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Improving the quality of the student's learning experience: an agent-based approach to on-line study guides

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Abstract

Study guides are a valuable resource for the distance education student. With the growing trend of putting courses on-line there an increase in the number of on-line study guides. This paper looks at how distance education students interact with their learning materials and considers ways of making this more engaging and effective by looking at the importance of affective responses. The use of an agent-based approach to on-line study guides is proposed as a way of achieving this. This approach can provide a more personal and conversational style through the use of voice and face which has been shown to be effective at engaging a student and producing a positive effect on the student's perception of their learning experience as well as increasing performance outcomes. This paper argues that these findings should be applied to on-line study guides to improve the quality of the student's learning experience.

Introduction

This literature review looks at how distance education students interact with their learning materials. The discussion will consider ways of making the process of interaction more engaging and effective by considering how important affective responses can be. We shall initially look at the difficulties the distance education student can encounter due to the nature of distance education study and will then look at an important resource to the distance education student — the study guide. The study guide has been chosen as a focal point as it is an important resource to the distance education student since it provides the necessary guiding and supporting information that is not always accessible to the distance education student in the way it is to the traditional student. Three concepts influencing the design of self-instructional materials such as study guides will be looked at: the tutorial-in-print, the reflective action guide and dialogue.

This review will focus on how the use of dialogue can be an important factor in engaging the student with their materials and thus promoting positive outcomes. We will consider three conversational theories: Holmberg's guided didactic conversation (Holmberg, 1989), Pask's conversational theory (Pask, 1975), and Laurillard's conversational framework (Laurillard, 1993). The discussion of these theories will serve to emphasise the importance of conversation in the learning process and how effective learning can be supported through conversation. We will then turn to examples demonstrating how dialogue can be supported through the medium of text. A number of differing examples will be presented and a critique of their effectiveness will be given.

As there is an increasing move towards putting courses on-line in an attempt to make more effective use of computer technology, we will then consider the use of on-line study guides. A number of on-line study guides will be described and the difficulties in transferring paper-based forms to on-line media will be considered. It will become apparent that many on-line study guides are mainly concerned with the more functional task of presenting information to the student and generally do not consider ways of making interaction more engaging and effective by, for example, considering how important affective responses can be and how they can be supported by using dialogic techniques.

This discussion will then consider a new direction that research might take to investigate ways of engaging the student in a more dialogic, and thus more effective, style with their on-line materials. This direction is a move away from viewing the study guide as just another resource to it being a

'participant' in the student's learning experience. Issues arising from agent research in general and more specifically from research into pedagogical agents will be examined. After briefly looking at more 'traditional' aspects of agent research we will concentrate on how people react to computers and agents. We will consider evidence that demonstrates that this is a fundamentally social process in which people apply a variety of social rules to their interactions with a computer. We will look at the factors which influence an individual's response such as voice, face and the role which is portrayed by the agent. Such anthropomorphic features can prove engaging, promote personal involvement and be motivating when used appropriately. However, we shall also look at the negative side of over-anthropomorphising these features.

The Student

Although a lot of this research, and literature review, will be concerned with technology, this research takes a student-centred approach as its focus. To this extent, this literature review will begin by gaining an understanding of the distance education student. This section will, therefore, look at issues to do with the isolation and motivation of distance education students; their orientations to study; and their approaches to study.

Distance education students work largely in isolation, and contact with fellow students and tutors can be infrequent. Although the Open University (UK) has a tutorial system whereby students can attend a tutorial every fortnight or month, these tutorials are not compulsory and many students cannot attend for a variety of reasons. Stoane (1985) suggests that this isolation could be a significant barrier to effective learning and that students should be given the knowledge and skills necessary to overcome this barrier and make their learning more effective. She argues that learning has, for too long, been based on performance outcomes and that educational technologists need to become more learner focussed. To this extent, she considers motivation as a prime factor in the learning process,

> "Without the desire to learn, effective learning will rarely occur." (Stoane, 1985, p347)

However, a student may be highly motivated, with a strong desire to learn, but lack the necessary skills to enable effective learning to occur and will require assistance and direction in their study. There are also students who may be not be highly motivated, but who already have these skills.

There are a number of different permutations we could discuss, however, the point is that students are individuals with differing skills, needs and motivations and these are influenced by a number of factors (Dodds, Lawrence, & Guiton, 1984).

The reason why a student comes to be studying can also affect their motivation and quality of the learning experience. Students' orientation to studying can be classified by four types: vocational, academic, personal and social orientations (Morgan, 1993). Students with a vocational orientation to study are looking at studying from the point of view of gaining the qualification or looking at how relevant the course will be to their career. A student with an academic orientation will be concerned with the subject matter and progressing academically. Those with a personal orientation will be looking at broadening their perspectives on life or doing the course to prove they are capable of academic study. Students with a social orientation are doing the course out of their interest in the social opportunities the course may bring - this orientation is perhaps more likely in a traditional university student then in a distance education student.

Students also tackle their studying in different ways. Marton and Säljö (1976) identified a distinction between a deep approach and a surface approach to studying. The deep approach is characterised by the student approaching their studying with the intention to understand the material. They would relate new ideas to previous knowledge and to everyday experience; be involved in the construction of meaning; organise and structure what they were learning; and focus on the writer's arguments. The surface approach is characterised by the desire to complete the task required. The surface approach student would focus on parts of the material; memorise facts; not bother to make links to existing knowledge and everyday experience; and concentrate on assessment tasks.

To sum up, we have briefly looked at a number of factors (isolation, motivation, orientation to study, approaches to studying) which we need to consider when we are thinking about the distance education student. Each of these has a bearing on the learning experience of the student.

Study Guides

We shall now look more closely at the students' interactions with their course. The nature of distance education means that the student and tutor are distanced from each other, not only in terms of physical distance but also in terms of time. Thus, there must be a medium through which teaching, and learning, take place. Currently, here at the Open University (UK), this is predominantly carried out through the medium of print.

The majority of contact the student has with the distance education institution is with the course materials, therefore the manner in which these materials are written is vital, not only in terms of content, but in terms of presentation. The study guide, therefore, can be an important bridging mechanism between student and institution and the materials provided. The study guide provides the student with supporting information, such as pacing and feedback, that is not directly available to the distance education student in the manner it is available to the traditional student. Without this, a distance education student is at a disadvantage, thus, study guides have become an important part of the distance education package.

But what *is* a study guide? Surprisingly, there appears to be little discussion concerning what a study guide is, or is not. However, Kember (1991) offers a useful description. He describes a study guide as a self-instructional package containing some of the course content, but not all of it. The purpose of the study guide being implied by its name: to guide the student while studying the course content. Kember views the study guide as being like a tutor sitting next to the student as they study and suggests the study guide should do what a tutor would do under these circumstances. Rowntree (1990) proposes that the minimum support a student should get from a study guide is: guidance on how to approach the materials; a way of assessing what they have learnt; and advice on where to get additional help if needed. All these are important considerations since the study guide is taking the place of the tutor and, to some extent, other students as well.

Study guides vary in their element of self-instruction: some merely provide basic guiding information, while others take on the bulk of the self-instructional material. A study guide reflects an idealised path through the course and materials. However, no study guide will entirely satisfy the differing needs of students, so students will vary in their application of the study guide.

Students *do* find study guides helpful (McKillop, 1997). When a number of traditional students

were asked if they had ever used a study guide and did they find it helpful, all those who had used a study guide had found it helpful. When distance education students were asked the same question, 91% (of those who had used a study guide) had found the study guide helpful and the rest were unsure. A variety of reasons were given for the study guide being helpful — the clarity and manner in which the information was presented; the main points were highlighted; it linked parts of the course; a plan for each week was provided so you knew what you had to achieve; it gave specific points to focus on; step by step examples were given followed by questions, and so on.

Morgan (1993) points out that as distance education is a relatively new discipline it does not have institutions who have long histories and tradition, therefore there is still much debate about the methods of delivery, assessment, purpose of courses, and so on. However, in terms of the materials offered to the student, Lockwood (1992) discusses three concepts influencing the design of self-instructional material, such as the study guide: the tutorial-in-print, the reflective action guide and dialogue. These concepts will now be discussed in turn.

Tutorial-in-print

The Open University (UK) has been influential in the development of the first of these concepts, that of tutorial-in-print (Rowntree, 1982). The idea behind a tutorial-in-print was to imagine that the learner was actually there and to describe the ideal form of teaching that would take place - a similar description to that of Kember's above. The session would not simply be a monologic lecture, but the student would be expected to participate in discussion and in an array of activities for which the tutor would provide support and feedback. The tutorial-in-print simulates the dialogue between the student and the tutor and activities such as exercises and questions are seen as an important part of this process. However, there are some potential hazards with this approach. The use of in-text questions (ITQs), or self-assessment questions (SAQs) has been employed to promote the student to take a deep approach to their studying. Marton and Säljö (1997) have shown that it is possible that these questions can interrupt the students' interaction and engagement with the text, resulting in a surface approach being induced. The student adopting this approach would be merely looking through the text in order to answer the question and compare it with the 'model answer' explanation of the writer, and not become involved in the meaning of the text as a whole. The quality of questions and their benefit to the student can, of course, vary and Lockwood (1992) has shown how students use a cost-benefit analysis approach to undertaking activities. He

has also demonstrated how simple techniques such as providing a space or a grid within the activity for the student to record their reply can lead to an increase in the number of students participating in that activity.

The tutorial-in-print approach owes much to ‘programmed learning’ and Rowntree (1992) suggests that it is best suited to areas where there is a quantity of knowledge to be mastered. In this approach, learning is assumed to largely take place while interacting with the materials so quite detailed feedback can be provided since the writer of the material can easily predict what the student will be doing.

Although interaction and dialogue can occur with the text, this approach exerts control over the student since they have to be kept within known parameters to enable such specific feedback to be given.

Reflective action guide

The reflective action guide (Rowntree, 1992) takes the idea of tutorial-in-print one step further. It assumes that a large amount of learning will take place away from the materials and so the writer cannot easily make predictions as to what the student knows. So the learner must provide feedback for themselves. There is no ‘model answer’. The student is given more independence and the text is more of a guide to activities that enables the student to reflect upon those activities. This approach is often used in project-based work which requires the student to engage in activities outside of the text. For example, some courses have a project-based component requiring the student to collect survey data, search archives, conduct interviews, and so on. In these cases, the outcome of the work cannot be know. However, guidance for the activity can be given together with questions for the student to reflective upon during the activity and following it

This approach differs from that of the tutorial-in-print whose aim is to help the student master a particular body of knowledge, in that it is concerned more with involving the student in reflecting and gaining personal insights while undertaking a practical activity. Here there are no known parameters within which to work and the student is required to set them for themselves.

As much of the activity is away from the text there is a limit to what can be done within the text to

support dialogue. However, the activity itself may involve the student in discussion with others and in the reading of text outside the core texts provided.

Dialogue

It is the concepts underlying dialogue, which I wish to concentrate on, therefore this section will be more detailed than the previous ones. Lockwood (1992) suggests that dialogue has considerable potential, but has been relatively unexploited. Evans and Nation (1989) suggest that dialogue should be made a major feature of self-instructional material. For them, dialogue is not merely concerned with giving someone information, it is about being involved in a communication where an individual is actively engaged in the construction and exchange of meaning.

Holmberg (1989) also does not view learning as simply being the dissemination of information. He does not view students as being passive recipients. For him, learning must engage the student in intellectual activity that requires them to try out new ideas, reflect and apply critical judgment. He proposes that the learning materials presented to the student should simulate personal communication and suggests that this personal style is particularly effective. To this extent Holmberg (1989) has proposed the concept of 'guided didactic conversation'.

Guided didactic conversation is based on the following postulates:

- That a feeling of a personal relationship between the tutor and student can promote motivation and satisfaction with learning.

- These feelings can be fostered through well developed self-instructional material and two way communication at a distance.

- These feelings are conducive to the attainment of study goals and use of good study habits.

- The general air and conventions of friendly conversation lend to the feelings of personal relationship.

- Messages given and received in a conversational form are easily understood and remembered.

- The conversational form can be applied through any distance education medium.

- Planning and guiding work are necessary for organised study which is characterised by explicit or implicit goals.

The conversation which is simulated through the text encourages the individual to engage in text elaboration, which Holmberg views as having an intrinsic conversational aspect. A student may think aloud or have an internal conversation while reading the text. He suggests that this is a useful learning strategy which can be turned into a teaching strategy by applying particular characteristics to the text. He suggests these as being:

- An accessible presentation of material in a clear and easily readable style using somewhat colloquial language.

- Explicit advice on what to do, what to avoid, what to pay attention to.

- An invitation to exchange views, to question, to make judgments.

- Able to involve the student emotionally so they take a personal interest in the subject.

- The use of a personal style including the use of I, my, you, your, etc.

- Explicitly stating changes of themes through typographical means, or explicit statements. In the case of spoken communication, through the use of pauses or change of speakers.

Many of the above points can be seen in materials taking the tutorial-in-print approach. However, Holmberg emphasises the underlying conversational theory behind these points while the tutorial-in-print takes a more directed approach.

Holmberg proposes that the operationalisation of his concept of guided didactic conversation using the above principles will lead to courses which are attractive to students, will support study motivation, and will facilitate learning. He expects that students taking a distance education course which has the character of a conversation will be more motivated and more successful than if the

course were presented by means of an impersonal textbook character. Holmberg (1989) has tested his theory and found that the students felt personally involved by the conversational materials, they liked the style of materials and did slightly better in assignment than students taking the original course.

Holmberg formalises his concept by stating that:

- The stronger the characteristics of guided didactic conversation, the stronger the students' feeling of personal relationship will be to the supporting organisation.

- The stronger the student feels that the supporting organisation is attempting to make the study materials personally relevant to them, the greater the students' involvement.

- The stronger the students' feeling of personal relationship with the supporting organisation and of being personally involved with the study materials, the stronger the motivation, and the more effective the learning will be.

- The more independent and academically experienced the student is, the less relevant the characteristics of guided didactic conversation will be.

Holmberg feels strongly that this conversational aspect to learning is important to the learning process. It can promote a personal bond between tutor and student enabling the student to engage with the materials in a reflective and critical manner. His theory is largely aimed at distance education students interacting with their learning materials, however, he does point to evidence which suggests that a more personal, friendly style by a tutor during face-to-face contact can also lead to more favourable responses. Rogers (1969) also discusses the importance of the interpersonal relationship in both the field of counselling as well as education. In terms of education, he demonstrates that the attitudes of the teacher can have a strong influence on the student, including learning outcomes.

The idea that conversation is important in the learning process has also been considered by others and we shall now look at some of these approaches. Pask (1976b) also viewed the conversation between teacher and student as being of fundamental importance to the investigation of the learning process.

His theory views learning as taking place through a conversation between two representations of knowledge — that of the teacher's and the student's. The concept to be learnt is represented as an "entailment structure" which can be viewed as a "map of knowledge". Pask (1976b) considers it crucial that the student can see this as well as the teacher. Understanding develops through a series of agreements between teacher and student throughout a conversation about particular concepts. The teacher uses information from their interactions with the entailment structure to decide how the learning conversation will proceed. To demonstrate learning, the student must not only be able to verbally explain a concept, but must be able to demonstrate it in a non-verbal manner such as through use of specially designed apparatus. Whalley (1995) shows us a diagrammatical representation of Pask's theory (Figure 1).

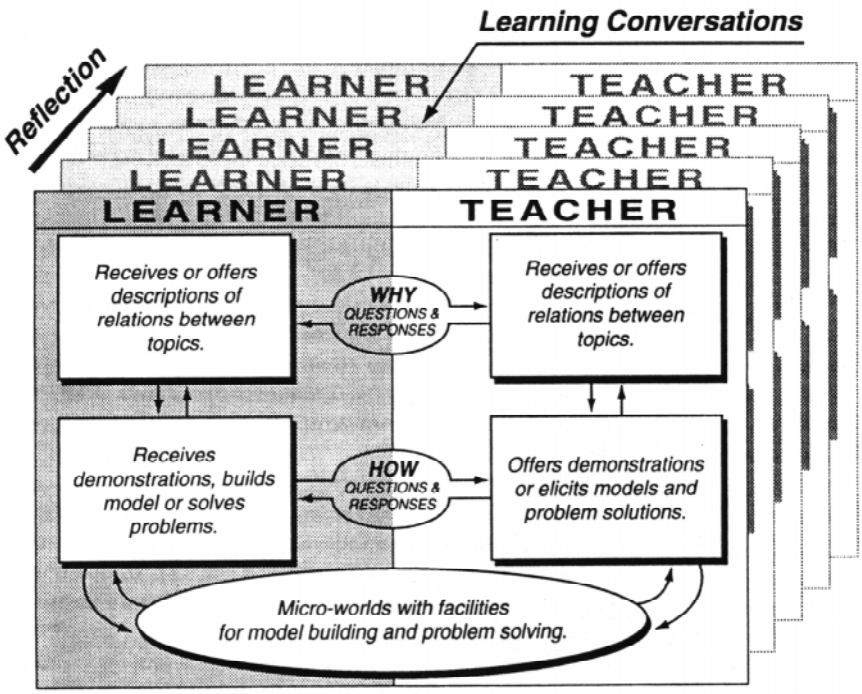


Figure 1
Pask's Conversational Theory

Interestingly, despite a conversation taking place, Pask points out that this conversation need not be in natural language, but could be in a programming language or portrayed graphically. Although most of the conversations we will be considering in this discussion will be those conducted in

natural language, it is interesting to consider that a conversation might be conducted in a manner other than natural language.

Although Pask's theory concerned education in general, he did consider the relevance of this theory for students studying at a distance. He commented that,

> "...students who have "learned to learn" may reach, in isolation, the standard reached by other people in a tutorial conversation." (Pask, 1975, p402)

Pask (1975) not only views the conversation between tutor and student as being relevant to his theory, but also includes the internal conversation a student has with themselves. He views this internal conversation as being between the 'learner' and 'teacher' in the student's brain. Pask considers the student themselves as being the most important teacher the student may encounter.

Another aspect to Pask's conversational theory is his suggestion that roles are important, particularly in the educational setting (Pask, 1976a). He suggests that theories, in particular those with rival hypotheses can be understood more easily if those putting forward the theory are represented as characters in the conversation. For example, historical background and personal information could be given. That way the student can understand the theories as they form the context for the characters debating the pros and cons of the theories. Later in this discussion we will return to issues dealing with roles and characterisation.

Although both Pask and Holmberg view conversation as being important in learning, they are approaching their theories from very different stances. Holmberg is primarily concerned with enhancing the experience of the distance education student through the personal qualities of conversation, while Pask sees conversation as a way of viewing the learning process. Pask's conversations are teacher-centred, while Holmberg's are more student-centred.

An attempt has been made recently to apply and update the work of Pask as a framework for educational technology (Laurillard, 1993). Laurillard considers that the learning process consists of four essential component process: discursive, which allows discussion between student and teacher on a topic; adaptive, where the teacher adapts the student's interaction with the world to enable them to experience it from the teacher's view; interactive, allowing the student to interact with the world and gain feedback on their actions; reflective, where the student reflects on their experience.

Laurillard (1995) shows the interaction of these components diagrammatically (Figure 2).

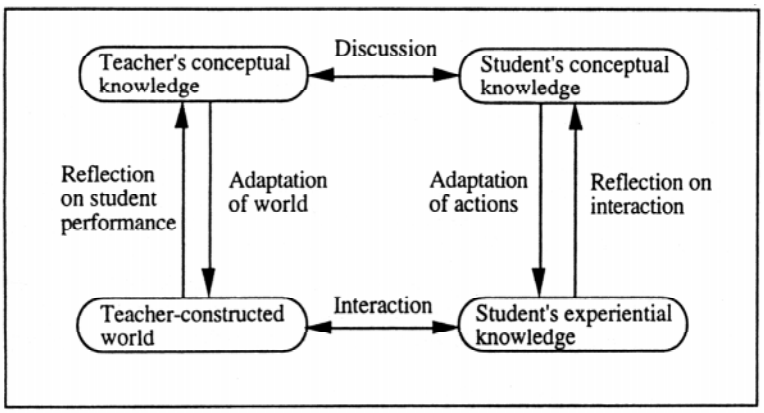


Figure 2
Components of the Conversational Framework

With this model, learning takes place in a similar manner to that proposed by Pask's model. The teacher and student discuss a concept and the teacher reflects on what the student is doing and adapts the conversation. The student adapts their actions according to what the teacher says and reflects on the results until their understanding of the concept matches that of the teacher. As in Pask's model, the conversation can be an internalised one. The emphasis of this model is a teacher-centred one. It is the teacher who controls the conversation and through this, controls the ideas adopted by the student. Langer (1989) explores the notion of control and argues that individuals who are allowed to make choices and thus perceive they are in control are more likely to have positive affective outcomes such as increased motivation.

Laurillard uses her framework as a criterion to see how different media support each component in the conversational framework. She considers that the essence of the academic teaching process is a conversation, but that most educational media do not support this.

A difficulty with these conversational theories arises when we attempt to apply them to the distance education setting. They confine learning to situations where there is a teacher and a student (or where this process is simulated through a medium) and these theories do not take account of the wider learning community that a student may find themselves in. The student may learn while in the presence of a person who is not a 'teacher', whose aim is not to teach, someone who is merely

participating in what comes naturally when two people are together — dialogue. Distance education students often engage in learning experiences with persons outside of the usual learning community. Juler (1996) introduces the idea of an interaction network to describe the wide range of interactions a distance education student may have. Such interactions could include the learning materials, the student's friends and family, study group, library, counsellor, work colleagues, and so on.

The theories of Pask and Laurillard do not appear to consider the more affective aspects of learning. They strip down the learning process into its more functional components - perhaps in an attempt to represent an ideal mode of learning. A well motivated, confident and happy student may be more likely to engage in this type of learning, however, another student may not be so confident, happy or well motivated, so the process of engagement in learning may require more than the functional essential components. Holmberg, on the other hand, considers that these feelings are important in the learning process, particularly for the distance education student. However, his theory lacks the details of the functional components that Pask and Laurillard focus on. The point to be raised here concerns the role of the teacher, which is being viewed differently in these theories. A more traditional view of a teacher is that of an instructor who has a goal in mind when teaching the student. A more progressive view of a teacher is one that encompasses several roles which may include that of an advisor, a facilitator, a counsellor, and perhaps other roles along these lines. Taylor (1995) suggests that the role of teaching may be changing as the emphasis on the value of independent learning increases.

One aspect of learning that these theories all agree on is the importance of reflection to the learning process. Holmberg considers that the conversational aspect of text encourages the student to engage in text elaboration, a form of internal conversation, thus allowing reflection to take place. Marton and Säljö (1997) state that a significant part of the deep approach concerns the learner engaging in a more active dialogue with the text and frequently asking themselves questions. Chi et al. (1989) have found that the more students explain things to themselves the more they learn from this process. They found that 'good' students were more able to detect when they did not understand something than 'poor' students. This ability to detect a comprehension failure is important as it led the 'good' students to asking specific questions about what they did not understand. In turn, the asking of these questions led them to engage in self-explanation. However, the 'poor' students lacked this ability to monitor their understanding.

Dialogue in Practice

Now that we have looked at some theories of conversation in learning and have some grounding for why dialogue is important, let us consider some examples of how a student has a dialogue with their course material when they are largely presented through the medium of text.

Juler (1990), like Holmberg, agrees that students interact with text as if they are having a dialogue with it and he also considers that the interaction they have with their text is just as important as interactions they have with other people. Students will often write notes next to the text, perhaps making queries to the author or even talking to the text as they read it (Ismail, 1988). Certainly, students will be having internal conversations about the text and Juler (1994) views this as every bit as important as the interaction they have directly with the text. He sees this process of dialogue as being important because it characterises a deep approach to learning — the importance of which we have already discussed.

So, how can dialogue within text be supported? We have seen above how the concept of tutorial-in-print can be used by employing activities and questions within the text, and we have looked at a number of characteristics offered by Holmberg. We will now explore some other ideas which have been proposed and, as we shall see, there are many differing and interesting ways of accomplishing this.

Rowntree (1990, p157) showed how a transcript of a conversation between two people could be used to include the reader in the conversation and allow them to consider their own point of view. At key points in the conversation, the reader is invited to reply to a point in the conversation and write their comments down before viewing how the conversation proceeded (Figure 3).

> they can 'get by' without developing their methods. What I'm suggesting, really, is that the education technology approach involves not just using scientific *knowledge* . . .
>
> T: Which may be pretty thin on the ground?
>
> E: All right. . but also using scientific *method.* By that I mean a hypothesis-testing method.
>
> T: How would you explain that?
>
> E: Well, educational technology would want the teacher - the 'professional' teacher, as you call him - to think of himself as a tester of hypotheses about teaching and learning. That is, he'd start with hypotheses, insights, about what purposes might be worthwhile, or about possible ways of achieving the purposes. . .
>
> T: From science?

How would you answer T's question about the source of the teacher's hypothesis?

.....
.....
.....

Now read on to see how E answered it.

Figure 3

Transcript of a conversation

Using transcripts of conversations has even been used by Modra (Modra, 1991) as a means of discussing dialogue in distance education.

This approach has also been employed by Nunan (1991, cited in Lockwood, 1992) who represented a dialogue between a student, teacher, and the writer by means of differing typographical cues. An extract is shown below in Figure 4.

Of course there is always the concern for directing the research activity in distance education to the real needs of the participants - those engaged in teaching at a distance, distance learners, and those who provide services and administer systems which deliver distance education. There is also the further question of whether any special characteristics of the enterprise of distance education shapes, limits, or promotes particular styles of research activity. I believe that my students should be familiar with the developing traditions of research activity within distance education and understand why research is directed towards certain problems...

I think I can leave the debate for now; I have the organising ideas of the area and enough background to be aware of possible criticism, pitfalls, problems that can arise. What I need now is key resources in each of the three paradigms, as well as some signposts so that I can find my way down particular pathways in the paradigms.

Before we move to the next section, which covers the three paradigms, you may wish to read through the discussions. The discussion on 'Paradigms, ideologies and educational research' is to set the scene for introducing the paradigms; 'Linking theoretical constructs and observations' deals with the way that each paradigm considers the linking of constructs with observation; and 'The nature of research in distance education' considers the types of research activity undertaken in the field...

Figure 4

Dialogue between student, teacher and writer

Here we can see how the differing text styles highlight, and make clear, the differing voices of the text.

A similar approach has been taken by Mulkay (1985), an extract of which is shown in Figure 5.

> I wish you were here with my now in my study, dear Reader, as I search for the words with which to introduce you to this volume. It would be much easier if we could *talk*, because in talking, I could answer any questions you wished to ask and provide an introduction designed specifically for you. One trouble with the printed word is that it commits you irrevocably to a particular sequence of words... Of course, the written monologue does have some advantages... I will be able to make it quite clear that *this* is what the book is about. Yes, the written monologue confers a certain interpretive authority on its author. The more I think about it —
>
> *If you need me, why don't you invite me into the text?*
>
> Who said that?
>
> *I did. If you want a dialogue instead of a monologue, why don't you invent a potential reader to talk to?*
>
> I can't do that. This is serious academic study, not a fairy story.

Figure 5

Dialogue between reader and author

Here we can see how Mulkay's traditionally written text (or monologue as he calls it) changes into a conversation as the 'reader' suggests they are invited into participating in the text by means of a dialogue. Again, we can see how Mulkay has used differing text styles to make each voice distinct. Evans and Nation (1989) feel that this is a positive approach in distance education and feel that if the reader is welcomed into the discourse as a participant then learning will be enhanced. Mulkay even plays with the roles portrayed in the book, he lets the 'book' introduce itself and then the reader and the author discuss the book.

Portraying a conversation in text is quite common in many differing domains, but has certainly been considerably used in education (see for example Open University, 1995, p4-8). The conversational style makes it easy to read and the participants in the conversation can take differing points of view to highlight issues for the student. However, it must be done with care, as ordinary conversation

does not 'translate' easily to text. Transcriptions of spoken dialogue can be difficult to comprehend. Typically, speech is full of corrections and paralinguistic features such as pauses, gestures and gazes. In fact, pauses account for between 40-50 percent of the total speaking time (Taylor, 1990). What we have in these examples is a very different kind of discourse to what we are used to — somewhere between speech and written text, but using the medium of text.

Nation (1991) takes a slightly differing approach to this issue. He interposed his writings with his own personal thoughts which he separated from the main text through the use of brackets. An example extract of this style is shown below in Figure 6.

> Now that you have an understanding of the factors which have influenced my choice of teaching methods, we can get down to a more detailed consideration of the matter. [Did I hear a voice say: 'How were we supposed to know this?' I'll choose to ignore it.]
>
> Teaching's a funny business. Fundamentally, it's quite simple. As I have said earlier, it's simply a matter of using appropriate methods to enable students to understand the designated content. There are so many ways of teaching. Yet, in our culture it is the didactic lecturer who is regarded as the standard model. [That's why the album 'The Wall' sold so well, but the film only has cult status.]
>
> In an introductory sociology course (Sociology 1) I taught recently, I used to begin with a discussion of two competing paradigms [that should send them to the dictionary] of teaching and learning. [Some of them will be aware of these. Some may even be converts!] I don't propose to rehearse that discussion here...

Figure 6

'Multi-voice technique'

Although no evaluation has been conducted on this textual style, Evans and Nation (1989) point out that students reacted favourably to the texts and they conclude that these texts were successful. However, these texts were used in a sociology of education course and it could be said that such a course, and the students taking it, would be more open to such a style. It remains to be seen whether such a style would transfer easily to other settings such as a computer course. This style may have its uses, but could distract the reader from the main part of the text as it is often not clear what the author is meaning in their 'aside' comments and the frequency and brevity of the comments can disrupt the flow of reading.

Nation (1991) calls this style a 'multi-voice technique', however, the voice is still that of only one

author and thus presents that author's point of view. Perhaps it would be more appropriate to regard it as a 'split-voice technique'. If we were to act out such texts we would still have one voice (one character) speaking, so it is really still a monologue. (Later in the discussion, in another section, we will look at issues to do with multiple voices and how these are associated with actors.) So, what we have here is the author in dialogue with themselves, and not the reader. However, it demonstrates an interesting way of putting forward an author's thoughts in a personalised manner — often in writing, particularly the academic style, the personal thoughts of the author's own inner voice are not permitted.

Mulkay (1985) also offers us insight into the author's thoughts and process of composing the text, however, he chooses to do this by introducing the voice of a 'textual commentator'. By doing this he avoids the possible confusion a split-voice might produce and allows the text to flow more easily. The introduction of a distinct voice enables the dialogue to be directed at the reader and not the author as is the case with the Nation example above.

We have used a number of terms to describe dialogue — conversation, discourse, interaction, discussion and dialogue itself. However, Juler (1990) prefers to use the term discourse as he sees this as encompassing all forms: whether monologue or group discussion; whether through the medium of text, sound, picture; a remembered conversation, and so on. He points out that this term covers not only the actual message, but the circumstances in which it was produced. A dialogue is often seen as being an isolated act involving some two-way communication. However, if we look more closely at the act, we may find that the discourse has a wider context and may include other interactions outside of those immediate apparent. For example, a dialogue between two students may be about their own personal interactions with their study materials following a discussion at a tutorial. In fact, Juler calls for the interactions students have to be widened outside of the normal learning community to enable less predictable and less structured dialogues to take place.

Juler (1990) also points out that the roles adopted during discourse are important. Analysis of educational discourse often shows the tutor in a more dominant role having a greater number of illocutionary and interactive acts than the student. This enables the tutor to control the flow of discourse and the interactions of the student. On the other hand, there are types of interactive events, such as brainstorming, where (in theory) all participants have an equal role and equal opportunity to put forward their ideas (Juler, 1990).

Enabling a student to interact with course materials in an engaging conversational manner has been viewed positively in the above discussion. However, as Juler has said, the roles adopted during discourse can lead to dominance and the curtailment of interaction. He also points out that even getting students together for a face-to-face activity does not necessary lead to 'fruitful outcomes'. The literature is lacking in a discussion concerning what constitutes productive, or even unproductive, dialogue — there is an implicit feeling that all (any) dialogue is a good thing. Perhaps when we are looking at ways of enabling student dialogue, we should also look at the nature and purpose of that dialogue. For example, Holmberg is interested in the effectiveness of simulating personal communication in learning materials and the effect this has on the learning experience of the student. In this case, what is important is a fundamental aspect of dialogue — its ability to engage the individual and produce affective outcomes. Evans and Nation call for the reader to be welcomed into the text and we have seen examples of how this is being attempted. However, the example they offer using their version of the multi-voice technique can be used as an example of how the reader is not welcomed into the discussion, but is allowed access to the author's internal conversation. We need to be aware of what we are hoping to achieve through the use of dialogue and ensure that this is indeed what happens.

On-line Study Guides

There is an increasing move to make more use of computer technology in teaching and learning and this is leading to more and more courses incorporating an on-line aspect to them. This in turn is leading to an increase in on-line study guides. So, with the medium of text shifting from paper to screen what approaches are being taken and to what extent are these approaches engaging the student in dialogue with the materials?

Sadly, it seems the case that many on-line study guides are simply on-screen version of paper-based ones and do little to exploit the affordances of new technology. This can be demonstrated by looking at a whole host of study guides on the Internet. There are a number of on-line study guides which do utilise the potential of new technology, however these mainly use hypertext links or multiple choice questions with the computer providing immediate feedback. There appears to be little attempt to offer the student more engaging forms of interaction. There are, of course, some advantages to be gained simply from putting material on-line as the materials can be quickly and

fairly easily modified — changing print-based materials can be costly and time consuming.

There are problems in blindly transferring a paper-based study guide to on-line if there are large amounts of text. There are differences in reading text on paper when compared to reading text on-line. O'Hara and Sellen (1997) point out that there are some inconsistencies within the literature on this point but they have conducted research which gives us some insight into possible differences would should inform the future design of on-line text. They found that paper supported annotation better than on-line conditions and that annotation was important for developing a deeper understanding of the text. Moving between texts is easier with paper as the paper can be physically laid out it a manner suiting the student — this supports integration between documents and allows the student to see the structure of the document. On-line documents are constrained by screen space and navigation by scrolling and clicking on differing windows to find information is not as effective. Paper gives implicit cues, such as the document's length which is not as apparent from an on-line document. They also found that being able to use two hands with the paper allowed tasks to be conducted in parallel. These issues all raise important design implications for on-line text and for systems being developed to support the above considerations.

Distance education students do like to have paper-based text they can take with them to read over breakfast, on the way to work, during a lunch break, and having to refer to text on-line at these times can be problematic as the student would have to have a computer available, perhaps even the CD-ROM, or access to an Internet connection (McKillop, 1998; Messing, 1998).

Messing (1998) suggests that any 'electronic book' must have many learning features provided by way of compensation for the restrictions the media imposes on the student. He also points out that there are many advantages in delivering materials on-line, and that distance education students are largely committed to technology. However, he found that even when a number of significant features were added to an electronic book, the students preferred the printed one. He suggests that the results he obtained were possibly due to forcing students to change the ways in which they studied. He comments that one student stated that,

> "I used to read in bed at night but the 14 inch monitor got too heavy for my arms!" (Messing, 1998, p964)

So it would appear that making any on-line study guide more compatible and complimentary to the

ways in which students study would be more agreeable. Adding seemingly 'attractive' features is not necessarily the way to go about designing on-line study guides and Messing himself found that some of the features of the on-line study guide he examined were flawed and were not being used in the manner anticipated. The degree of 'attractiveness' varies according to perspective — organisation, academic, or student? Students in this study were also required to connect to the electronic book via the Internet which proved costly, time consuming and disruptive.

There does appear to exist an attitude concerning computer use that putting materials on-line in a hypertext 'point and click' style appears to add something. This can be demonstrated by the number of books which have been put on-line which do not offer anything a paper-based book cannot — the page is turned by pointing and clicking at a forward or back arrow instead of physically turning the page, and there may be a number of icons to jump to different chapters. However, Rogers and Aldrich (1996) point out that if this approach is to succeed then they must have some 'added learning value' beyond what is offered by their paper-based counterparts. Whalley (1995) also agrees that multimedia systems must offer something more than point and click interactivity. He suggests that they should actively engage the student in the learning environment and considers the idea put forward by Laurel (1991) that multimedia representations can engage people intellectually and emotionally.

One study guide offering a hypertext point and click interface is offered by De Montfort University via the Internet (http://www.iesd.dmu.ac.uk/~slb/wcsgc1.html) (Figure 7). Upon first glance, this appears to be an appealing on-line study guide with many hypertext links and a very structured approach. There is a considerable amount of information given to help the student through the course and plan their study. However, it does have some fundamental problems. There is lots of interaction in terms of objects which can be clicked upon, but little more to actively engage the student with the system or to support the student while using it. A tool bar is provided at the bottom of each page, but some of the icons are confusing and do not have text to aid their comprehension. It is not clear where you are in the study guide as no overview of where you are in the system is provided, nor any overview indicating which parts have already been visited. There are also many hypertext links and it is all too easy to keep clicking on these and get lost or not learn anything at all. Hypertext systems can impose a great load on cognition and can cause navigational disorientation (for further discussion of these issues see Rouet, Levonen, Dillon, & Spiro, 1996). What I wish to highlight here, is how it is possible to include much of the information a student may need in an on-line study guide, but end up depreciating its value because of its other features.

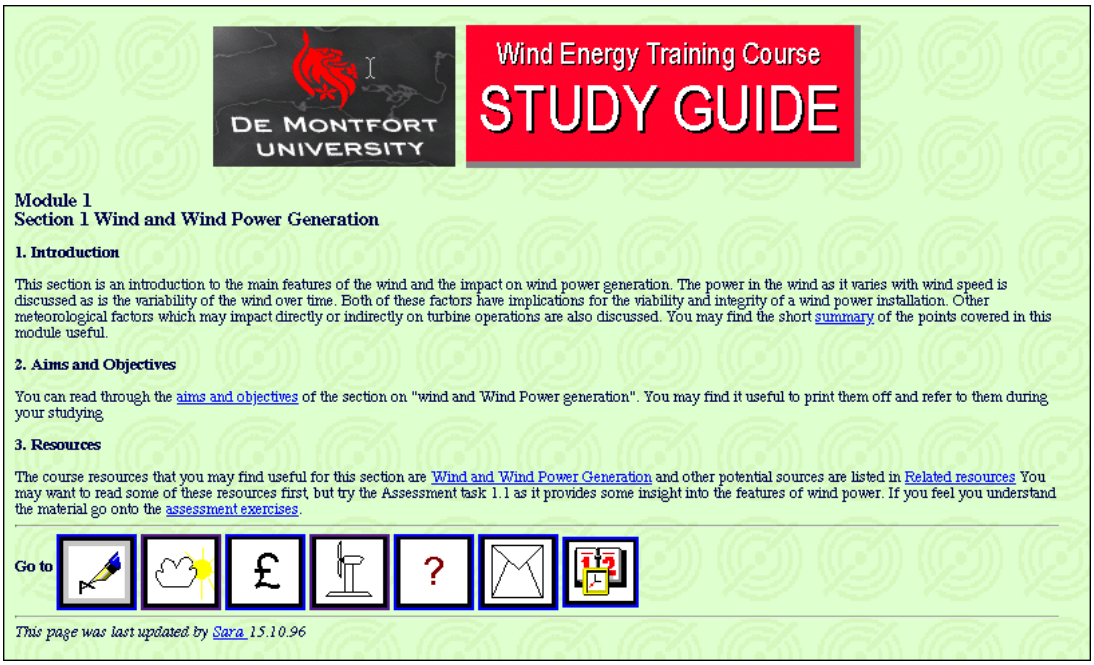


Figure 7

De Montfort University's Wind Energy Training Course Study Guide

At this stage it might appear that attempting to design on-line study guides is more trouble than it is worth. However, the story is not as depressing as would appear. The use of computers as a medium for study guides is quite new and 'teething troubles' are to be expected until a solid research area into their use and effects, even affects, is built up. The rest of this discussion will contribute to a more positive outlook for on-line study guides, including looking at a number of existing on-line study guides.

Hewson and Styles (1994) designed an electronic study guide for their Open Learning students taking an introductory computing course. They developed their system with two main aims in mind — to allow an interactive discovery learning approach and to provide support for less experienced students. They too employed hypertexts links between pages and sections, but they provided a map to aid navigation which showed the sections that had been visited. A number of additional features were also included. Each session contained review exercises covering the main points of each

module. A notebook was available for students to make their own annotations. A reference button provided a listing of references pages in the textbook and a glossary was also provided. This system has only undergone informal evaluation and its use by students is awaited. It will be interesting to see if the additional features provided outweigh the disadvantages of the medium.

Arshad and Kelleher (1993) have applied a novel solution to creating on-line educational materials. Their system, SOLA*, is an advisory system that provides advice to the student on what should be learned, how it should be learned and when it should be learned. They are interested in taking an approach where adaptation to learner style and the provision of advice about learning is paramount. They feel that their approach is important as the range of educational materials available to the student is increasing and students are being expected to take greater control over their learning. They also recognise that many students have difficulties in managing their study time.

To accomplish this, their approach draws heavily from the Intelligent Tutoring Systems (ITS) field: SOLA* incorporates information about the domain, the teaching materials and the student. However, they point out that many ITSs are designed for used in a narrow domain and do not generalise to other domains. The approach taken in SOLA* is intended to be applicable to all domains. Arshad and Kelleher (1993) report that the system has been well received by users and it will certainly be interesting to see how successful this approach is as it is tried out in differing domains.

A more recent approach to the design of on-line study guides has been undertaken by Mole et al. (1997) who have designed an Interactive Course Map (see Figure 8) for a second level distance education course in computing at the Open University (UK). They have considered the learning situation of students which is becoming more common, one where students are working with a variety of on-line tools and resources. This situation, they suggest, presents students with two potential difficulties — learning how to use the variety of tools and developing study habits to make effective use of them. The Course Map was designed to support students on this course manage the complex mix of media. The Course Map is partitioned into three areas: the course content, the course resources, and the tour areas. The course content area reflects the block structure of the course and clicking on each button gives the student an outline of the block and a week by week overview. The resources for each week are also displayed. Hypertext links provide the student with more detailed information on the resources and chapters. The course resources area provides a list of each resource which the student can click on to get an overview of the resource and information

on how the student might study with it. The tour area provides a Course Tour which introduces the students to the structure of the course; introduces them to the course resources; and generally gives information on the map and advice on studying the course. The tour is presented by audio narrative given by a course team member whose picture appears in the course tour area.

Figure 8
Course Map

Formative testing demonstrated that students could use the Course Map (Sumner, Taylor, & McKillop, 1997b), but an important issue for Mole et al. was whether students would actually use it. An initial evaluation of students using the Course Map during the course has shown that students *do* use the Course Map (McKillop, 1998). Students felt that an understanding of the structure and overview of the course was very important and the Course Map gave them this information. Indeed, they expected the Course Map to provide them with this information. All the students had taken the Course Tour and all were positive about this aspect of the Course Map. In particular, students liked the personal style of presentation and this is in accordance with Holmberg's theory. These finding are important and exciting for the field of on-line study guides and further details of the findings from this study will be discussed in a later section.

The above discussion has looked at a number of on-line study guides using a variety of differing approaches and it would appear that the field of designing on-line study guides is a promising one. However, we must bear in mind the issue presented by Messing (1998) that the benefits outweighing the drawbacks is a key aspect of designing on-line study guides. Also, we must consider whether these benefits will be quantitative or qualitative, or both.

These study guides largely ignore issues of how to engage the student in the system and concentrate more on the functional task of presenting students with information in a manner that will help them with their studies. With this discussion in mind, I would now like to suggest one direction that this research might take: the use of an agent-based approach to on-line study guides for distance education students. This approach, I feel, will present novel ways in which we can engage the student in a more dialogic style. Perhaps we can move away from the study guide being just another resource to it being a 'participant' in the student's learning process. To elaborate on this I will first look at agent research in general before looking at issues related to existing pedagogical agents which will inform this discussion.

Agents

So, the first question has to be - what is an agent? I do not intend to get embroiled in this question as it is very much a contentious issue (see Franklin & Graesser, 1996). Reaching an agreeable definition of a concept is nearly always a arduous process. However, I will give a brief overview of the main issues before making clear what I believe is important in this area in terms of making a contribution to research in on-line study guides.

As stated, there is much controversy about what an agent is, or isn't. Popular definitions of an agent have much in common with the description offered by Maes (1994). Maes views agents as personal assistants who collaborate with the user in the same work environment to reduce work and information overload for the user. Tasks that can be delegated included information retrieval, meeting scheduling, mail management, and electronic news filtering. Most agents in these situations will learn the user's preferences and ways of working and will apply this knowledge to the task at hand. Agents like these are commonly represented pictorially, for example, using a

caricature and often this has a degree of animation which may reflect differing states of the agent, i.e. whether it is working, waiting, or offering a suggestion.

Lieberman (1997, p67) offers a simple description of what an agent is. He considers that an agent,

> "...is any program that can be considered by the user to be acting as an assistant or helper, rather than as a tool in the manner of a conventional direct-manipulation interface...should display some (but perhaps not all) of the characteristics that we associate with human intelligence..."

He goes on to add that it is the user's view of how the program is acting that is important and that one program may be viewed as an agent by one person and not by another.

I do not intend to go into any further depth regarding the definition of an agent as I do not believe it will aid this discussion. (For further discussion on what an agent is and a taxonomy of agents see Franklin and Graesser, 1996). What I now intend to do is to look at some issues arising from agent research which will be pertinent to this discussion.

Although brief, the above discussion has highlighted two aspects of an agent — its functionality and its manner of portrayal. Erickson (1997) refers to this as an agent's *adaptive functionality* and the *agent metaphor* and points out that these two aspects often arise together in an agent. However, he feels it is important to realise that metaphor and functionality *can* be decoupled — functionality can exist without the program being portrayed as a character. Much work in the agent field is being undertaken to either develop functionality or to attempt to make agents more lifelike characters. However, the manner in which people react and interact with agents has attracted little research despite being a very important area and it is this area which we will turn to now.

People and agents

The manner in which people interact with agents, and computers, provides us with some important considerations when designing systems such as on-line study guides. We will look at how agents can engage the user and how they can evoke psychological and social responses. These responses are of particular importance in a learning context as they can lead to positive learning experiences

and outcomes. Voice and face will be concentrated on as they appear to be particularly effective in producing powerful responses.

Nass et al. (1994) have shown that individual's interactions with computers are fundamentally social. They have found that people apply a variety of social rules to computers. These include applying politeness norms; applying the notion of 'self' and 'other'; applying gender stereotypes; and that users feel they are interacting with the computer and do not see the computer as a medium for interaction with the programmer. They have also looked at how people apply anthropomorphic characteristics to objects — the more human-like, or living-entity like, the object is, the more willing we appear to attribute human characteristics to it. In fact, Reeves and Nass (1996) suggest that simple line drawings, as long as they have eyes, or allude to being alive, are sufficient to induce psychologically rich responses.

Two key elements arise from their research. Firstly, that people interact with computers as if they are social actors. Secondly, that richly represented agents endowed with faces, personalities, and so on, need not be used to generate a range of social responses. Using more simple cues, such as voice, can be powerful in evoking these social responses.

The first element suggests that we can design on-line study guides which students will be able to interact with in a manner that is within their understanding of the processes of personal interaction. In fact, Brennan (1990) claims that people's expectations of human-computer interaction are often based on what they expect from human-human interaction. Erickson (1997) points out that many agent systems do not act in a manner that is consistent with a user's normal understanding how a computer system behaves, and that such a mismatch can lead to difficulties for the user and even to the user becoming disheartened with the system and giving up using it altogether.

The second element suggests that we can design an interface that will not provoke an over-anthropomorphic response, leading to the student having false expectations of the system. The more we endow a system with human-like characteristics, the more the user will expect the system to behave with human-like intelligence (Norman, 1994) and we are a long way from producing systems with accurate representations of human intelligence. However, what we can do is provide sufficient cues to engage the student with the system.

Let us concentrate on one aspect of the findings of Nass et al. (1994) which may be especially

pertinent to this discussion: their findings regarding voice. Nass et al. (1994) found that voice alone was enough to produce a social response and this finding is important to us as dialogue is fundamentally socially based. Their subjects stated that they viewed a computer with a different voice as a distinct social actor and that the same voice on another computer was considered to belong to the same social actor. In their book, Reeves and Nass (1996) expand upon their findings regarding voice. They point out that their book is co-authored, but the medium of text does not make this clear, however, they suggest that if their book was presented orally, then this would become more apparent. They tell of their students who place bets on who has written which part of their co-authored papers! Amusing this may be, but it demonstrates the difficulty of text — multi-authored text becomes a monologue unless techniques, such as those discussed in the previous sections, are employed. Reeves and Nass suggest that there may be an important difference between reading and hearing their research and that this concerns the intensity of multiple voices.

There are problems with multiple voices. Although humans are adept at discriminating voice from a barrage of extraneous noise, we can also find multiple voices distracting. If we have a number of voices, there are a number of things we have to remember associated with each voice. Each distinct voice has a relationship with an individual, but there are also relationships between multiple voices (Reeves & Nass, 1996). In an interface, this is something that must be considered. The voices will be associated with the system, so need to have clear roles and functions with the user and between themselves. Reeves and Nass suggest that multiple voices could be used for integration or even differentiating aspects of a system.

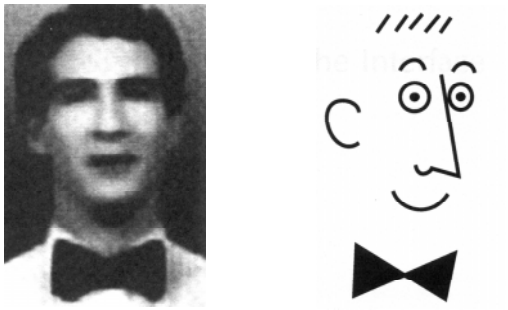
We also have to acknowledge that voice will evoke reactions based on stereotypes associated with a number of different factors making up the voice — gender, age, class, accent, and so on — and that people will expect that voice to live up to these.

Voice can be generated in two main ways: using a database or dynamically generated natural language. A database of audio clips can be used either on their own or with supporting graphics, video or text (see for example the guides metaphor (Oren, Salomon, Kreitman, & Don, 1990) discussed at the end of this section). Natural language techniques can be used to produce real-time dynamically generated conversations. This can be achieved by applying speech recognition and understanding with speech synthesis algorithms to simulate human to human spoken conversation (see for example Phil in the Knowledge Navigator (Apple, 1987) discussed briefly below).

Dynamically generated natural language can also be used at the text level (see for example the Sounding Board (Schank & Cleary, 1995) discussed later in the Other Approaches section). There is, however, a 'halfway' point between these two approaches whereby a database of short clips can be strung together dynamically in real-time to produce an effect more like that of the natural language techniques (see for example Herman the Bug (Lester et al., 1997) discussed later in the Pedagogical Agents section). In order to successfully accomplish this, the database may need to be quite large.

The main difference between these approaches is a tradeoff in terms of flexibility for the user and the designer. The database approach provides less flexibility for the user as all the clips are incorporated into the system during its design. The dynamically generated approaches provide more flexibility for the user since the voice, or text, is produced dynamically in response to the user and is not constrained by what is in the database. However, the approach used in Herman the Bug strikes a balance between these positions.

Another powerful feature that humans are especially attuned, is face. In fact, we appear to be born with an ability to discriminate faces at a very early age (see for example Bruce and Green, 1990, p360-361). There does seems to be a compulsion amongst agent-builders to portray their system with an 'appropriate' facial human representation, for example, Phil in the Knowledge Navigator (Apple, 1987). As we have previously discussed, this may not be necessary for the system's functionality, but the response produced by such a portrayal is important. In fact, the case of Phil is quite interesting. Phil was originally realistically portrayed using high resolution video with natural language understanding — he appeared quite human (see Figure 9a). However, Phil's behaviour and speech was simple and he performed quite basic tasks leading many people to view him as being stupid. A later version of Phil portrayed him as a line drawn cartoon character with limited animation (see Figure 9b). People preferred this Phil as the simplified character reflected better what he could do (Laurel, 1991).



a *b*

Figure 9
Phil

Walker et al. (1994) have conducted research into how people responded to a synthesised talking face shown on a computer while subjects participated in a questionnaire survey. They found that, compared to the subjects who answered the questions presented wholly by text on the screen, subjects who were presented the same questions by the talking face spent more time, made fewer mistakes and wrote more comments.

They also found that when the face was a stern face, rather than a neutral face, subjects spent more time, made fewer mistakes and wrote more comments. However, they did not like the experience or the face as much as subjects in the neutral face condition.

They felt that there could be difficulties associated with portraying a face on screen: that it could become the focus of attention and distract from the task at hand, but this was not borne out by their study. They also found, in keeping with Nass and Reeves (1994), that the talking face could elicit social responses. They concluded by saying,

> ".....we anticipate differences in the appropriateness of face-based interfaces depending on the social interaction demands of the situation, on the expression and gender of the faces used, and on individual temperament characteristics of the users." (Walker et al., 1994, p90)

So, it would appear from their research that portrayals of talking faces can be more engaging than text. They point to research by social psychologists that demonstrates that the presence of another person can increase the motivation of another to participate in a task. They postulate that the presence of the face served to provide 'evaluation reminders' which led to the individual trying

harder and that the sterner, more expressive face, provided more evaluation reminders, leading the subjects in this condition to pay closest attention to the task. Whitelock et al. (1995) have also found the presence of others had a motivational effect. They found that students working in the presence of others performed better than those working totally alone and have concluded that peer presence alone has a motivational effect. These findings could be especially useful in distance education where there is often a lack of face-to-face contact and often little peer contact on a day to day level.

Faces can also be generated in two differing ways: using a database or real-time dynamic generation. The database approach is as described for voice. The real-time dynamic generation of faces uses animation techniques to produce synthesised faces which are usually synchronised with voice (for example (Walker et al., 1994)). However, the generation of real-time talking synthesised faces is at the edge of current technology and Walker et al. pre-computed their talking face and stored it for optimal use during their study.

One system, where we can see a number of aspects from the above discussion emerging, is the guides metaphor of Oren et al. (1990). They used depictions of characters as guides to aid the navigation of an interface of an on-line encyclopedia on American history (Figure 10). Users found the guides engaging and attributed emotions to them and also to their interactions with the guides. They found that users could get angry with a guide or could think that the guide was angry with them. In one case, a software bug caused the guide to disappear and the user attributed this to the fact that the guide was angry with them for not following their chosen link. The relationship the user had with the guide was very personal and many were keen to view the guides as characters even though this aspect was never explicitly developed. Oren et al. doubt that the same would have happened if their settler guide had been represented as a covered wagon and they see this as showing how powerful the human figure is at suggesting personality.

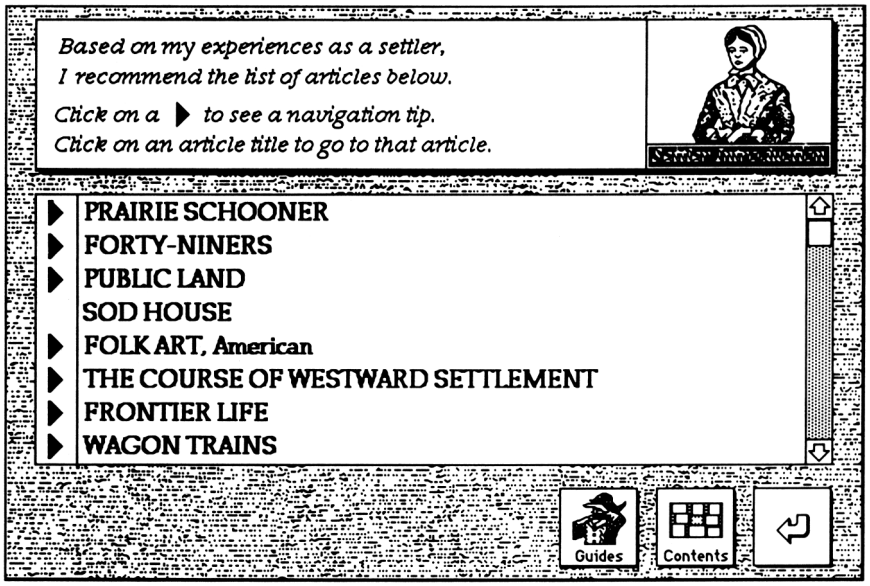


Figure 10
Guides

They also wanted to encourage users to make connections between the material presented. To this extent, they exploited the user's desire to have a point of view for each guide and offered material on a given topic from each guide's point of view of it. They felt that being able to present differing points of view would avoid the problem of having a dominant, and thus 'correct', point of view, and would encourage users to draw their own conclusions. They suggest that guides could be a way to present multiple voices and points of view.

Oren et al. compare their guides to agents and view their guides as a simple form of agent. They feel that it is important that the guides were accepted in an educational setting and that users can react favourably to agent-like interfaces. They conclude by suggesting that,

> "Education may be an appropriate setting for both interface agents and narrative-style presentations of information." (Oren et al., 1990, p381)

It is to the educational setting that we will now turn to. Since we have discussed the idea of systems incorporating agents, we will now look at a number of pedagogical agents.

Pedagogical Agents

The Story Archive

The first system I wish to look at is one which develops Oren et al.'s (1990) concept of guides who have different perspectives. The Story Archive was developed in response to the difficulty of attempting to locate information from a broad range of available resources in schools and the fact that knowledge from experts is not readily available in this situation. Schank and Cleary (1995) felt that the computer could be used as a repository for the memory of experts. The Story Archive contains video archives from many experts covering many domains, but concentrating on historical events. To navigate the Story Archive the user accesses the Searching Agents who link the stories together. This is intended to mirror what one would do in reality, that is, go to a local expert in that field. Each Searching Agent has expertise in a particular area and links the information together according to its area of expertise. Each agent is given two personas which either look for general principles or specific examples related to the area. Each persona is given either a name from history or a title reflecting the differing stances they take. This way the user can see the story from differing points of view presented by differing voices.

The manner in which the interface presents these agents is interesting. When a user selects a particular topic, the Story Archive will suggest an appropriate video clip and represent this as a card to click on. Around this card are the various Searching Agents who will change colour from black to blue indicating that they have relevant follow-up stories. A list of concepts related to the video clip can be selected. When they are selected, the agents with stories relevant to these concepts will change from blue to pink or even red indicating a close match with the user's interests. The user has full control over which point of view to follow up.

We can see how this system ties in with what has already been discussed in the previous section. Unfortunately, Schank and Cleary do not discuss any evaluation of this system. It would be interesting to know how engaging and useful their use of these agents was; how the user perceived these characters and their relationship with them, particularly as many of them were actual historical characters; and also the manner in which users actually used the system.

Herman the Bug

At the very beginning of this discussion we looked at motivational issues and Lester et al. (1997) have demonstrated that pedagogical agents can have a powerful motivational effect on middle school students (average age 12). They designed an animated pedagogical agent, Herman the Bug (Figure 11), who inhabited a learning environment and provided advice while the student designed plants. They discovered a 'persona effect': that the presence of this agent had a strong positive effect on the student's perception of their learning experience, leading to an increased motivational effect. They believe that the persona effect happens because the character exhibits lifelike behaviour which enhances its believability and credibility leading the student to perceive and interact with it on a social basis. Not only did this agent increase affective responses positively, but it also increased performance outcomes. They suggest that the increased performance may have been due to the animated agent being able to more actively engage the student in learning, possibly enabling reflection and self-explanation to take place.

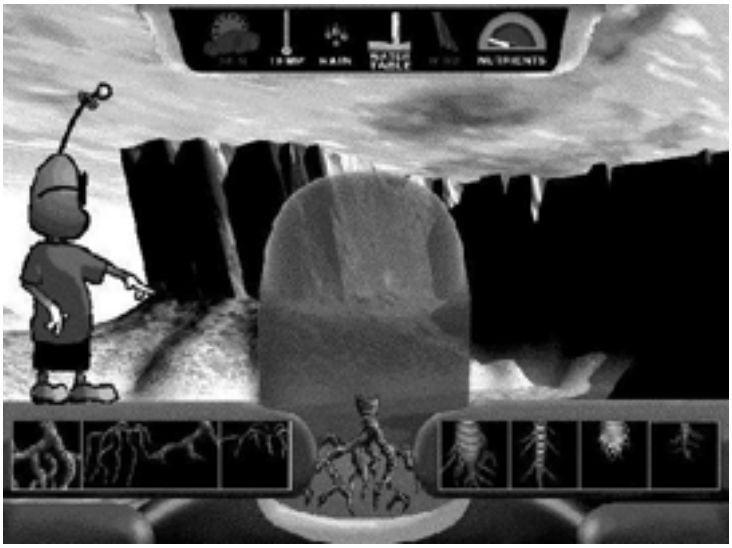


Figure 11
Herman the Bug

They found that the more expressive the agent, the more positive the perception was of the student's learning experience. Even the version of the agent who did not provide any advice was found to

have a marked positive effect. Again, we have evidence that even a small portrayal of a socially-based human-like stimuli can produce a strong social response. With Nass et al.'s (1994) research, simply having voice was sufficient to produce a social response and here it is an animated character portraying lifelike physical behaviours.

Lester et al. point out that an important aspect of this research will be to identify the characteristics of an agent which are most effective for differing age groups, domains and learning contexts. Herman the Bug is a cute little character who appeals to middle school student, but whether this approach would work well with an adult audience engaged in study is doubtful. Nevertheless, it demonstrates that agents can have powerful affective outcomes, and performance outcomes, in a learning context.

It is this aspect of agents, their engagement and manner of this engagement, that appears to be an important issue: that simply including a mute character, or using voice alone, can have such powerful learning and psychological effects. As previously discussed, this affective response is not something that has been considered in the Pask and Laurillard conversational theories. Laurillard's theory is put forward as a framework for evaluating the effectiveness of educational technology. However, it is not sufficiently rich to account for the affective outcomes of this system, in particular the way in which the more expressive the agent, the more positively the student viewed their learning experience. Laurillard's framework would not perceive there to be any differences between the different versions of the system.

The Virtual Participant

We now move to the distance education setting to look at a system, the Virtual Participant, which uses an agent-based approach to support teaching in computer-based conferencing (Masterton, 1997). Here we will see that 'cute' characters may have detrimental effects when applied in an adult setting. But first, an overview of this system.

The Virtual Participant is an agent which participates in a computer conference by matching current discussions with those in previous years using a case-based approach. When a match is made it makes a posting to the conference containing a number of relevant messages from a previous year's

discussion. Students are able to query the Virtual Participant based on questions which it supplies or to email it directly for a response. By interacting with the Virtual Participant, a student is able to choose the line of the discussion which they are interested in and view the relevant discussions on-screen. They are free to look for discussions that would help clear up any difficulties they were having or find discussions that might widen their understanding of a topic. Masterton (1998) believes that this approach can help students reflect on their current discussion and, in turn, their reflections can be added to the database.

In the first prototype the text style available was limited to one style and one font. This caused some problems and students could not easily identify the different parts of the messages (Figure 12).

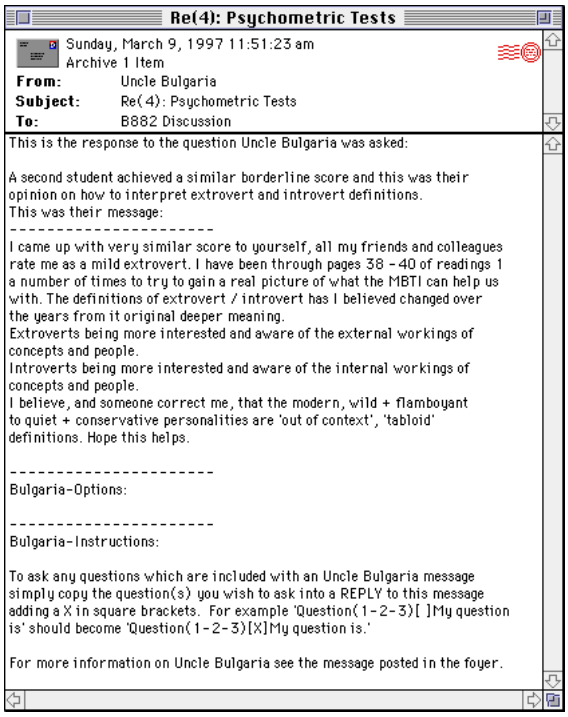


Figure 12
Single font and text style

This difficulty was alleviated in the second prototype by the introduction of a range of fonts and styles, and as can be seen in Figure 13 the different parts of the messages are clearer.

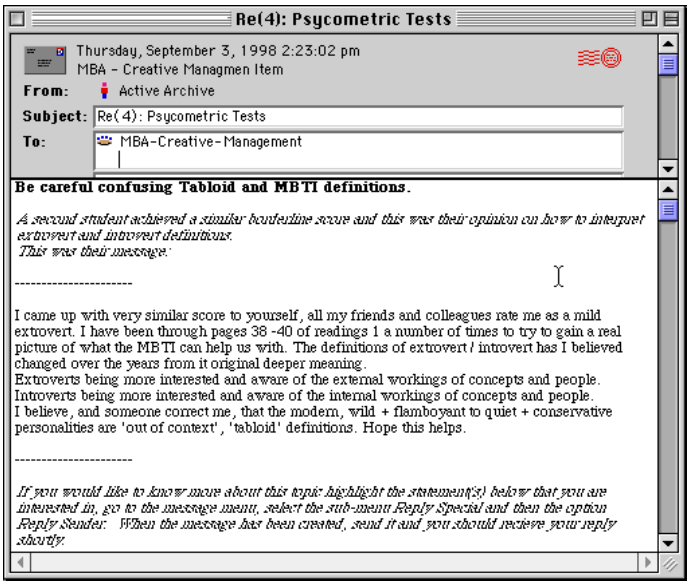


Figure 13
Differing text styles

So, we can see from this, that it is not only important to have these dialogues, but the manner in which they are offered to the student are also be important.

The first prototype was given the name ‘Uncle Bulgaria’ after an animated character. However, this appeared to provoke negative comments from a number of students whose views of the system seemed to be coloured by their dislike of the name and not what the system actually did. Those students who did not know the cartoon character made no comments on the name. This suggests that using an existing character’s name results in the user attempting to apply their pre-existing knowledge of that character to an understanding of the system. Such an attempt can end in confusion. The name, Uncle Bulgaria, does not appear to adequately reflect what the system does: the system is not a wise old furry animal that lives underground and tidies up the litter left by humans and recycles it. However, Masterton worked around this difficulty by not anthropomorphising the system, but ‘mechanomorphising’ it. Mechanomorphising has been defined as the attribution of machine characteristics to humans (Caporael, 1986). Recently the system has been renamed the ‘Active Archive’ which has produced no negative reactions.

The tendency to anthropomorphise systems rather than focussing on what service the system

provides has a long history. Shneiderman (1997) tells of how anthropomorphised systems, e.g. Tillie the Teller and BOB the Bank of Baltimore, were gradually phased out in favour of names focussing on the service they provided, such as Advanced Transaction Machines. The dangers of over-anthropomorphism appear to reach across a number of domains.

During the use of the first prototype, students felt the need to have the role and behaviour of the system more clearly defined (Masterton, 1997). Students wished it to be clear that it was not a student or a tutor as these are roles that are clearly identifiable and the role of the system did not match with this. We have previously discussed the importance of ensuring that the system acts in a manner that is consistent with how the user believes the system will act (Erickson, 1997).

There seem to be some important lessons to be learnt here. The approach of the Virtual Participant was intended to be as non-intrusive as possible. However, Herman the Bug's character was deliberately intended to be noticed: it is hard to ignore a cute bug flying around one's screen? The success of these different approaches appears to reflect the differing characteristics of the intended audience: adult students and middle school students. It would appear that heavily anthropomorphised characters do not sit well with adults — with perhaps the exception of computer games. Masterton (1998) also suggests there is anecdotal evidence that children and young students prefer the anthropomorphic portrayal of a system.

Progress Advisor

Another pedagogical agent for adult distance education students which did not rely on a bias towards anthropomorphism was that of the Progress Advisor (Figure 14) for on-line study guides (McKillop, 1997).

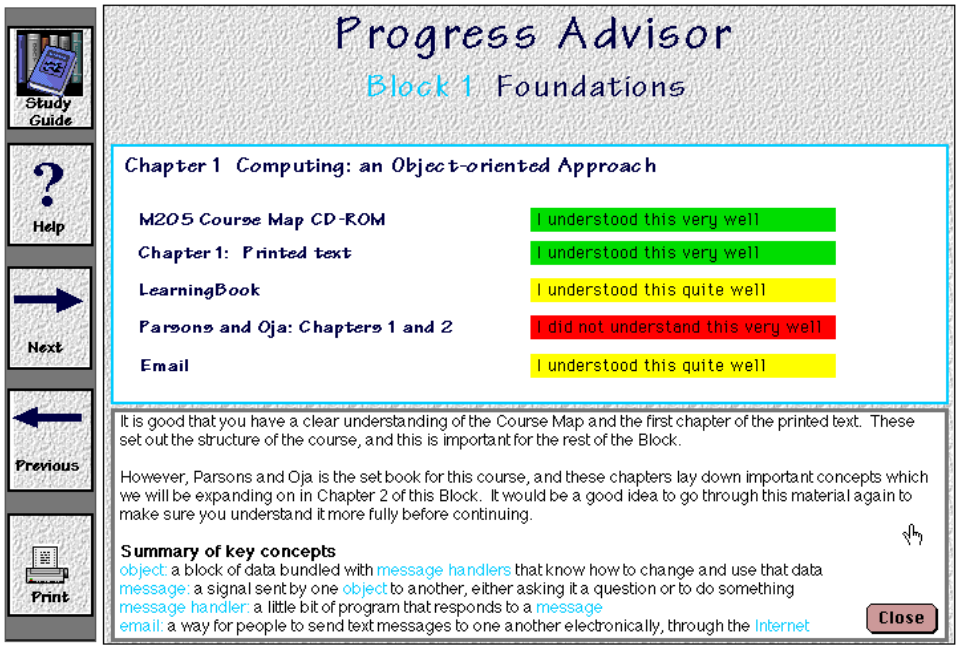


Figure 14
Progress Advisor

The concept of the Progress Advisor arose out of an investigation into how distance education students could be supported during their studies through the use of on-line study guides. Two major difficulties with supporting distance education students are that of pacing through the course and feedback on academic progress. Pacing has been described by Yule (1985) as providing planning approaches to studying including feedback on progression through the course. Rowntree (1992) also stresses the importance of feedback on academic progress and states that feedback is essential to the learning process.

In an attempt to move towards a solution to these difficulties a prototype of the Progress Advisor was constructed and evaluated by distance education students (McKillop, 1997). The evaluation was conducted using a 'wizard of oz' approach where the system's responses were simulated. The students were guided through the prototype by the evaluator who used a set scenario to represent an envisioned 'typical' use of the system. The system used information requested from the student and also aimed to use dynamic information from the student's use of the study guide to construct the advice given. Advice was presented both textually and graphically. The evaluation showed a favourable response by students to the system. Most students liked the system and stated they would find using a Progress Advisor helpful. One student commented that it would be a useful

motivating guide.

No student disliked the name of the system though it appeared that the use of the word ‘advisor’ had evoked some anthropomorphic responses from one student who thought the Progress Advisor was going to speak to her. Another student, when asked to comment about the system’s advice giving, thought that the system was ‘happy’ or ‘not happy’ with her progress. Again, perhaps because the role of an advisor is usually a person, it is not surprising that she viewed its advice in this personal manner. However, it seems that the students’ expectations of the system, gathered from its name and their interactions with it, fitted well with what the system was intended to achieve.

Other approaches

There are a number of other systems which I feel would be useful to bring into this discussion at this point. Whilst they may not fit neatly into the pedagogical agent category, their approach lends much to the issues that we have considered.

Critiquing Systems

Critiquing systems could be viewed as agents, and indeed they are: they are delegated a task and they perform this task autonomously. But what is a critiquing system and where is its relevance in this discussion if it is not considered an agent? A critiquing system (for example, see Figure 15) is a knowledge-based design support system which actively works to influence the designer’s thinking by pointing out possible problem areas and contentious issues (Sumner, Bonnardel, & Kallak, 1997a). This is done while the designer is working in a design environment which incorporates a critiquing component. As the designer works, a critic message window will inform the designer of possible problems with the design.

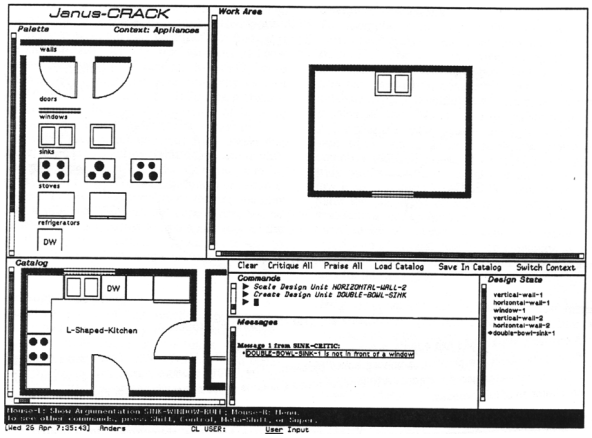


Figure 15
A Critiquing System

Fischer et al. (1990) suggest that the critiquing approach can allow users, including students, to take control over their learning situation. Allowing students to have control over their learning situation means that they initiate actions and decide goals. They criticise the computer tutoring approach as it cannot support this way of working by anticipating what the student will do. Critics, on the other hand, can work in situations were they only have partial knowledge. The critic is not passive, it does not have to wait for the user to ask for support and will only interrupt when the users actions could be improved.

In terms of the user's relationship to the critiquing system, Fischer et al. suggest that users can view the messages as being helpful or hindering, just as they might view similar recommendations from colleagues. They suggest that the critiquing strategy should consider issues to do with the intrusiveness of the process and the emotional impact of interacting with a computer that gives a critique of their work.

Interestingly, Sumner et al. (1997a) found the critics would not only affect the designer's thinking directly, by providing messages, but also indirectly. They found that simply being aware that a critic would fire was sufficient to influence the designer's thinking and lead them to look for problems in their design that might cause a critic to appear. Designers felt that the critics had led them to think more deeply about their design choices and this led Sumner et al. to conclude that critics can promote reflection and also that the quality of reflection appears to be deeper for more experienced designers. Interestingly, Sumner et al. muse on the possibility of changing the

critiquing metaphor to one of a design consultants metaphor where the rule sets would be 'anthropomorphised' into the differing perspectives of, for example, a user consultant or a marketing consultant. Each critic set would take on differing roles.

This is yet another system which appear to produce an affective response amongst its users, however, this is not an issue which the designers of these systems have overtly researched other than looking at positive and negative influences on designers' behaviour (Sumner et al., 1997a). For instance there may be emotional responses to being aware that a system has a critic in it, one possible reason for changing the metaphor to a 'design consultant' one. Also, the manner in which the designers attempted to avoid the critics firing is an interesting one.

Course Map

Although we have previously discussed the Course Map (see On-line Study Guides section), I now wish to look more closely at one feature of it which I feel is especially pertinent to this discussion: the tours. The tour provided an introduction to the course and use of the map using an audio narrative presented by a course team member whose picture appeared in the course tour area. This aspect of the Course Map was viewed positively by the students and some even expressed disappointment that there were not further tours for subsequent sections. The personal style of presentation was liked and the students liked seeing a picture of a member of the Course Team during their tour narrative. There is often a lack of face to face contact in distance education courses and students liked the 'face-to-face' contact the tour provided: one student had been unable to attend any of the tutorials and felt that the tour was a bit like having a tutorial. Another student made a point of stressing the importance of face-to-face contact.

What is important about these comments is that providing a human aspect to this system appears to have produced positive reactions amongst these students. The simple act of providing a voice to read the narrative and a face to go with it has had a strong positive affective response. I feel that having this aspect as part of an interface can engage the student in the system. Being able to respond to the system in some socially based way appears to be an interesting outcome of agent research and one which can have important implications for designing systems for distance education students.

Sounding Board

Schank and Cleary (1995) propose that the use of questions by a student is important in the learning process, enabling the student to learn more than just facts and allowing them to construct meaningful explanations. They suggest that, given the opportunity, students can identify gaps in their knowledge and ask questions which will enable them to redress this. They point to the work of Chi et al. (1989) who found that the more students explain things to themselves, generate self-explanations, the more they learn from this process. Schank and Cleary state that people often use other people to bounce ideas off as a sounding board, and they propose that computers can serve as a sounding board. To be a sounding board takes patience and computers, on the whole, are infinitely patient. They state that,

> "Computer systems acting as sounding boards serve as design tools for thinking." (Schank & Cleary, 1995, p107)

In their Sounding Board system it is the user who maintains control and the system which supplies the initiative. The system has no knowledge of what is being discussed, it engages the user in a dialogue by asking questions of various types to guide the user in reflecting upon the issue being discussed. These questions will, however, be influenced by the particular domain.

Schank and Cleary provide an example of a dialogue with the Sounding Board from the business domain in which a sales manager discusses a problem she has in landing a new account. An extract of the dialogue is shown below in Figure 16. The actual interface is shown in Figure 17.

Question: What problem are you working on?

Response: I'm trying to land the Motorola account.

Question: What larger objectives would getting Motorola's business help achieve?

Response: It would get our foot in the door of the industry.

Question: Should we start by focussing on the SPECIFIC problem you've identified or the more GENERAL one?

Response: Getting Motorola's business.

Question: Is getting Motorola's business a matter of maintaining the status quo, or of achieving something new?

Response: Achieving something new.

Figure 16

Dialogue with the Sounding Board

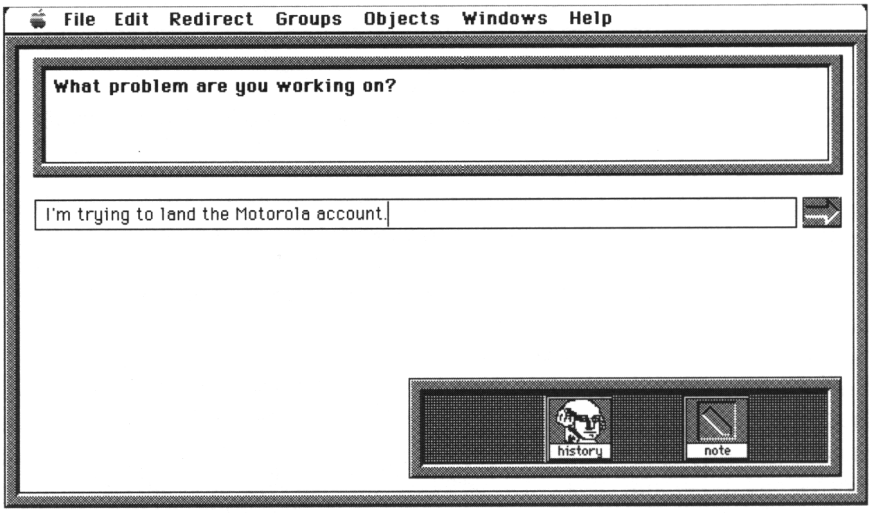


Figure 17

Sounding Board Interface

In distance education there is little opportunity on a day to day level to bounce ideas off others in a similar situation to oneself. Computer conferencing is offering increasing opportunities for this to happen, however, conferences are public arenas and students are often lacking in the confidence to send messages (Masterton, 1998). The Sounding Board concept offers one-to-one support which is private and non-judgmental in a conversational style indicative of a personal tutorial.

Discussion

The distance education student may encounter many difficulties during their study due to the nature of education at a distance. Therefore the materials provided must give them the necessary guiding and supporting information that is not accessible to them in the way it is to the traditional student. We have looked at the important role that the study guide can have in providing this information and shown that students find such study guides helpful.

The manner in which the student interacts with these materials is important. There are a number of ways of presenting the information, but a dialogic style appears to be most promising. Dialogue is an important part of the learning process — learning occurs through the conversations we have with others, ourselves and teaching materials. Pask and Laurillard have stressed the importance of dialogue in learning in their conversational theories, but their theories do not look at the affective responses a student may have, nor do they consider the actual interpersonal relationship between the student and their tutor, and how this may affect the learning process. Often these are not considered an important part of learning, or even part of the learning process, but they are important and can have a strong positive effect on the quality of the student's learning experience and even on their learning outcomes.

Holmberg's theory of guided didactic conversation does consider these points. Holmberg argues that using a dialogue style which simulates personal communication can not only encourage the student to engage in text elaboration, but can lead the student to feel personally involved in the materials and feel they have a more personal relationship with the tutor. Holmberg's approach takes a genuine student centred view, something which is often lacking when considering ways of supporting student learning. We can see this in some of the on-line study guides which have been reviewed. They mainly concentrate on the functional task of presenting students with the materials and largely ignore issues to do with how to engage the student and make the learning process a more positive and personal experience.

However, it is all very well saying that increasing engagement is a good thing, but how can we actually achieve it? I have suggested that we can look to research being conducted in the agent field as a possible way to accomplish this. The manner in which people respond to agents, and computers, is fundamentally a social process encompassing many aspects of personal interaction. We have seen how people appear to have a natural tendency to anthropomorphise objects and that

this can have both positive and negative outcomes. However, we can control and exploit the positive side of anthropomorphism to enable the student to engage with the system in a more personal and effective manner.

There are two key elements which are of particular interest in the application of on-line study guides — the use of voice and face. We have seen how effective a talking face can be in engaging the user and how its mere presence can increase motivation. This finding is of importance to us since there can be a lack of face-to-face contact in distance education and the use of talking faces in an on-line study guide may make the learning experience more personal and more effective. In fact, the audio visual tour in the Course Map was viewed positively by the students using it. Similarly, the guides metaphor was engaging and the students found they had a very personal relationship with their guides and were keen to see them as actual characters — something that would have been unlikely to have happened if they had been represented by an icon. The use of the guides to present multiple points of view is also important. By doing this, a dominant, and thus seemingly correct point of view is avoided. Students are able to draw their own conclusions. The use of voice, and multiple voices to represent different points of view, or different aspects of a system, is a simple but effective technique. Using multiple voices avoids the monologic style which is so often part of academic discourse. We have already looked at a number of techniques being used in text to lessen the monologic style and these appear to be successful even in this medium. Based on the findings of this paper I would suggest that Holmberg's theory would, largely, be applicable to the on-line setting as well.

I am not suggesting that tutors should be replaced by their electronic personifications, but in situations such as distance education where the majority of teaching is not conducted face to face, the application of the findings from this literature review could well have significant positive outcomes for the student.

We have seen how successful this approach can be in the educational setting from the review of pedagogical agents and other systems which use this approach. Herman the Bug's persona effect has a strong positive influence on the student's perception of their learning experience, including increased motivation. Not only can an agent usefully increase affective responses, but it can also increase performance outcomes. Even using a mute version of the character, or voice alone, led to positive outcomes. However, we need to consider the dangers of over-anthropomorphising a system, as in Uncle Bulgaria, and get the balance right when portraying the system.

This literature review has shown just how important affective responses can be in the learning process and that it is important to consider the personal relationship between student and tutor. The agents reviewed give us an indication about what affordances of agents might be most appropriate to use in educational materials, such as on-line study guides, to promote positive affective responses and a more personal and dialogic approach.

Summary

This paper has looked at the difficulties a distance education student may face and a number of factors that may influence the effectiveness of their learning and the quality of their learning experience. Within this context the study guide can be an important resource providing the student with important supporting guidance and information. The focus for this discussion has been to look at the manner in which students interact with their learning materials and to look at ways of making this more engaging and effective by considering the importance of the student's affective responses while using these materials.

A number of different styles of presenting self-instructional text have been considered and the importance of a dialogue style has been stressed. Dialogue is an important part of the learning process and three conversation theories have been discussed: Holmberg's guided didactic conversation; Pask's conversational theory; and Laurillard's conversational framework. We have seen how Holmberg's theory stresses a personal style of communication through text to enable the student to feel personally involved in the material and to promote a more personal relationship between student and tutor. Pask and Laurillard's theories do not considered these affective responses and concentrate largely on the functional aspects of the learning conversation.

As there is an increasing move to put courses on-line we have looked at a number of on-line study guides. Most of these do not consider ways of making interaction more engaging and effective and concentrate largely on the more functional aspects of teaching. This paper has demonstrated the importance of these affective responses by considering findings from agent research which show that voice and face can not only have a positive effect on the student's perception of their learning experience, but can also lead to increased performance outcomes. Based on these results it seems probable that these findings could be applied to on-line study guides to improve the quality of the student's learning experience.

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