EDITORIAL

Presentation, Perception and Parables

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ABSTRACT

Presentation, perception, and parables are three themes that are significant within the fields of information systems and computing. The theme of *presentation* concerns the presentation of information to the user. The theme of *perception* concerns the process by which stimuli are received and interpreted. The theme of *parables* refers to 'stories' that bear significant meaning and from which 'lessons' may often be drawn. Using an analogy from the world of art, we discuss each of these themes as they apply to information systems and computing and give example areas within the fields to illustrate. We then summarize the contents of this special issue in the context of the three themes.

1. INTRODUCTION

Progress in the field of computing is rapid and ongoing. Where once we processed only numbers, now we process a diverse assortment of data types, including text, graphics, continuous media such as video and audio, and conceptual data such as 'artificial' knowledge contained in rules and neural networks. Where once we used computers for a limited range of selective, pre-defined functions, now they are used for a wide variety of less discerning purposes for which processing is no longer carried out in batches but is

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predominantly in real time and on demand. There can be little argument that this trend is set to continue as both hardware and software become yet more advanced and complex (Communications of the ACM, 1997).

The diffusion of information technology within all aspects of society has seen attitudes from stakeholders toward technology evolve and adapt as necessary. As a result, the initial technical focus that leads to the emergence of the field of computing is now complemented by the more socio-technical field of information systems that addresses a wide range of issues concerning not just technology but also its development, management, and organizational and social impacts (Boland & Hirschheim, 1987). Research within information systems has always been interdisciplinary, drawing heavily from relevant fields within the sciences, arts, and humanities, such as psychology, engineering, mathematics, management science, philosophy, and political science, as well as computing. Consequently, the information systems research literature differs from that of computing in that it is composed of papers covering a very wide variety of interconnected topics from a very wide variety of perspectives and using an extensive diversity of research methods.

This special issue of the *Journal of Intelligent Systems* comprises papers that reflect the rich mixture within these two fields. We have selected three related themes that we feel have a strong presence within the research literature at this time, namely presentation, perception, and parables. In Sec. 2 we overview these themes through the use of an analogy from the world of art. Sections 3, 4, and 5 then discuss each of these themes as they apply to information systems and computing in more depth. Section 6 presents an overview of the papers within this special issue within the context of these three themes.

2. PRESENTATION, PERCEPTION AND PARABLES: AN ANALOGY FROM THE WORLD OF ART

To introduce these three themes, it is useful to depart temporarily from information systems and computing and exploit an artistic analogy. Consider a great painting of a typical scene. In the painters' eyes, their paintings will have at least one, but usually multiple, meanings and their paintings may

evoke one or more feelings within them. Similarly, the viewers will draw on their own interpretations, which may or may not coincide with those of the painter (Greenberg & Sandra, 1991). Consider the great painting *Sunday Afternoon on the Island of La Grande Jatte* by Georges Seurat (1886), which depicts a crowd of French men, women, and children relaxing in a park along the Seine River near Paris. Although the painting depicts an informal scene from everyday life, Seurat also painted the scene with tiny dots of pure color so that they would blend together when the painting was viewed from a distance. Thus, together with the many meanings and feelings evoked by the scenes within the scene of the painting, there are also other meanings generated by Seurat's attempt to try out new theories in color vision that were being propounded at the time.

Consequently, we can identify three significant themes of influence on a great painting such as Seurat's:

- *Presentation*: How the painting is presented, namely, what techniques are used to effect the image on the canvas? In Seurat's painting, the technique used was an early attempt at dot-based (or pixel-based) color printing.
- *Perception*: How the painting is perceived, namely, what interpretations are made by the viewer and by the painter? In Seurat's painting, the viewer merges the colored dots to interpret the scene in its entirety and also interprets the elements of the scene and the scene as a whole.
- *Parables*¹: The story the painting is telling, namely, what story is invoked in the viewer's and painter's mind by the perceived presentation and, more important, what lessons are to be learned? Seurat may have painted a typical Sunday afternoon that would have had a special meaning for him, but the story told within the viewers' minds may be quite different as they relate it to their past experiences.

As is apparent from the discussion above, each theme influences the subsequent theme; thus, presentation influences the viewer's perception which, in turn, influences the parables evoked. This is only part of the story, however, as the three perspectives are really tightly inter-related. Thus, for example, a consideration of perception by painters influences the presentation that they will

¹The authors are aware of the conventional use of the term 'parable', but we use an alternative definition in this context, which is given in Sec. 5.

Fig. 1: The relation among presentation, perception, and parables

attempt to make and also the parable that they hope to evoke within the viewer's mind. Thus, rather than a straight (sequential) 'chain' of influence, the scope of influence of these three themes is actually more like that given in Fig. 1.

In the following three sections, we discuss each of these three themes in turn as they apply to information systems and computing.

3. PRESENTATION

The theme of presentation in information systems and computing concerns the presentation of information to the user. These days, only the poorest of systems are developed without a consideration of how to present their output efficiently and effectively to the user through the user interface

(UI). UIs have now evolved such that they facilitate the use of a variety of features to aid and enhance presentation and interaction. The latter are typically encapsulated within a central software resource known as a UI management system (UIMS), which provides functionality for such elements as windowing, menus, icons, and so on, and thereby reduces redundancy and helps to maintain a common 'look and feel' (Marcus, 1997). We should note, however, that presentation does not concern *only* the externalization of the UI. This is merely one aspect. Presentation must refer also to the processing of the information that is to be presented. For example, in *information retrieval*, documents are indexed and the indexes are compared against a user's query to rank and select candidate documents. Therefore, presentation is a large theme that runs throughout information systems and computing, and we are therefore limited to only a brief consideration here.

As painters in our analogy in the previous section are restricted by the size of their canvases, so presentation of information is limited by the relatively small window through which an information space can be viewed, meaning that information items cannot be seen in their full context (Leung & Apperley, 1994). *Information visualization* seeks to resolve this and other problems by providing appropriate visual depictions of very large information spaces. Information visualization necessarily requires a consideration of information retrieval techniques (Hollan et al., 1997) to determine how the information is to be visualized (externalized)—for example, based on rankings. In this way, information may be filtered and selected appropriately for the visualization process. Common techniques for information visualization include the following (Baeza-Yates & Ribeiro-Neto, 1999):

- *Brushing and linking*: Connecting two or more views of the same data so that changes in one are reflected in the other.
- *Panning and zooming*: Similar to movie camera movement.
- *Focus-plus-context*: Making the focus of attention larger.
- *Magic lenses*: Manipulable transparent windows that effect transformations when overlapped on data.
- *Animation*: To retain context and help make information visible that would otherwise be hidden from view.

With the contemporary importance of the World Wide Web, *hypertext* (text only) and *hypermedia* (a variety of media other than just text) have

become dominant and popular techniques used for information structuring and browsing. For large information spaces, however, users have been known to suffer disorientation and feelings of 'being lost' (Utting & Yankelovich, 1989). Hence, the use of additional information, such as maps, is required to help alleviate this problem. Furthermore, the use of continuous media (video and audio) has necessitated a deep consideration of both technical issues—for example, regarding how different media may be effectively synchronised (particularly within distributed systems) to effect a coordinated hypermedia presentation that can be interacted with while still retaining synchrony (Bulterman, 1995) and less technical issues concerning the appropriate use of media and combinations of media for different types of presentations (Heller & Martin, 1999).

This approach is proving particularly important for disabled users requiring alternative media to navigate information spaces. For example, auditory navigation of hypermedia has been examined for use by blind users (Morley et al., 1998).

As information presentation has become more complex, so the use of *metaphors* has proved more beneficial for users. Metaphors communicate essential concepts through terms and images that are (typically) already familiar to the user (Neale & Carroll, 1997)—for example, the desktop metaphor and its associated metaphors of folders, files, windows, and so on. Thus, a metaphor uses similarity of one process with which a person is familiar to teach that person about a different process (Allen, 1997). Continuous media have dictated the need for metaphors drawn from consumer electronics, thus audio players behave more or less like CD players and video players behave mostly like VCRs.

4. PERCEPTION

Perception is the process by which we receive and interpret stimuli. Perception is a key element of cognition along with attention, memory, reasoning, judgment, imagining, thinking, and speech.² Perception is,

²Cognition, Microsoft® Encarta® Online Encyclopedia. <<http://encarta.msn.com/>>

therefore, key in influencing our actions within the world. Psychologists identify the role of *experience* and the role of *context* in perception (Bruce et al., 1996). Experience builds up memories of past perceptions that can serve later as contexts for making new interpretations. External contexts, namely the stimuli that are near to the stimuli to be perceived, also influence the interpretation that is made.^{3,4} Both experience and context enable correct perceptions to be made from inadequate information and incorrect perceptions to be made from adequate information because the role of experience and context can be overwhelming at times—namely, we literally do not believe our eyes or our ears.

As in all areas of life, issues of perception are rife within information systems and computing. Information and systems are perceived by all stakeholders, not least by users and systems developers, therefore the scope of influence of perception on both research and practice in information systems and computing is sizeable and diverse. We consider briefly a number of areas by way of example, but this is by no means exhaustive and new applications of perception are occurring all the time.

Perhaps the most germane area for perception in information systems and computing is that of *computer vision*, whose goal is the automatic and intelligent understanding of images (Jain et al., 1995). Perception is particularly key to computer vision because of the need to mimic or to substitute the human process of visual perception. Attempting to incorporate the subjectivity of perception into systems that rely on intelligent image understanding is therefore key to future efforts (Nishiyama et al., 1994). The great challenges involved in this endeavor mean that progress in computer vision is relatively slow, having achieved mixed successes thus far.

Knowledge about human visual and auditory perception has also proved of benefit in the area of *multimedia data compression*. Multimedia data files are typically substantial, ranging from megabytes to gigabytes, and so there is a great need to reduce as much redundancy as possible in order to reduce file sizes. Multimedia data compression achieves this by exploiting the limitations

³See ><http://encarta.msn.com/find/MediaMax.asp?pg=3&ti=761571997&idx=461547591>> for useful example of visual context effects

⁴Foley, H.J. Perception (psychology). *Microsoft® Encarta® Online Encyclopedia*. <<http://encarta.msn.com/>>

of human visual and auditory perception. For example, modern audio compression techniques, such as MP3 (MPEG Layer III), use encoders that are based on *sub-band coding*. Sub-band coding exploits the phenomenon of *auditory masking*, whereby one sound can mask other sounds (Pan, 1993). Thus, if a strong audio signal occurs simultaneously with, or slightly before, one or more weaker audio signals, then this strong audio signal will mask these weaker signals. Consequently, these weaker signals may be eliminated or more coarsely represented as the resultant noise will not be perceptible by the human ear anyway.

Issues of perception are also significant within the broad area of *human-computer interaction (HCI)*. Not least we find issues of perception at the center of techniques for the construction of user models in HCI because these are created by attempting to understanding a user's mental model. The user model is then used to produce a more personalized system that adapts to each individual user (Allen, 1997). Understanding such matters as how we perceive graphics is also of fundamental interest to the HCI community because this knowledge helps to facilitate the design of efficient and effective graphical user interfaces (Lohse, 1997) and visualizations. Many of these issues come to the fore in navigation, in which a user will cycle iteratively through the phases of browsing, modeling, interpreting, and formulating a browsing strategy for navigating a wide information space (Spence, 1999), such as that formed from hypertext or hypermedia. Recently, we have come to witness the emergence of advanced *perceptual user interfaces (PUIs)*. The PUIs are characterized by interaction techniques that combine an understanding of human capabilities with computer input/output devices and computer vision to produce rich interaction environments (Pentland, 2000). Such environments are based on multi-modal interfaces (Oviatt & Cohen, 2000) that are grounded in how people interact with each other and with the real world (Turk & Robertson, 2000). Moreover, with the ubiquity of networks has come a need to consider interactions within the group context. As a result, Hollan et al. (2000) argue that the theory of distributed cognition offers considerable benefits to future research in HCI, as it seeks to understand the organization of cognitive systems through the extension of what is considered cognitive from the individual to encompass also interactions between people and with resources and materials in the environment.

That perception has a significant impact on all aspects of the *information systems development* process has also become apparent (Communications of the ACM, 1995). How to narrow the gap between the user's real-world perception of data and the conceptual view imposed by an information system has been a subject of research for many years (Jagannathan et al., 1988). Toward the end of the 1980s, Davis (1988) noted that the division between *what* and *how* in the traditional software development lifecycle can be subject to individual perception, due to differences between the 'languages' of user and developer. Nevertheless, differences in perception may be seen to occur between all relevant stakeholders in the information systems development process (Lyytinen, 1987) and not just between users and developers. This occurs because of perceptual differences in the vision of the system to be changed and the vision of the solution system. Hence, the influences and effects on various stakeholders' perceptions have been of interest for some time. For example, a study by McKendree and Carroll (1986) found that the role of an advisor would be determined heavily by the initial approach taken by the user and the advisor's perception of the user's needs. Morgan's (1986) work in organizational theory—in which several powerful and useful perceptions of organizations were identified—is therefore proving useful within information systems analysis of organizations as a whole and can help to identify stakeholder perspectives and biases. These concepts are sparking new and related research issues, such as that of cognitive biases creeping into decisions made by experts in environments that are clouded with uncertainty (Stacy & Macmillian, 1995).

5. PARABLES

The third theme of parables also plays a significant role within information systems and computing. We use the term *parable* in this context to refer to a 'story' that bears significant meaning and from which 'lessons' may often be drawn. In this sense, parables have a long tradition in information systems and computing in the form of case studies. Nevertheless, definitions of the term case study differ somewhat. Whereas Eisenhardt (1989) defines a case study simply as a research strategy that focuses on understanding the

dynamics present within single settings, a more comprehensive account is given by Yin (1993; 1994). Yin (1994) likens the case study to alternative research strategies, such as experiments, histories, and simulations. Yin (1993) therefore defines the case study as an empirical inquiry that investigates a contemporary phenomenon within its real life context, where the boundaries between phenomenon and context are not clearly evident and where multiple sources of evidence are used. From this definition, Yin (1993) identifies six possible types of case study, dependent on combinations of the following two factors:

- *The number of cases*: Either single or multiple.
- *The purpose of the study*: Either exploratory, descriptive, or explanatory.

Whatever the definition, however, case studies have been used for a variety of diverse purposes within information systems and computing—ranging from comparing programming languages (Lawlis & Elam, 1992) and understanding the factors involved in selecting a supercomputer network (French, 1990) to forming and implementing an information strategy for a building society (Walsham & Waema, 1994).

Benbasat et al. (1987) identify two types of problems for which case study research is particularly appropriate:

1. those problems in which research and theory are still at their formative stages, and
2. 'sticky' practice-based problems where the experiences of the actors involved are important and the context of action is critical.

Yin (1994) concurs with this approach and argues that case studies are most suitable for the exploration, classification, and hypotheses development stages of the knowledge building process. The rapid progress in technology, combined with the relative 'youth' of the fields of information systems and computing (particularly information systems), suggests therefore that we should not be surprised with the rise in the use of case studies (Walsham, 1995), both in research and in professional literature.

The use of parables in the broader sense has proven particularly popular in other areas of information systems and computing, particularly within HCI. Laurel's (1993) seminal book, *Computers as Theatre*, related human-computer interaction to theatre and drama and described how theatre may be used as a UI metaphor. From this, she proposed a number of design principles for

designing human-computer interaction, with a view to enabling new forms of drama. These design principles were centered around the dramatic themes of (a) action, (b) character and thought, (c) language and communication, and (d) enactment. Since then, the use of parables for design has increased in popularity. At the recent ACM Symposium on *Designing Interactive Systems 2000*, a panel (Gruen, 2000) discussed the use of stories in this way, focusing on those used either for the content or as the organizing theme within a system, and those told around the people, settings, and activities in which a system is used for the purposes of setting vision, guiding design, and communicating value. One view held at the panel was that the same elements that contribute to a compelling story (in whatever form) are also important for delivering a compelling system.

6. SPECIAL ISSUE: INTERSECTING PRESENTATION, PERCEPTION AND PARABLES

The present special issue comprises eight papers that reflect the themes of presentation, perception, and parables. Rather than include papers that concentrate exclusively on one of these themes, we have selected papers that combine them and that therefore lie within the intersection areas of Fig. 1. Figure 2 illustrates how each paper relates to Fig. 1.

The first two papers within this special issue bear the underlying themes of presentation and perception. The first paper by Macredie and Morar examines presentation and perception in the context of desktop virtual environments. In particular, the authors consider the effects of visual depth cues and propose a research agenda to serve as a basis for future understanding within the area. They argue that an emphasis on the differences of visual depth cue perception between individuals is needed to enhance (presentation within) desktop virtual environments. The second paper by Pouloudi and Magoulas tackles presentation and perception within the context of medical image interpretation. The authors examine technical, organizational, and social issues regarding the use of neural network-based methodologies in the development and use of expert systems within this area, concentrating in particular on ethical issues.

Fig. 2: How the papers within this special issue relate to Fig. 1.

The next two papers deal with the perceptual theme in combination with the parables theme. The paper by Choudrie and Hlupic presents and compares three case studies of UK organizations undergoing business process change. These case studies are used to identify key issues regarding the characteristics of a re-engineering team, human and organizational aspects of business process change (such as conflict, trust, communication, and motivation), and the roles of information technology and project management. The paper by McGrath considers a single case, that of the infamous London Ambulance Service Computer Aided Dispatch (LASCAD) project within the UK, but within a historical context. Whereas other authors have examined this project with a view to understanding 'what went wrong', McGrath examines the project with the objective of trying to understand current failings in the

ambulance services sector in the UK. In so doing, she provides alternative perspectives on the project.

The next two papers in this special issue deal with presentation in combination with the parables theme. The first paper, by Alshawhi, Irani, and Jassim, argues that a key factor in managers' inability to select appropriate computing hardware is a lack of effective decision aids. Consequently, the authors propose a model for presenting performance data to support the evaluation of computing hardware clusters. The use of the model is illustrated for a computational fluid dynamics application running on two different hardware clusters. The second paper, by Gardner, describes the development of a hypermedia documentation mechanism for information systems development. The paper describes the Fully Integrated Environment for Layered Development (FIELD) and its use within the Norfolk and Suffolk Broads Authority, an environmental control organization.

We close the special issue with two papers that reflect all three of the underlying themes of presentation, perception, and parables. The first paper, by Chen and Rada, analyzes and models the dynamics of using a collaborative hypertext system that is based on time series data from real users of the MUCH system. The second paper, by Ghinea, Thomas, and Fish, discusses the DRoPS (Dynamically Reconfigurable Protocol Stacks) project and makes the case for a greater consideration of human perceptual requirements, in addition to traditional notions of Quality of Service (QoS) within communications. To this end, the authors define the concept of Quality of Perception (QoP), which is used within the DRoPS architectures and which necessarily maps onto notions of QoS. The performance of DRoPS is compared to TCP/IP and UDP/IP, thus providing a technical case perspective.

We hope that this special issue illustrates the variety that is apparent within the three themes of presentation, perception, and parables within information systems and computing.

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