Developing A Theory and Practise of Pervasive Information Capture, Processing, Visualization and Documentation

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ABSTRACT
Developing a theoretical framework for pervasive information environments is an enormous goal. This paper aims to provide a small step towards such a goal. The following pages report on our initial investigations to devise a framework that will continue to support locative, experiential and evaluative data from 'user feedback' in an increasingly pervasive information environment. We loosely attempt to outline this framework by developing a methodology capable of moving from rapid-deployment of software and hardware technologies, towards a goal of realistic immersive experience of pervasive information. We propose various technical solutions and address a range of problems such as; information capture through a novel model of sensing, processing, visualization and cognition.

Categories and Subject Descriptors
D.3.2 [**User Interfaces**]: *Object-oriented languages* and H.5.2 [**User Interfaces**]: *Input devices and strategies, Interaction styles, prototyping, theory and methods,* and J.5. [**Arts and Humanities**]: *Fine Arts.*

General Terms: Languages, Design, Human Factors, Theory.

Keywords
Pervasive Information, Education, Collaborative Learning Environments, Bauhaus, Visualization, Locative Media, Installation Art.

1. INTRODUCTION
The definition of *pervasive information* (PI) depends firstly on the definition of 'pervasive computing', which acknowledges the deployment of computing elements (of which approximately ninety-eight percent are outside the recognizable desktop or laptop 'computer' paradigm) which are found in mobile phones, automobiles and household objects, and in the tagging of consumer and manufacturer goods, via 'RFID' technology. A second aspect of 'pervasive information' is found within software applications which ride upon the internet or web substrates, including email and mobile-phone communication and especially the use of 'Bluetooth' devices. A typical example is found in one significant area of our research; the development of software which supports the collaboration of groups of people working on common projects, but at different physical locations, using the web. The development of our Java-based software with applications in remote and distance or 'blended' learning has been described elsewhere [1] [3].

Each of these examples motivates our move towards a definition of PI and contains some common characteristics: First the input or 'sensing' of information from each human actor involved, second a processing of the conjoined information according to the principles of self-organizing systems, third the visualization of the processed information to the individual actor, and finally the 'cognition' of the visualized information by each observer. While our definition of 'visualization' is centred primarily on the experience of a visual image, we also include the use of auditory or haptic feedback to the actor.

1.1 Domains of PI
It is not difficult to identify and categorize the sources of pervasive information. The use of email communication is now a ubiquitous form of information transfer, open to all who have access to a networked PC. Interaction using this medium of natural text provides a system of semantic information content which is based upon human dialogue, the most natural of inter-human interaction processes. Yet there is a surprising level of structure which emerges in this baseline medium. While person-to-person (p2p) communication remains the principle *modus operandi*, the possibility of 'any person-to-any person' communication links may lead to the formation of higher-order communication structures. For example groupings of communicating individuals (who share common interests, a shared agenda, or simply a need to collaborate as defined by a work-place project) may spontaneously emerge. Interestingly, the structure of these 'communicating groups' may well differ from

the organizational structure imposed by the workplace. People working for a particular company, organized into levels of activity and responsibility, the 'natural' groups imposed by the company, may actively form groups transcending this imposed hierarchy. In this sense, groups are likely to self-organize according to the individuals' needs and interests as mentioned above. Recent research has confirmed this hypothesis.

The formation of on-line distance 'learning groups' is another active area of research in Higher Education [6]. We have recently developed software to investigate the formation and maintenance of learning groups. The technology deployed uses the Java programming language to support collaborative and distance interactions and current research investigates the use of intelligent Agent-based technology (again using Java) as a means to coordinate the formation of these groups [4]

We have also focussed on the contemporary Bluetooth communication technology [5] as a means both to support the sharing of textual information (e.g. via 'Bluetooth-enabled' mobile phones) to the assertion of human presence within a public space. The latter involves the sensing of human presence within a delineated public space (entrance foyer, railway station hall) and rendition of the collective individual presence on an installation plasma screen providing a relevant or amusing visual feedback to the passer-by within this public domain.

1.2 Visualization of PI –Initial Thoughts

Our current visualization approach, implemented in pure Java uses the context of a virtual world to support the documentation of pervasive information.

The object of information visualization is the human actor, who is confronted with an image, text, or sound within a given context. The actor is encouraged to become immersed within the experience, or at least to recognize elements of information which are deemed relevant or informative. The collaborative group-worker expects to be presented with information from the entire group, perhaps a shared architectural drawing, a textual-based story, or a mathematical equation. The email correspondent expects to receive messages, to access archives of a particular dialogue or a bulleted précis of a communication experience. The casual viewer of a piece of locative art expects to recognize his presence with the space of interaction, where his motion or position perturbs a digital artwork presented in that space, perhaps by means of a Bluetooth device being carried.

This project aims to establish a classification of PI by deployment of specific trial activities. We are currently developing software to collect, visualize and document PI in a variety of ways so as to build up a strong experimental dataset from which we inform our developing theory. Each of these activities suggests a different modus for visualization and documentation of PI.

The design life-cycle comprises two phases. The first involves the construction of a number of Java-based applications, easy and quick to implement, each of which address a particular facet of our PI theory. The deployment of these applications, currently underway, aims to inform and refine our initial theory. This will provide input to the second phase where we propose to engage 'Virtual Reality' software to provide a rich and sustainable software environment to visualize and document the content of the associated PI. We are currently evaluating the use of a standard 'computer-game engine', 'Unreal Tournament' as a vehicle to engage with all levels of our pervasive information definition, specifically in the production of educational and training materials [7]. The investment of time in the production of these resources is significant, and is not appropriate to an initial phase of research, hence our adoption here of Java2D and Java3D.

Our current visualization approach, implemented in pure Java uses the context of a virtual world to support the documentation of pervasive information. Human actors may navigate this world, displayed on their PCs or PDAs to experience the information.

Here a 3D world is constructed depicting those email messages sent within a group of communicating human actors. Messages arriving at each actor are clustered at a particular location within space (think art gallery), where messages are rendered on vertical 'display panels' emerging from the floor. The height of each panel may indicate the activity of the actor and the depth of the stack of panels reflects the history of the email communications. Participants within this email fraternity are able to wander though this 3D space and to select and zoom-in to read particular message panes. There are also flat 'tiles' located on the floor of the 3D space, which when activated spawn vertical panes of archived information.

Any collection of objects needs a form of organization; here a topographic repository of space is adopted. We currently are working with two models, an outdoor 'landscape' or 'Zen Monastery' where 3D space is partitioned into four regions; one contains the 'current' communication, the second; those messages sent 'yesterday', a third for those from 'last week' and finally those which have been 'archived' over a longer time period. We expect that the traversal of these spaces will become familiar to the actor, who will rapidly learn how (i.e. where) to discover the information required from this repository.

1.3 Documentary Rendering of Collaboration

A crucial element to designing documentation for PI has emerged through a collaboration of the Department of Biophysics at Moscow State University, and UCW. This collaborative research project develops techniques to support collaborative learning groups. The idea is to engage a small group of students, at distributed geographical locations, to collaborate, in real time, on a common project. This is not an uncommon end goal but the difference here is that we are focusing on the methodologies to incorporate the *documentation* of information generated within this pervasive context.

We have so far identified three contexts for pervasive collaborative learning, which we refer to as the *common canvas*, the *shared canvas set* and the *contributed canvas* contexts. The *common canvas* presents each group participant with the same unique canvas where text or images may be deposited and also be concurrently modified and viewed by the participating actors. An example could be the construction of an architectural plan where each participant may add, move, modify or simply highlight buildings and other objects on the canvas to move towards a common architectural goal. The *shared canvas set* provides each participant with a separate canvas of objects, but here the entire set of canvases may be shared with all group members. An example is a digital electronics workbench (see Fig.1) where each participant works autonomously to produce an electronic circuit which can then be shared in its entirety with the group. Note that the canvas is *dynamic* as it contains shared electronic circuits that may be simulated and their functioning visualized by each participant.

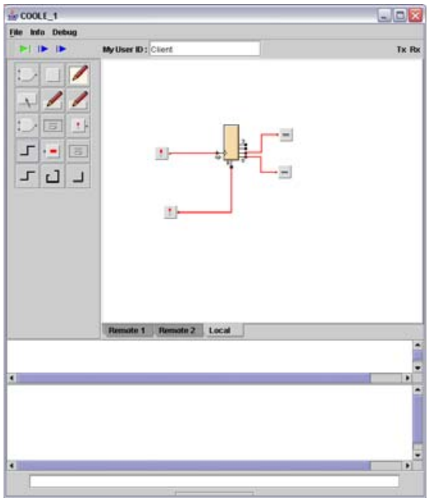

Figure 1. Digital Electronics Workbench. Here the local student has constructed the digital circuit. He transmits this to all students in the group who are able to simulate the circuit on their local machines. The windows at the bottom provide the chat-room facility.

In the third *contributed canvas* context, each participant may deposit a specific object onto the same unique canvas, but where the functionality of each object is defined by the 'owning' participant. An example, shown in Fig.2, consists of simulated robots which inhabit a common robot world, containing other objects such as 'trees' and 'rocks', but where the behaviour of each individual robot is specified by the owner participant.

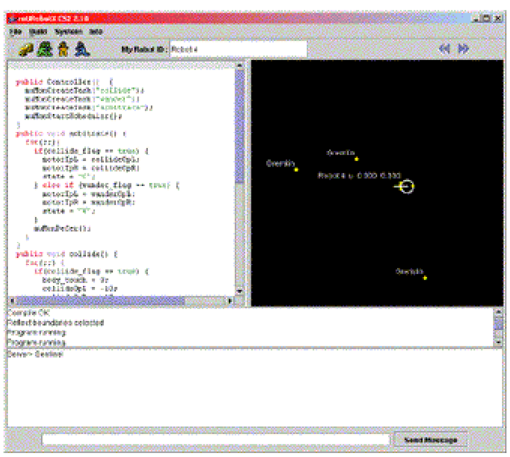

Figure 2. Simulated Robots sharing a Common Robot World Canvas presented simultaneously to all group members. Each robot is unique.

There are clearly two issues here. First, how the elements of PI are best presented (or represented) to each individual, (taking the individual's perspective into account), and second how the *dynamics* of the development of the pervasive information is assured and communicated to each participant to ensure a meaningful experience.

1.4 Towards a Theory of PI

Our research using these contexts over the past twelve months has clearly indicated the need for a theory of pervasive information which can accurately describe our experiences, but also aid in our engineering of useful educational tools and approaches.

The documentation of information within these three contexts was driven by the need to obtain a meaningful and stable experience for all participants, avoiding conflicts which may have emerged from simultaneous modification of objects and time-delays in communication of intention or evaluation.

The *common canvas* context enforced strict ownership of a canvas object. When selected by a participant, the object remained the participant's property until released. The group members could observe the real-time modification of that object by the owner, but remained unable to modify any object other than those in their ownership. The *shared canvas set* context was more relaxed. Since ownership of a canvas was dedicated to each participant, there were no conflicts of action. Each participant would receive documentation only when actioned by the owner. The currency of the documentation is the responsibility of the owner, there is an implicit agreement to collaborate in the process of developing, updating and distributing the documentation. The *contributed canvas* context is the most integrated. A real-time visualization of the documentation, available to each participant implied the existence of up-to-date documentation. Changes and modifications to the individual participant's objects could be either implicitly observed through changes in total system behaviour, or else explicitly through messages posted via the 'chat room'. This clearly implies trust on the part of each group member to collaborate to a common goal.

From the point of view of pervasive documentation there are clear issues to be addressed here. The viewer needs time to read the document and must be protected from updates to the document during that time. Clearly we need to address issues of 'human timescales' whether it is the solar quantum of the day, the 20-minute lecture slot or the 120 minute movie experience.

Within this time frame, determined by human cognition, the participant 'brackets' all changes, modifications and influences to the information received, and retires into a shell of isolated contemplation and analysis. In effect, this defines a bounded quantum of perceptual information. We do not imply that the document is 'static' within this frame, but rather non-updatable.

Any theory of documentation centred in the use of digital or computer technologies must be predicated by a theory of those technologies. We have recently proposed a theory of 'Bauhaus Computing' (involving a model of 'Bauhaus Processing') which is central to the current discussion [2]. The theory of Bauhaus Processing is cast into the familiar 'layer' mould of computer science. Illustrated in Fig.3, we propose a model comprising levels of sensation, self-organizing processing, visualization and cognition. The human actor completes the feedback loop of perception, processing and action.

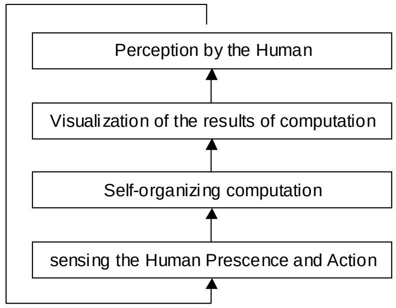

Figure 3. *Bauhaus Processing* describes a loop where the human actor is central. The computation process is understood as working with the sensorial of a multitude of actor inputs, providing a visualization of this collective to *each* actor and acknowledging the *perceptual* processes involved in this visualisation. It is *dynamic* and purposeful, engaging each actor in a recognizable movement to individual goals.

1.5 Framework for Representation of PI

As a corollary of our embryonic theory of Bauhaus Processing we move on to formulate a framework for the representation, visualization and documentation of pervasive information.

In terms of this project, we propose to disengage from debates concerning representation and to assert that representation is inextricably linked to objects within our context; text is rendered as text, images as images, etc., yet representation in our view, finds its full 'interpretation' through the transient nature that exists in an experiential and sensorial environment

Several attempts have been made to replace the flat-screen/ flat-land rendering of documents. The use of non-Euclidean geometries to emphasis a focal point is well known. So is the use of Virtual Worlds and Immersive Environments.

We selected the use of virtual worlds as an appropriate metaphor for the visualization of PI. Our approach is to construct a virtual world through which the participant may move, discover and interact with meaningful 'active objects' containing pervasive information. Each object is situated at a definite location in space, and may reveal its history of production and interaction through an appropriate graphical structure, a sheet, cube or sphere. These objects are also hyper-objects, when activated, may reveal their history, their connection to human actors and their relevance in a scale of contextual validity.

There are two facets to this work. First the process of visualization of the information, second the visualization of relationships between the objects of information. For example, spatial proximity of objects could indicate their temporal proximity on the timeline of creation.

The most natural arena for the visualization of any information is Euclidean space, the three-dimensional world which we inhabit and therefore with which we are familiar. We have chosen to render PI with a 'perspective' projection, providing the participants with a somewhat similar natural experience.

Let us take the example of email messages. We all rapidly accumulate a stack of messages from our correspondents. Yet hidden within this stack is a more global net of communication. Through the facilities of email 'copying' and 'forwarding' we establish sub-networks of correspondence. These are currently unseen and are retained only within our minds. Would it not be useful to have a visualized documentation of sub-networks on our desktops, explicitly? This is one aim of the representation of pervasive information we propose. Taking this example further, we can conceive of email messages as graphical panels within a three-dimensional virtual environment, rather like panels displaying paintings in the three-dimensional space of an art gallery where the participant is able to freely wander and view, autonomously.

Panels of email messages may emerge from the tiled, textured floor upwards into space. We may move in this gallery, approach and read an email panel. Yet our focus of attention in the room may well be what we perceive from afar. We may recognize a Cezanne panel and are attracted towards it, or by a particular shape or color of a panel cluster. These panel characteristic may be programmed according to the theory of PI to establish explicit visualizations of those abstract properties of the PI object which until now remain implicit or forgotten.

Of course this entire space is dynamic. As we wander around, we shall explore the dynamics of the panels, rising and falling, changing color or shape, as the abstract property represented is itself changing. So the virtual gallery can be said to 'extend' our own static art gallery, the pieces displayed are dynamic, the whole gallery room becomes dynamic and reflects an important aspect of pervasive information, its continuous changing content, and amount as we observe and interact in its shadow.

Our framework for representation of pervasive information is based upon the metaphor of space, not the abstract trans-Euclidean space such as that proposed by Special Relativity, but the concrete horizontal-vertical space (with bumps, corners and potholes) experienced by the cognisant human. There are many ways to describe and rationalize this space. We may take the approach of the town-planner, who must juggle issues of local economy with social and political forces. We may take the approach of the architect, who chooses to structure space according to his beloved metaphor (such as the Centre Pompidou or La Parc de La Villete). Or we may choose the mathematical certainty of a chessboard, a city-block of intersecting roads, or else the organic development of a European city, from medieval to contemporary. The metaphor we choose is not simply determined by client specification or personal inspiration, but is conditioned by the technology of construction available to the engineer who must implement the architect's design.

So we propose a theory which starts at the mountain top, from the metaphysics of idea to the foundations of the language of building; a descending movement of idealism flowing through an upward movement of pragmatics of the available technology. In truth, the constraints are at the bottom. Idealism is unbounded, but the technology is constrained, by epoch, economy and resources.

Fortunately contemporary technology is liberating not constraining. Web technologies such as VRML of Java and the powerful Game Engines offer us power of expression. Construction of lifelike virtual reality systems is our long-term 'second phase' research goal. The first phase (where we are currently active) is minimalism. This has informed out choice of Java2D and Java3D technologies to provide the visualization platform. Yet any decision about technology must be complemented by a corresponding decision about genre of expression. Here we invoke another minimalist principle, the architecture of a 'Zen Monastery' as the environment for our representation of pervasive information.

Figure 4. Tofukuji Monastery, Japan. Image from slide presentation compliments of Ronald L. Carlisle, Ogelthorpe University Museum of Art.

The image, reproduced in Fig.4 depicts a scene from a Japanese Zen monastery which contains the basics elements we strive to obtain. A *minimalist* or *constructivist* collection of objects in three-dimensional space i.e., those clearly recognizable to any actor as a part of a building. This static image comprises forms, textures and all elements we associate with the 'Zen' paradigm, expressed in numerous works of art and literature]. These forms, so simple and expressive, may be easily transformed into visual elements rendered by the Java2D and Java3D programming environments. Stated simply, the planks, walls and tiles constitute the Zen environment map directly upon the drawn or filled rectangles available to the Java programmer.

But the difference between our concept of representation, and the photograph presented is clear: One is static, the other is dynamic. Yet we must acknowledge that the static image is merely a 'snapshot' of the dynamic, and therefore that our dynamics must extend this snapshot into the fullness of the environment we intend the actor to perceive.

A simplistic (and incorrect) conclusion may be that the technology must be developed to support the metaphysical idea. But this cannot be true. The idea is primary, the technology merely serves to interpret, represent and document this idea. Whether we choose a 'Zen Garden' to visualize our pervasive information, a Rubens composition or a Cezanne landscape is irrelevant. The chosen context merely defines how we structure and represent the information, how we render the images and portray the object interactions, but does not constrain our ability to document and communicate the underlying information.

The crux of the information representation is the participant or observer, who must extract semantics in order to interactively engage. The genre of expression is significant. Aficionados of cubism respond to those geometrical shapes. Realists absorb portraits and landscapes. The artist, or producer of visualization software should set aside his competencies and prejudices, and develop a whole gamut of visualization genres that will excite each and every participant.

Of course, the software engineer will oppose this generality. Conditioned to produce a computer program to implement a particular goal, this engineer will abhor this freedom and demand a more constricted specification. Hence the need to invoke some principles of software implementation and our choice of the 'Zen' approach to this end.

2. Towards a Theory of Representation of PI

Any theoretical edifice is grounded in a context of experimental study and ultimately practical application. Computer Science theories, for example, of process scheduling are aimed at developing efficient operating systems while being informed by the current software and user evaluation. A theory of Representation of Pervasive Information must likewise be grounded in its target and its objects of study. In this case, these 'objects' are living human actors, individuals within a society. Our theory is therefore grounded in the study of life itself, the mathematical, biological and social studies of living systems.

We propose the following sub-headings for the development of a theory: (1) The nature of living actors and their relationships, (2) The *perspective* of the actor, (3) The *dynamics* of the system of actors and environment, (3) The *mathematical description* of living systems, (4) *Transcendence* (or transformation) from a 'real-world' visualization of objects to an abstract world of concepts or properties.

1. Actors and their Relationships

Reflection on the structure of living systems we observe, suggests the existence of a few fundamental elements which comprise these systems, and also distinct *relationships* between, (or organization of) these elements. We propose the following initial classification:

a. The individual object (a web-page or email message) and the boundaries separating these objects.
b. An implied background or canvas in which these objects may be placed, or deemed to exist.
c. The form of each object, comprising its geometrical shape, tone, color and texture.
d. The symmetry of the objects existing on the background which implies a metric of scale, i.e. symmetry may be enforced locally within regions of the canvas, or globally throughout the whole canvas to obtain, e.g. a tessellated pattern of objects.
e. Similarities (but not identities) between the objects allowing the perceiver to construct identifiable groupings between objects, without being coerced into acceptance of *a priori* structure.
f. Continuity or gradients of object representation expressed across the whole canvas, rather like undulating hills containing rich detailed objects of

vegetation, or winding country lanes through a plethora of randomly-placed farms and dwellings. This provides a feeling of 'naturalness'.

g. Repetition of basic object forms (or other characteristics) invoking feelings of wholeness, of Gestalt.

h. The establishment of inter-object relationships suggesting links between objects which are located in space, but whose dependence transcends this spatial location.

2. The Perspective of the Actor

In the virtual world we propose, the observer is able to navigate between objects placed on a familiar field of representation. A typical virtual world should contain recognizable elements of the real physical world, the ground, the sky, buildings and pathways or roads. The observer may stroll or drive through this world. The observer may choose to fly above the world and gain a different perspective on the objects it contains, an 'overview' of the content of the pervasive information scenario. We propose the following initial classification:

a. The 'fly-over' viewpoint. Here the actor may rise above the detail of the underlying representation, to see the global perspective of elements and their dynamics, to be able to make a decision as to where to descend, to savour the detail

b. A ground-based movement, to approach an element of interest, e.g. a web-page, and to read and interact with its content.

c. The formation of historical paths of movement from object to object. Imagine a set of vertical web-pages displayed in a cornfield or grassy meadow. The actor's movement between pages of interest will carve paths into the grass or corn which implicitly records her/his history of wanderings from page to page. The actor will become familiar with the network of paths he has created and use these to define his future movement through this landscape. Perhaps even there will be opportunity to take the dog for a walk.

3. The Dynamics of the System

Pervasive information is not static, it is not a published book or article, rather it is a living set of textual or other elements communicated in email correspondence or collaborative group work which changes and accumulates through time, it is *dynamic*. Nor is this Pervasive Information a single isolated document, rather it is a system of connected documents with implicit or explicit connections. It is a *system.* Therefore it is natural that we deploy the theories of *dynamical systems* in constructing our theory of Pervasive Information.

a. The concept of timescale is fundamental to dynamic systems theory (DST), whether applied to biological, atomic, or any phenomenon. Here, since we are concerned with the human experience, we elect to identify the recognizable human timescales, such as 'now', 'today', 'last week', 'in my archives'.

b. From the point of view of perception, we know that computing technology can provide us with visualized updates of documents almost instantaneously. This speed of delivery may exceed our patience or capacity for processing. Hence the need for a timescale of 'smoothing' or 'relaxation' of changes in the presented information, allowing us enough time to understand, analyse and reflect upon these changes.

c. Updates and modifications to information with which we are engaged do not occur at our behest, rather at that of the author. Changes to a text we are reading may occur at any moment in time. We need to be aware of these changes, but given the opportunity to complete our current reading of our selected information source. Here the theory of Discrete Events may have bearing on our theory of Pervasive Information.

4. The Mathematical description of Living Systems

This is a variegated domain of theoretical research rich with models which have their progeny both in experimental biology, theoretical physics and mathematical biology. Let's take one representative example, grounded in over 200 years of mathematics while subject to the full force of computational theory and technology of parallel processing, the 'Reaction Diffusion' approach.

Here a system of living elements (within an environment and ecological region such as rabbits and foxes) is described by a series of mathematical equations. Each equation determines the evolution of one biological variable, which is usually taken as an expression of each species. That equation is taken to exist at each point in space, representing the habitat of the species concerned. Each equation expresses two processes, first the diffusion of the species it represents through space and second the development of that species over time, at each point in space, taking into account all the other species present at that point, at that moment in time and their inter-relationships (for example who eats whom and how each may reproduce). A typical equation is shown in Fig. 5 with annotated explanation

$$\frac{\partial u}{\partial t} = A - (B+1)u - u^2 v + D_u \nabla^2 u$$

$$\frac{\partial v}{\partial t} = Bu - u^2 v + D_v \nabla^2 v$$

Figure 5. The "Brusselator" Reaction Diffusion Equation consists of two components "u" and "v" at each point in space. The rightmost terms on each line symbolize the diffusion of the "u" and "v" components. The left side of the equation preceding the "=" symbol indicates that the equation is *dynamic*-- codes for *change* in "u" and "v" over time. To the right of the "=" symbol are various combinations of "u" and "v" symbols which determine how the two components interact with each other and co-determine their dynamics. This structure of equation can explain the various appearances of animal pattern coats.

Although this description appears quite specific, it turns out to be quite general and has been applied to various processes, from image processing to network description. This applicability is due to the two fundamental ingredients present in its formulation: First the idea of diffusion or communication or pervasiveness of information, and second the local, point, or centered processing of received information. In short, Reaction-Diffusion systems provide a mathematical description of Pervasive Information which yields to all the tools of mathematical analysis and simulation.

5. Transformation Theory

Our embryonic theory of Pervasive Information has so far emphasized the use of a virtual world (which mirrors the physical world) through which our actors may wander and interact. We have suggested that real objects such as email messages may be efficiently and accurately rendered in this world in such a way that the actor may deduce correlations between activities based on perceived properties of these object, such as color. But there is another requirement. The actor could choose to be ‘teleported’ into a transcendental world, where the relationships between actors and object are made explicit, rather than their physical location. So the actor is able to wander through a space of relationships, to interact with this abstraction rather than the pure physical. This is akin to the ‘Fourier Transformation’ of the experience of a piece of music, into a representation of its frequency content. Returning to our email example, we could easily effect a transformation for a virtual world of clustered text messages, to a world of colored blobs, each labelled with an indication of the theme of the conversation. Alternatively, a world of geometrical shapes could indicate those members who tend to email each other on a regular basis, representing a clustering of communication activity.

3. CONCLUSION

This embryonic theory of Perceptual Information is itself dynamic, and overlaps expanding theories in both Computer Science and Art Theory. Each of course attempts to contribute its own formal attitude, but it is in the dialogue of overlap that true creativity obtains. The tradition distinction between form, technology, and aesthetics goes back to the Vitruvian concept triad of *utilitas, firmitas and venustas*. Yet this classification, just like the Bauhaus *Form follows Function* may be in need of an overhaul, indeed Mies Van Der Rohe provided the inversion, to function follows form. Yet our project is even more radical than this. We suggest that the architects question ‘What is a Church’ should be replaced by the question ‘How is a Church’ [6] , in other words the static description should be replaced by the dynamic, fundamental to Pervasive Information.

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