"Of Spiders, Men and Powerful Ideas"

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1.   Abstract

Dr. Peter Ward is the Director of the Information Modelling Programme (IMP) group in the University. The following discussion presents some of the work of this group in the area of computer-based multimedia, human computer interaction and the development of new means of organising and providing access to information and knowledge. One of the IMP projects that has received a lot of international media interest over the past year is the research on "Spider Phobia". Mustapha Hassan, a clinical psychologist from the Sudan, has been working on this project (as part of a Ph.D study), examining the application of interactive multimedia techniques to the assessment and treatment of this model of simple animal phobia.

And what of "powerful ideas"? The facility to represent the world in terms of symbols, numbers and calculations, the written word and speech, the richness of sounds and pictures, and the possibility of encapsulating and communicating such representations in a dynamic and interactive fashion is currently offered by the new generation of information technology that is "interactive multimedia". Perhaps 'idea-processing' - supported within hypermedia environments, employing telematic networks, integrating a community of design, modelling and communication - will become the next revolution in personal computing, following number crunching, form-filling, and word-processing.

2.   Introduction: the Information Modelling Programme (IMP)

IMP is a multi-disciplinary initiative, established in 1987, combining ideas and expertise from system design, software engineering, graphic design, education & training, entertainment and cognitive psychology. The work of the group is concerned with the development of new environments for the support of communication processes with a focus on the promotion of understanding in a number of contexts.

In general, we are concerned with basic and applied research and the development of methodologies and materials for the construction of user-oriented systems that deliver satisfactory support for effective cognitive processing - thinking, learning and communication; systems that are essentially easy (and aesthetically pleasing) to use and responsive to intuition and enquiry. People generally seek out interesting, pleasing and fulfilling stimulation. The aesthetic sensibilities can be and are accommodated by the designers of working environments. Computer-based mechanisms for the processing and communication of information will figure largely in the working environments of the future. There is no reason why the design of information processing and communication mechanisms eg in an office (administration or design tasks) or, in a school (education or training tasks) should not be aesthetically pleasing and enjoyable.

We are interested in a wide range of issues from human factors, the design of the computer interface, through to knowledge representation and pedagogy to the details of low-level software implementation in the construction of information systems. We are interested in the development of object-oriented software technology because it provides the possibility of dealing elegantly with complexity: the abstraction out of simplicity and the decomposition and reconstruction of domains and things in the real world in terms of elements/entities and relationships/behaviour. We are

interested in the development of multimedia information systems (MIS) which can accommodate large numbers of multimedia objects within applications which are portable and distributable across a range of hardware and operating systems. As far as the design of educational applications is concerned, the motto "SMILE" - supporting multimedia interactive learning environments, represents the notion of enjoyment and assistance in the working environment for both teachers and learners and represents an approach which we are hoping to implement.

Interaction with machines should be rewarding, they should lighten a burden, facilitate the execution of tasks. Computers are machines that have the potential to process information with phenomenal speed and efficiency. As far as we ordinary mortals are concerned, this should be in useful ways, essentially providing us with support for the things we want or must do with information. Like any well designed tool, computers should enable access to the medium and empower without perplexing (the ergonomics of the tool should be of a high order so that the tool becomes almost an extension of the hand or intention). The interface between the human and the computer is not just a technology within the machine, it is the input/output channel (of communication) and the interface includes both sensorimotor and cognitive components. As such these include devices such as the keyboard, the mouse, the touch screen, maps and other means of exposition.

What is an 'interface'? The exciting thing about computer-based multimedia is the possibility that it can be interactive. The dictionary definition of the words 'interaction' and 'interfacial' include notions of reciprocal action, intermediate, included between. 'Interactive' in the context of computer-based information systems can refer to a dynamic relationship between the information and the user, and is exemplified by the 'WIMP' (windows, icons, mouse and pull-down/pop-up menus) interfaces that are the characteristic of the Apple Mac and which are also available on other machines. They offer a measure of "direct manipulation", in which, rather than engaging in a complex natural language based dialogue with the machine in order to get or do something, objects (such as an icon representing a waste-basket) are available in the interface which provide the user with a simple model of the action giving instant feedback when used. 'Interactive' can also refer to a dynamic relationship between information components such as language and image, for example between a textual label and an equivalent graphical/pictorial object in a representation. To be truly "interactive" a computer-based information system must provide ready and intuitive support for enquiry. It must provide all logical channels and modes of communication at an interface which is essentially transparent in the sense that it supports the intention of the user to search for, access, examine and make effective use of information. It must provide a range of simple tools for the manipulation of information which are use easy to use. The interface should adapt to a variety of user types, from the 'power' user (experienced in the use of information technology) to the naive user coming to the system for the first time. It should positively stimulate interest and encourage further use.

3.   Interactive Multimedia

What is 'interactive multimedia'? In information technology terms, computer based 'multimedia' represents a set of mechanisms for the encapsulation and delivery of data e.g. digital or analogue pictures, text and sound on magnetic or optical (laser) disc. Computer-based multimedia technology is hardware (machines) and software (instructions to model information). It has evolved over the past ten years or so from the platforms (computers) handling information coded as numbers, formulae and text with alpha-numeric displays, to platforms (computer-based machines) capable of processing and delivering all forms of information both analogue and digital.

The audio-visual and computer technologies have become integrated and currently offer a variety of processing, storage and delivery platforms. An intermediate stage in this development path has been "interactive video" - a hybrid of audiovisual and computer technology with more or less interactive control of multimedia materials from the computer. Offering some flexibility in the organisation and

access to materials, it employed the analogue optical laserdisc as the storage medium. While this analogue medium suffers from a lack of universal implementation standards, the digital optical laserdisc medium CD-ROM* has been carefully introduced with a world standard in place at the outset. It is the base technology for CD-ROM/XA*, CD-i* and DV-i* (and CD-tv*) and, like the Winchester (hard) disc is a digital storage medium with information in digital form.

Computer based interactive multimedia technology offers the possibility of multi sensorial stimulation. As well as visual and auditory channels, haptic (touch), kinaesthetic (force and movement), vestibular (positional sense) and olfaction (taste and smell) may be included in a consideration of potential interface components and channels of communication. Indeed, for the unsighted the development of the sense of discriminative touch is an important perceptual modality and means of communication (e.g. Braille). The sense of smell is a potent cue in long-term memory and is a medium for the communication of behavioural (e.g. fear) and physiological (e.g. reproductive) states. The 'virtual reality' systems of the future may be expected to include all these modalities of communication.

Applications for interactive computer-based multimedia include 'Point of Information/ Point of Sale' (POI/POS; examples of these are beginning to appear in town centres and supermarkets), 'Education & Training' (E&T; examples of these are rather few and far between), and 'Professional Support/Cooperative Work' (PS/CW; examples of these include, 'desk-top publishing', document and picture archiving, computer-aided design and manufacture). The "Spider Phobia" system is an example of a potential therapeutic platform.

Multimedia adds a new level of complexity to the design of information systems and to the material encountered by users. The world of objects and interactions can be modelled in a variety of ways, including in a fashion known as 'object-oriented'. Object-oriented structures are like hybrid hierarchical/relational trees and networks, but with extra dimensions - such as inheritance, so that representations are economical (avoiding unnecessary repetition) and flexible (having a basic measure of general applicability, including meaning which is reusable). It is an approach we have naturally adopted in IMP as we have sought to combine an 'intuitively human' approach to the general processes of modelling information about the real world and to the design of applications with the conventional programmer's task, which is to translate an understanding of real world situations into processes which are essentially procedural, dictated by the language of the machine and not really akin to how humans normally deal with problems.

Information & knowledge systems in the current context involve notions of databases or resources of information organised in a variety of ways, including alphabetical lists, tree-like hierarchies and relational sets and 'chunks', such as definitions, arguments and topics.

These resources need to be accessible and configurable into vehicles for the representation and communication of ideas. An essential requirement is that of ordering and prioritising information for the most effective and immediate communication. Knowledge is information organised into meaningful and contextually appropriate structures. "Hypertext' is an abstraction in which words

can be organised into networks of reference, context and meaning. "Hypermedia" is a natural extension of hypertext in which multiple and integrated 'media objects' can be constructed into information and knowledge structures with the possibility of encapsulating and representing the real world. "Hypermedia webs" are like hypertext networks and include nodes - collections of meaningful media objects, and links - indicating meaningful relationships. Context and Viewpoint are aspects, "organisers", of information which can be constructed within hypermedia environments and can give them alternative and added value.

4.   The Spider Phobia Project

Little Miss Muffet
Sat on a tuffet
Eating her curds and whey
When down came a spider
And sat down beside her
And frightened Miss Muffet away

Spiders are Arachnids: members of the class Arachnida in the phylum Arthropoda, having a fully chitinised exoskeleton, with two pairs of prehensile or sensory appendages on the head and four pairs of ambulatory appendages (walking legs) on the thorax; and which have very successfully invaded dry land. There are twelve orders of Arachnida, of which the Scorpionidea (the scorpions),the Araneida (the spiders), and the Solifuga (the mites and ticks) are three representatives. True jaws are absent. In spiders, the first pair of appendages are the chelicerae, normally with claws whose tips contain the opening for the poison glands. The second pair of appendages are the pedipalps, and are employed for the mastication of prey, spiders having developed to an extreme extent the tendency found in other arachnids towards a carniverous diet. Digestion is largely external. They suck out the body juices; others crunch up the prey first of all. While most spiders on account of their size can only feed on insects, others are able to attack larger animals; birds in the case of Mygale (the "bird-eating spider).

Some people would be finding this textual account of spiders rather unpleasant! Moreover, the sight of a spider: a picture of one, let alone the real thing, may be very alarming and unpleasant indeed to some people. A fear of spiders can be acquired by a 'modelling' process in which observation and learning e.g. from an adult when a child occurs. In South Australia, it is as well to learn a certain caution when it comes to orientation in the rest room (as far as spiders, particularly the small variety) is concerned. The Nursery Rhyme about Miss Muffet has probably encouraged many to fear the arachnid in a fashion out of proportion to its capacity to do any real harm.

The fear of spiders - spider phobia or arachnophobia - is an example of an anxiety-related disorder. Anxiety-related disorders include phobias, obsessive compulsive disorders (e.g. the hand washing behaviour shown by Macbeth's mother) and generalised anxiety states. The characteristics of anxiety as an emotion are that it is distressing, and that its sources are indefinite. Fear is experienced with reference to a specific aspect of the outside world. Fear with a more or less specific reference but out of proportion to the real danger is a phobia. Spider phobia is regarded as one of the commonest animal phobias and is an anxiety-related disorder whose clinical treatment includes encouraging the phobic to come to terms with and to acquire a better understanding of the object of fear. The Spider phobia project was conceived as a test-bed for some ideas and mechanisms relating to the potential of the new interactive multimedia technologies to enable people to better understand their world and to add value to existing mechanisms - in this instance for the assessment and treatment of a clinical condition with cognitive and behavioural dimensions. The experimental study involved two groups of subjects - one to be assessed and treated by conventional methods, the other to be assessed and treated with the prototype computer-based

method.

The prototype system consists of a PC (IBM-type 286/386), with a colour graphics screen (VGA standard) and a television screen. The computer was connected via a serial line with an external LaserDisc Player: which plays an analogue laser-read disc containing a resource of audiovisual material. In this case, the resource included various pictures: still cartoon and photographic images, animations, and moving video images of spiders (the potentially phobic object) in all shapes, varieties and situations. There were 'chunks' of video material, including a demonstration/tutorial of how the computer-based system is used and a demonstration of relaxation technique by a therapist. Also included were pictures of other material, such as paintings, poster art, and 'holiday snaps', which might be a source of amusement and distraction. Sound, including musical items of various types as well as ambient sounds such as waves at the sea-shore, a summer breeze through the pine trees etc. Again, a potential source of diversion and aid to relaxation. Some textual material about spiders and the graphical interaction buttons and menus, organising programmed access and interaction, were contained on the computer's hard disc as was the programme which is the framework of low level instructions controlling human-computer interaction and the display of material from the resource eg from the laserdisc or computer hard disc. Two varieties of user interaction and access to material contained in the programme were evaluated: a mouse pointing device and a touch screen. Various menus of buttons were designed and displayed on the computer screen; these could be selected by the user. A first prototype employed the mouse, enabling the user to move a cursor on the screen and select an item of interest by clicking on it. Skilled mouse control requires about 15 minutes to learn. Because we were concerned that the interface to the programme was as 'user friendly' as possible and presented no extra source of anxiety to the phobic subjects ('clients'), a second prototype employed a touch screen requiring the client only to select a menu button with a finger by touch.

Essentially, the computer programme is a model in parallel to conventional therapy. Its aim is not to replace the therapist but to provide a support tool. The client first meets with the therapist (in this case Mustapha Hassan) and in a process of initial assessment, various questionnaires are completed, gathering information about their phobia, previous experience of treatment, if any, and their attitudes, experience and expectations of computers. Such questionnaires can also be offered on the computer for completion. At an appropriate time the client is invited to make use of the computer assessment and therapy system. The client can make a selection from a menu of buttons eg. 'Information About This Programme'; 'Start Programme'; 'Quit Programme'; 'Help'. Upon selection of 'Start Programme', a new screen is presented with a new set of buttons offering a selection of material about spiders and also including a number of buttons (describing a graded scale of anxiety) which the client can select, indicating at any time their feelings (level of anxiety), ranging from not at all anxious to very anxious! Material about spiders includes textual material (even the word 'spider' can provoke a phobic response) with some explanation about them (part of coming to terms with the phobic object is acquiring a better understanding of it). Knowing about spiders can make people think very differently about them. Pictorial representations are available in a graded, hierarchical series from simple sketches and amusing cartoons, through realistic drawings and animations, to photographic images and video sequences of real spiders of various shapes and sizes in various situations eg in a bathroom, in a drawer, on a web, on a persons hand. Included is video material of spiders being confronted and handled in a number of ways - from being close to and not touched, handled with gloved hands and freely handled. In conventional treatment, an end point can be confronting and in the case of siders handling the phobic object. Using the computer programme, the client, when they feel ready can select a view of a spider eg a photograph of a medium-sized British House spider or if they are feeling very brave, they can select a piece of video of a large Tarantula being prodded by a handler whereupon it suddenly runs off, stage left (enough to test the nerve of anyone)! At any time and should the client become anxious, they can select a button from the anxiety scale (which selection is recorded as any interaction the client has with the system can

be recorded by the programme) and in the case of the indication of anxiety, then the current selection would be replaced with a menu of relaxation material: a relaxation exercise on video, a gallery of pictures (not including spiders!) and a selection of music and other diverting and potentially pleasant material. Perhaps after selecting some pictures or music, and when the client feels ready, they can go back to the spider material, re-examine the representation that caused them distress or proceed to another view eg a bigger spider or a different situation. Of course they can terminate and leave the programme at any time. They can engage in a cycle of exposure and relaxation in this way and it is the control which they learn and which they can exercise over this process which is a feature of the interactive programme. The feedback from subjects (about 35 clients have so far used the system) has been enthusiastic almost without exception. We have received a number of unsolicited letters from subjects who have told us that their expectations have been greatly exceeded. A few quotes from these illustrates this, "I began to feel so much in control that I could overcome my distaste and get rid of (them) whenever I liked .... ; I learnt that spiders were not 'evil' creatures with a desire for persecuting me but simply another species of living things and with much more fear of me than I ever had of them. Since the turning point when I first touched a spider and realised how fragile and, well to be honest, how sweet they were (!), cradling a tarantula in my hands didn't seem such a big step after all!....; the last session was wonderful. I managed to take out all three spiders and in particular the fully grown taratula. It was quite heavy and its furry legs tickled my palms and the pads on the end of her legs were just like velvet. To my partners horror (who also has a fear of spiders) I now want to keep a tarantula as a pet!".

Early on in the project we made contact with 'Phobic Action', the voluntary self-help group based in London. Its director, Ken Sell, has become very interested in our work. At the time we acquainted him with our hypothesis and our prototype programme, he had been receiving advice from therapists (clinical psychologists and psychiatrists who give support to the group) that the possibility that "computers" may be used to assist the treatment of phobia was an interesting and serious prospect. We had rather been expecting that the response to our initiative, based on the use of "sophisticated computer technology" would be met with scepticism, even opposition. Indeed we were advised that generally there is a shortage of trained therapists and far more people seeking help than the present system can deal with effectively. Moreover, many phobics report that they are reluctant to seek help, experiencing anxiety at the prospect of seeing a therapist and frequently are demotivated and distressed at the experience: feeling an anxiety because they are too much under the control of the therapist. The potential of the computer-based approach of interactive modelling, assessment and behavioural modification is that it offers the possibility of a significant level of control (within the framework of the programme) to the phobic subject who can more or less control what they experience and when, with access to a means of dismissing the object of fear to which they are exposed and replacing it with something else perhaps diverting or pleasing. Paradoxically and generally speaking, and this is an observation that we have confirmed to some extent in oue work, people seem more willing to communicate 'sensitive' information of a personal nature to a computer (in a questionnaire) than to another person, even a potential therapist.

The original idea for the project was based on a curiosity about the extent to which interactive multimedia representations (including all manner of information structures, simulations, visualisations and so forth) - with a focus on the interaction - could provide a means of positive and constructive, stimulation and the promotion of understanding. Whatever the true nature of education is, and whatever means subtle or otherwise we seek to devise to encourage it, the computer somehow has the potential to be developed as a tool or catalyst in educational processes. Such processes are not necessarily restricted to the class room, the library or the laboratory and there is much interest in 'life-long' learning and the potential of information technology to support processes of distributed/'distance', 'open' learning. The idea that helping people come to terms with things that concerns them, makes them anxious and afraid is on a continuum with our interest in developing the technology to support students within learning environments. It is particularly

interesting to be able to explore new avenues and every day applications for technology rather than pursuing sophisticated and exclusive 'institutional' applications.

The "Spider Phobia" project, while attracting considerable public and media interest is yet to attract external funding although we are in the process of trying to attract support and we are hoping that somehow the publicity will identify a benefactor: perhaps a wealthy philanthropist who just happens to be afraid of spiders. We are very interested in taking this work forward and exploring, not only a means to develop this prototype technology into a therapeutic tool for spider phobia, but as a platform for other anxiety-related disorders and indeed as a tool for the psychological assessment(and perhaps treatment) of a variety of conditions. There are many routine procedures and tests that could be implemented, perhaps even more efficiently and effectively, on an interactive computer-based multimedia platform. There is a possibility that the consumer versions of this technology, which are just around the corner, such as CD-TV and CD-i will provide not just a means of learning how to play golf or defeat a race of mutants from the planet Zog but also materials on a compact disc that you might buy in the newsagents dealing with common simple phobias and how you might deal with them. We shall see.

Recently, an Australian film crew spent a day with us filming our work and in particular the "Spider Phobia" project for a networked documentary series about science and technology, 'Beyond 2000'. It caused a great deal of excitement in the corridors: the lights, the cameras, the action. The true stars of the show were the spiders however. An almighty cry emanated from interviewer, a polished and experienced professional, hardened by life on the road in search of scientific adventure, when on the third take of handling the spider before camera (and I don't quite recall the script) the Tarantula made a sudden exit stage left (up his shirt sleeve)! Interactive multimedia is such fun.

Details of current and future projects can be obtained from Dr. Ward in the University, c/o IMP The Worsley Building Room 9.79.

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