed. From the perspective of the enterprise, this may take the form of deliberate meetings of people with similar interests or recognized skills, in communities defined through alignment and imagination. From the perspective of the customer, it is important that the enterprise appears to outsiders as a coherent whole. This requires both an awareness within the company of the many people and communities who have any form of dealing with the customer, and a reflection to the customer of what the enterprise is doing for them, and the current state of processing.

Finally, we must deal with the limited resource of the attention of individual people At this point we start to approach the territory of Human-Computer Interaction, which is beyond out current concern. Nevertheless, there are several important social patterns related to managing someone's attention.

The human-computer interfaces through which a person participates in systems of computer-mediated conversations must provide a balance between focusing attention on current thoughts, providing peripheral attention to things going on, and forwarding demands for attention requested by others. A number of patterns will be required to structure demands for attention, including those from others and things that a person herself may wish to do. They might combine accounts (such as a published calendar), filters (a secretary), means for organizing time (queued e-mail and calendars) and ensuring that something will be dealt with. One trick is to introduce conversations that people can be relied upon to attend to, such as office conversations [12]. As elements within a larger conversation space, they become part of a navigable structure that is perhaps only accessible to the single person whose attention they manage.

THE BUILT INFORMATION ENVIRONMENT PATTERN LANGUAGE NEEDS TO BE SHARED BY BOTH ORGANIZATION DESIGNERS AND INFORMATION SYSTEM DESIGNERS

Patterns can help go beyond current practices which fail to connect organization and information systems design as two aspects of the design of a larger whole.

Current information systems design approaches such as the Unified Modeling Language strongly favor information technologists. Their means for reasoning about the usage situation — the Use Case — is inadequate because it is too fuzzy and vague. Rigorous approaches to information modeling such as Kilov and Ross [19,20] are more precise, but they are extremely terse and do not lead to a story situating the designed information system with respect to the emerging organization design.

At the other extreme, the fact that in designing information systems we are primarily seeking to change or support social practices has led to many approaches that ensure stakeholder participation in the design process. While these address epistemological problems related to learning what the user considers to be valuable, they do not necessarily lead to or exploit a rich, common language shared between users and designers.

Kling and others have called for the introduction of more social science into the formal training of information systems professionals [21]. He has even called for the formation of an academic discipline of Organizational Informatics having both sociological and mathematical foundations [23].

While we seek to exploit many of these efforts, we believe that Erickson [13] has made a compelling argument that theoreticians seeking to inform practice should focus on the construction and presentation of an accessible and well- grounded *lingua franca* rather than on attempting to increase the supply of people trained in theory. He attributes the success of Alexander's pattern language [3,4] for the built physical environment to the following:

- although there seem to be profound theoretical insights behind Alexander's work, in the form of patterns that act as concrete prototypes those results are made readily accessible even to nonprofessionals
- the patterns are thoroughly grounded in the social, conveying the way in which patterns in the built physical environment support patterns of events in social space
- the patterns embody values, stating why certain patterns of events within the social realm are worth achieving.

What we find particularly appealing is that the pattern language can be readily used to tell the story of a place, and why it works or fails to work.

We are starting to build a pattern language for the built information environment for similar reasons and using similar means.

In the current state of development of this pattern language, we are focusing on building a sense of what it might contain as a whole, and what its underlying principles might be. Many of the key results of CSCW can be brought into the pattern language by being expressed in terms of the interplay between conversations and communities. Wenger's system of concepts surrounding the central concept of community of practice is our preferred way of discussing detailed organization design [34]. For information systems design we favor our own conversation construct [28] which provides a bridge between the social realm and information technology, with a computer-supported conversation being a circumscribed region of virtual space grouping virtual resources for use by a specified group of agents.

Given the similarity between the ways that the built physical and information environments support the social realm, there may well be a case for including in the documentation of a pattern language for the built information environment a rich set of comparisons and contrasts between virtual space and physical space.

In fact, there is a strong case to be made for a pattern language that merges the socio-spatial and the socio-informatic. This would allow us to reason about a space combining social space and the physical and virtual spaces that support and co-form social space.

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END NOTES

1 Here we build on rigorous definitions from systems science [1]. An organization may be purposefully adaptive because its parts — people and smaller organizations — are purposeful. A system is purposeful if it is ideal-seeking. Software, which is a mechanism, is at best goal-seeking (and so purposive), since it cannot itself change the ends that it pursues. Thus software is at best adaptable and if it is this is a property of the way that it is constructed rather than the way that it functions.

2 "Workflow from within accomplishes smooth flow of work through methods which are internal to the work. ... In contrast, workflow from without seeks to order the work through methods *other* than those which the work itself provides." [7, p.63].

3 After pointing to the many perceived failings of a workflow-based system, Bowers *et al* argue that "one might even argue (after all!) that a workflow system like [the application] *is* a reasonable solution, *provided* an organization anticipates the extra work and reckons in its cost in bidding for new business, *provided* those offering work for tender do not incorporate demands which might rebound on them," and so on [7, p. 63].

4 For an account of how one kind of enterprise — the on-line marketplace — may succeed or fail, see Kollock and his discussion of the relative merits of negative and positive reputation systems [24].

5 Number in braces refer to the identifying number of each referenced patterns within Alexander's *A Pattern Language* [3].

6 Alexander's colleague Howard Davis explores various building cultures in some depth in [10]. He points out that often the primary reason why commercial properties are built is by banks as a financial investment. Under such conditions, aesthetics are clearly secondary to return on investment.

7 For example, in describing the format that he users for documenting patterns, Alexander talks of a pattern's "solution. Each pattern is documented as a solution to a problem. Its documentation include the solution — the heart of the pattern — which describes the field of physical and social relationships which are required to solve the stated problem, in the stated context." [2, xi]. For a more complete discussion of pattern languages as a genre for a *lingua franca* between "implementers" and "users" see [13].

8 This observation is well known in studies of work; see, for example, Lave and Wenger [25].

9 To summarize, in [28] we motivate a focus on agents and conversations along several grounds. Our interest in enterprise adaptivity led us to ask what it means to provide adaptable software to support an adaptive enterprise. The key inspiration there is to align software engineering's attempt to separate concerns on achieving construction in shearing layers -- Stewart Brand's model of how the physical built environment is constructed so that it can be adapted in response to several qualitatively different rates and scales of change [8]. We then exploit various results of CSCW such as Clement and Wagner's observation of human communication as fragmented exchange within regionalized communication spaces to motivate a unit called a "conversation," and the notions of transactions, articulation work and the production of accounts to focus justify special mechanisms for transactions between conversations. Finally we point out that types of conversations differ in terms both of how quickly their vocabulary and protocols of discourse change, and in the scale on which they occur, and that this characterization can be used to determine an appropriate means for implementing each kind of conversation. So, for example, the millions of highly stylized credit card transactions that a company must handle can and must be implemented as an expensive, slow to develop and rarely changed, high throughput, high availability application in a slowly changing shearing layer, while groupware such as a Notes discussion database is typically customized by its small group of users as part of a rapidly changing shearing layer. Thus, the ability to break the world down into largely separate, but connected conversations with different change characteristics because of their support for certain positions in a constellation of communities (e.g., the high alignment and low engagement required for credit card processing), enables a highly valuable separation of concerns within the software engineering realm.

10 The levels of scale that deal with entire business strategies or even professions and industries are beyond the scope of this paper, as is the more detailed concern of human-computer interaction. An example of a set of patterns for business strategy is [29]. For various human-computer interaction patterns see the Interaction Design Patterns Page [14].

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