ARAHAAN:
1. Kertas soalan ini mengandungi LIMA (5) soalan, dalam SEPULUH (10) halaman bercetak tidak termasuk kulit hadapan.
2. Anda dikehendaki menjawab SEMUA soalan.
3. Semua jawapan hendaklah ditulis di dalam kertas jawapan yang disediakan.

INSTRUCTION:
1. This book script consists of FIVE (5) questions in TEN (10) printed pages excluding the cover page.
2. You are required to answer ALL questions.
3. Answer ALL questions on the answer sheets provided.
1. (a) Berikan maksud untuk **DUA (2)** istilah-istilah berikut:

- Ergonomik
- Antropometri

*Define the meanings for **TWO (2)** terms below:*

- Ergonomics
- Anthropometry

*(4 markah/marks)*

(b) Bincangkan **TIGA (3)** prinsip umum dalam pembangunan sesuatu produk yang baik. Berikan contoh bagi setiap prinsip berkenaan.

*Discuss **THREE (3)** principles in the development of a successful product. Give an example for each principal.*

*(6 markah/marks)*

(c) Manusia mempunyai dua jenis ingatan yang dikenali sebagai Ingatan Jangka Pendek dan Ingatan Jangka Panjang. Terangkan dengan terperinci kedua-dua ingatan tersebut.

*Human has two kinds of memory known as Short-term Memory (STM) and Long-term Memory (LTM). Explain in details these two kinds of memory.*

*(10 markah/marks)*

2. (a) Berikan **DUA (2)** jenis paparan visual yang sering digunakan untuk menyampaikan informasi dari mesin kepada operator.

*Give **TWO (2)** types of visual display that are commonly used to transfer information from a machine to an operator.*

*(4 markah/marks)*
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(b) Jelaskan **TIGA (3)** sumbangan ergonomik kepada reka letak di tempat kerja. Berikan contoh yang sesuai untuk setiap sumbangan.

*Explain THREE (3) contributions of ergonomics to workstation design. Give relevant examples for each contribution.*

(6 markah/marks)

(c) Terangkan **EMPAT (4)** jenis kesakitan yang boleh berlaku pada bahagian atas badan semasa melakukan kerja.

*Explain FOUR (4) pains which can happen to the upper body while working.*

(10 markah/marks)

3. (a) Berikan definisi mengenai faktor manusia oleh Chapnis (1985).

*Give the definition of human factor according to Chapnis (1985).*

(4 markah/marks)

(b) Jelaskan **TIGA (3)** cara bagaimana manual pengguna dapat membantu pekerja yang tidak mahir.

*Explain THREE (3) ways how user manual can help unskilled worker.*

(6 markah/marks)

(c) Bincangkan **EMPAT (4)** perbandingan pekerja yang mahir berbanding pekerja yang tidak mahir

*Explain FOUR (4) differences between skilled and unskilled workers.*

(10 markah/marks)
4. (a) Baca artikel di LAMPIRAN 1 dengan teliti dan jawab soalan-soalan berikut.

*Read the attached article in APPENDIX 1 carefully and answer these questions.*

(i) Nyatakan jenis ergonomik yang paling sesuai untuk menerangkan tentang artikel tersebut.

*Please state the most suitable type of ergonomic that is the most suitable to describe the article.*

(3 markah/marks)

(ii) Berdasarkan jenis ergonomik yang dimaksudkan, nyatakan kaedah yang paling tepat yang telah digunakan oleh para pengkaji berkenaan untuk membangunkan alat bantu mengajar yang dimaksudkan.

*According to the type of ergonomic that you have suggested, which is the best answer to explain the method that is being used by the researchers to develop teaching aid.*

(3 markah/marks)

(iii) "Jenis ergonomik yang dimaksudkan ini tidak berbeza berbanding dengan jenis atau bidang ergonomik yang lain". Bincangkan secara kritikal dengan menyatakan TIGA (3) contoh yang boleh diperolehi daripada artikel tersebut.

"This type of ergonomic is no different from any other area of ergonomics" Discuss critically this statement and provide THREE (3) examples that you can extract from the article.

(12 markah/marks)
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a) Baca kajian kes di LAMPIRAN 2 dan jawab soalan-soalan berikut.

*Read the case study attached in APPENDIX 2 and answer these questions.*

(i) Kenapiasti **EMPAT (4)** kesakitan yang mungkin dialami oleh pekerja yang terlibat.

*Identify FOUR (4) possible sprain or strain that might happen to those workers.*

(4 markah/marks)

(ii) Daripada ilustrasi batang paip yang diberikan (Rajah 1), buatkan **SATU (1)** ilustrasi batang paip yang lebih ergonomik dan dapat membantu menyelesaikan masalah yang dihadapi oleh pekerja untuk membuka, membersih, dan memasang kembali batang paip tersebut.

*From the illustration given in Figure 1, illustrate ONE (1) illustration of a pipe that is more ergonomic to help the workers to solve their problems.*

(8 markah/marks)

5. Tubuh manusia merupakan sistem mekanikal yang dicipta untuk melakukan pelbagai fungsi sehari-hari. Nyatakan dan perincikan **DUA (2)** perbezaan sistem skeletal dengan sistem maskular.

*Human body is a mechanical system which designed to perform a variety of functions in daily life. State and elaborate TWO (2) differences between skeletal system and muscular system.*

(10 markah/marks)

KERTAS SOALAN TAMAT

END OF QUESTION PAPER
DELIVERING DIFFICULT CONCEPTS USING VISUAL REPRESENTATIONS

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It is difficult to present new, complex ideas in ways that are informative and interesting in situations where a vast amount of information has to be delivered and understood quickly. Given short attention spans, boredom thresholds and limited capacity to assimilate new information, it is essential to use an effective conveyer of the message, which presents the content in a clear and unambiguous manner whilst helping the receiver to remain alert and focused and integrate the information with existing knowledge. This paper introduces a collaboration between computer scientists and artists¹ to develop an effective, animation based information communication tool, in the form of an application scenario, to be used for communicating to students (and wider audiences) dry technical aspects of pervasive computing.

Key words: Visual representations, animation, pervasive computing.

Introduction

An ongoing collaboration between the Cogent Computing Group (CCG) in the School of Mathematics and Information Sciences and the Visual and Information Design Research Centre (VIDE), Coventry School of Art and Design is developing an animation to convey information about a new, relatively complex concept—cogent sensors—in a way that will capture the interest and imagination of audiences, inform them and hopefully instil in them a desire to find out more about the subject.

This paper considers: the role of graphical representations in teaching and training; the development of the animation (the process and the expectations of the group during its development); the usefulness of the visualisation in facilitating debate amongst the CCG and lastly, an evaluation of the material in terms of the added value of the material.

Animations in practice

We are now at a stage where education is not confined to schools and universities, it occurs throughout life, either within the confines of industry, especially in knowledge-based organisations, or through life-long learning. Audiences and presenters/commissioners of teaching and training material are therefore mature and sophisticated, having

¹Zeshan Ahmed and Alex Jevremovic developed the visual representations and animation.
been exposed to a rich, varied and high quality visual culture. They need to communicate about technical, scientific, conceptual and managerial information within and between large scale companies and institutions: the information may pertain to physical devices and principles such as the operation of machines, chemical compounds or drugs; or address concepts such as safety procedures, aspects of learning and training, the communication of decision making, marketing and research processes.

To meet these demands, companies may hand over responsibility for their external advertising and publicity campaigns to specialist agencies who can produce material to the necessary quality. However, internal training and awareness programmes that are vitaly important in terms of making known the activities and aims of the organisation, often do not receive the budget, care or specialist attention they warrant even though the employees, delegates, directors, visitors who attend these sessions are indeed the same persons who are immersed in the televised culture of the wider community. They tend to judge the informational diet served to them by similar standards to the programmes seen outside. No matter how worthy a subject matter may be, if the method of presentation does not engage and judged as standard by the viewer, then that subject matter will not be seen to its advantage. This applies equally well to the development of material for teaching within our institutions where material should also be developed bearing in mind the principles of multimedia design for learning (for example, Mayer, 2001).

The value of animations in education

An increasing amount of research is exploring the potential of different combinations of multimedia to support education. Animations have been found to increase motivation (Rodgers, 1995), aid the quality of learning (Stephenson, 1994), enhance communication of concepts involving time and motion (Hays, 1996) and the visualization of "invisible" dynamic processes that otherwise would need to be understood through abstract concepts (Huk et al., 2003). Researchers have concluded that multimedia presentation enables people to understand things that would be very difficult to grasp from words alone. When both words and pictures support each other, students construct verbal and pictorial mental models and build connections between them. As well as the capacity of animations and illustrations to portray information differently, benefits may also be derived from reductions in cognitive load through the use of a second cognitive channel (Mayer, 2001).

A case in point here is the emerging area of pervasive computing. Pervasiveness is foreseen as the "next big paradigm shift" in computing, making computing available everywhere, anytime. The forecasted social impact is immense and to date, awareness, even amongst computing students is limited. Although the area has so far benefited from enormous research efforts, the tomorrow's "dream applications" are commonly designed (and then presented) using a bottom-up approach from the level of physical components and computational algorithms, building up to functional systems.

CCG believed that a top-down view, both in the design and the presentation/dissemination of ideas and concepts phases would be more fruitful both technically and in order to ease the communication and exchange of ideas within the technical development team. Rather than look at the minute details of cogent sensor operation, we have developed an animation of a usage scenario, without considering operational details.

The context – cogent sensors

In the context of Pervasive Computing, CCG have promoted a "dream application" at several international conferences, e.g. Newman and Gaura, 2004. The application is a
concept demonstrator for the potential of highly specified and intelligent integrated MEMS (Micro-ElectroMechanical System) based wireless sensing devices. Such a concept is believed feasible using present day technology.

The scenario is for the use of a network formed from a multiplicity of microsensor nodes as a means of planetary exploration (in contrast to using highly functional probes or rovers). Such a scenario would provide the context (and a reason) for the application, and would highlight a number of factors such as the release and deployment of the sensors, the types and quantity of information that might be gathered from the network, and the mechanisms required to transmit that information back to earth. From this scenario, the CCG can outline the design for the node including provision for the required transducers, the signal and data processing circuitry, the data transmission and reception equipment and the actuators required to deploy and maintain the sensor on station.

The development of the animation

The animation proceeded from initial informal discussions about the requirements of the group and possible scenarios (contexts) between the group and John Burns (illustrator and animator), through to a series of concept sketches -- produced by Robert Newman which were elaborated and further refined in discussions between CCG and the co-authors.

These discussions served two purposes: to make the content of the key frames clearer and secondly to provide a vehicle for CCG to discuss how the sensors would work in practice. Examples of the concept sketches and the resultant key frames produced by the research assistants under the direction of John Burns are shown in Figure 1.

At the time of writing we have 15 key frames that can be used as speaker support, and a 5 second animation detailing a meteor hitting out the sensors. The intention is to produce a fully narrated, animated 2.5-minute sequence that will cover the entire concept accompanied by stills that can be used as speaker support to illustrate the presentation.

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Figures 1(a) and (b). Concept and detail sketch of the sensors being released on to the Mars landscape.

Figures 1 (c) and (d). Concept and detail of the sensor sending out a signal.
Stakeholder views of potential deployment and effectiveness of the animation

During the detail design stage a questionnaire was distributed to team members responsible for the development of the animation (i.e. the coauthors and the animators) to determine whether there were any differences of opinion with regard to the purposes of the animation, process, concepts to be portrayed, benefits, surprises and problems that had arisen. Clearly, such factors address wider issues than can be dealt with here, such as corporate strategy, interdisciplinary working and group dynamics.

Both groups (CCG and VIDE) agreed on the purpose of the animation, the way it would be used, the concepts that were to be portrayed, thereby indicating the success of the initial discussions and the initial concept sketches. Both groups expressed pleasure at working together on a project that furthered the research interests of both groups. Naturally the CCG were more detailed in their outline of the key concepts that could be portrayed. Surprise was expressed on how some apparently clear and unambiguous concept drawings could be (mis)interpreted. In such cases the drawings became a vehicle for more detailed discussion of operational details that had not been previously considered. Additionally some concern was expressed concerning the nature of the scenario and the extent to which it would create an appropriate mindset in the audience.

The role of the animation in terms of the CCG

Prior to the use of the material for teaching processes, the slides were shown to the wider CCG for comment. This produced a lively debate dealing with issues such as conventions in animations (e.g. the shortening of time, use of light to denote sending of signals), the nature of visual representation, audience characteristics (sophisticated viewers, subject experts or novices) and the impact this would have on their ability to detect/tolerate inaccuracies without losing confidence in the scenario, the main purpose of the animation. At a second level, discrepancies were noted in the modelling of the environment—such as the meteorite impact, the use of light/colour to represent transmission of signals, the density of the network. The third level of debate was about issues the group had not considered, such as clustering of signals and detailed design.

From experience, we know that such debates are common. We have provided a visual representation not a representation of the actual event. Misrepresentations and ambiguities focus the attention of the wider group on issues they may have not addressed thereby enabling opportunities for clarification and new research directions. Providing opportunities for such discussion is clearly a benefit of generating visual representations.

The animation as a vehicle for delivering information to learners

The material developed so far (the stills and short animated sequence) has been used in the delivery of a lecture on pervasive computing to Masters students. Following the recommendations of researchers such as Mayer (2001) and Roßling and Freisleben (2000) these were integrated into the lecture. The stills were displayed as a PowerPoint, remaining on screen for approximately a minute whilst a particular point was discussed. After the lecture students were given a chance to ask questions on the material before completing questionnaires and engaging in small group discussions about the added value of the animation and screen shots in the lecture. Such a question is believed to be compatible with the argument put forward by Mayer (2001) regarding the affordances of different media in enabling students to build up representations of the material.
All students saw value in the use of graphical material in textbooks and lectures as augmentation, to provide an overview of basic concepts or more detailed explanations. Some regarded the graphical material before the written. The graphics provided "an image in the mind, which will be easy to visualise the whole problem clearly". Comments also confirmed the different affordances of the media and that the graphics had allowed them to focus on problems, and provided additional stimulation. Most students were able to provide detailed answers about cogent system technology and its application. However, most were unable to visualise usage scenarios that did not involve space travel or geographic modelling and were unable to imagine sensors with different appearances.

Conclusions

Within the computer science communities, most of the concepts involved in the development of even the simplest pervasive applications are difficult to handle. Lack of public understanding of such technologies has resulted in negative publicity, part of this can be attributed to the way in which ideas are communicated. It is the responsibility of researchers to find mechanisms, perhaps visual representations that meet the needs of their audiences. The design teams of complex applications are increasingly multi-disciplinary. Communication around visual scenario representations may facilitate interaction in the group. If pervasive computing is to be developed then we have to explain the concepts to students who are not very confident with traditional technologies. Taking them through the logic and visualisation of the application would ease the instructor’s task, interest the audience with the animation acting as an anchor for QA sessions on the technical details. A more considered use of visual representations is relevant to communities that need to make results more accessible to the public.

References

Huk, T. Steinke, M. and Floto, C. 2003 Helping teachers developing computer animations for improving learning in science education *PROCEEDINGS OF SITE* pp. 3022–3025
“Di satu tapak kimia, jabatan penyelenggaraan perlu melaksanakan kerja-kerja mengalihkan beberapa seksyen paip (lihat Rajah 1) untuk membolehkan mereka mengkases ke dalam paip tersebut untuk dibersihkan. Adakalanya kerja ini memerlukan sehingga empat orang iaitu dua orang untuk memegang paip tersebut manakala satu orang pada setiap hujung paip untuk membuka skru penghubung. Kerja ini mestil dilakukan bersama-sama untuk mengelakkan kesukaran sekiranya satu bahagian telah dibuka sedangkan satu lagi belum dibuka. Malah ia akan menjadi sukar apabila ingin dipasang semula sekiranya tidak dilakukan bersama-sama.”

“In one chemical plant, the maintenance department had to remove a section of pipe (see figure 1) periodically to access the inside for cleaning. At times it would take up to four people to perform the task – two to hold the pipe and one at each end to unbolt the connectors. The work had to be done in tandem, since if one end were uncoupled before the other, that end would likely drop and bind, thus creating considerably more work to unbind it. Even more difficult was lifting the pipe back up to reconnect it”.

Rajah 1 / Figure 1