



# Click and Listen: A Case Study of the Development of a Computer-Assisted Language Learning Package

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## Citation for published version (APA):

King, A., & Procter, R. (1997). Click and Listen: A Case Study of the Development of a Computer-Assisted Language Learning Package. In *Proceedings of the Workshop on CALL and Cultural Studies in the Language Curriculum* (pp. 110-123). Springer Nature.

## Published in:

Proceedings of the Workshop on CALL and Cultural Studies in the Language Curriculum

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# ‘Click and Listen’: A Case Study of the Development of a CALL Package

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## Abstract

We describe the resourcing, development, use and evaluation of interactive multimedia courseware in language and linguistics teaching and learning at three institutions of higher education in Edinburgh who collaborated on the ‘Click and Listen’ project. It also addresses several topics, arising from our experiences with ‘Click and Listen’, some that are of relevance to CAL generally and others that are particularly salient to CAL in the sphere of linguistic education. They are: Benefits, Added Value and Good Practice (which touch inevitably on the related areas of professional and vocational training); Functional and Cultural Integration and Present and Future Perspectives.

## 1 Background

Having created a networking infrastructure (EaStMAN) to link higher education institutions in East Central Scotland, in August 1995, the Scottish Higher Education Funding Council (SHEFC) invited bids in an open competition for finances to resource the hardware, software and training requirements of projects. This MANs (Metropolitan Area Networks) Initiative welcomed applications to fund projects to develop new materials, or in some cases adapt existing applications and materials, for use in teaching and learning activities in institutions who wished to collaborate with each other to utilise and exploit the technological capabilities and potential of the newly-created MAN.

The ‘Click and Listen’ project resulted from a successful bid and received funding for applications and materials development and personnel training. The lead institution is the Department of English Language at the University of Edinburgh; its partners are the Department of Speech and Language Sciences (Queen Margaret College) and the Faculty of English (Moray House Institute of Education). The remit of the project was to develop an interactive, computer-based click-and-listen package as a teaching/learning aid and resource for basic Phonetics and Phonology. Its primary concern has been with Scots and Scottish English which are particularly under-resourced in teaching materials of any kind.

The WWW was selected as the delivery and presentation platform for the package. Its potential as an educational technology has quickly become apparent [9]. Not least, the non-linear exploration of material that such hyper-media affords is widely believed to encourage (if properly designed) a richer understanding of the structure of the knowledge domain [4]. More importantly, the WWW's rapidly expanding capabilities for delivering multi-media content (e.g., graphics, animation and audio) was expected to provide a good match with project requirements.

## 2 Project Aims

### 2.1 Benefits and Added Value

At the outset of the project, benefits envisaged in the sphere of linguistics and language learning were as follows. Phonetics and phonology are studied by all students of English and Scots Language in the Department of English Language at Edinburgh University. In the past and at present, teaching of it has tended to centre round the traditional modes of lectures, tutorials and textbook-reading by students. Fundamental to any language course, phonetics and phonology are essential to English Language and Scots courses at Edinburgh in their own right, but also as an essential component in the study of social, regional, historical and literary variation. Learning phonetics and phonology is often found extremely difficult by beginning students to a large extent because the traditional methods just outlined allow students limited and only fleeting access to pronunciation of sounds in association with their International Phonetics Alphabet (IPA) symbols — whether in isolation or larger utterances. Many students have, as a result, found it difficult to correlate particular sounds with their IPA congeners or to produce or work with IPA transcriptions. The primary beneficial outcome of the project hoped for was the greater facilitation and enhancement of phonetics and phonology learning and teaching.

The two other collaborating institutions were to gain from the 'Click and Listen' materials to aid vocational training: in speech therapy in the case of Queen Margaret College and teacher training in that of Moray House. All students on the B.Sc. course in Speech Pathology and Therapy at Queen Margaret College undertake an intensive training in phonetics and are expected to acquire skills in production and perception of speech sounds and their transcription using the IPA — skills fundamental to their professional practice. At present, good practice in practical phonetics demands intensive small group work which is very expensive in teaching time. It was hoped that the 'Click and Listen' package would improve upon current practice by offering the possibility of reducing teaching input without losing quality of learning.

Knowledge and awareness of, and skills in Scots and Scottish English Language were, and continue to be, desirable to Moray House students on the B.Ed. Primary course and the Graduate Secondary course for teachers of English. Indeed knowledge and skills in this area have now become central to teacher training in the light of recent Scottish Office Education Department

requirements. These place great emphasis on education in the languages of the community — viz., Scots, Scottish English and, to a lesser extent, Gaelic — and the teaching of language in the context of Scottish literature and culture. Similar requirements are made of pre- and in-service Drama course students and those of the Masters in Scottish Culture. The relevance and value of ‘Click and Listen’ as a linguistic resource on Scots and Scottish English for such students is clear and has been confirmed by the results of the evaluation. As an elementary phonetics teaching aid, it aimed to represent an advance on and augmentation of present provision at the Institute and provide invaluable support to students hesitant in the use of Scots language and delivery of Scottish literary texts in the classroom.

## **2.2 Good Practice**

It was hoped that staff and students in all three institutions would, as a result of collaborating on ‘Click and Listen’, learn from each other by having access to and sharing expertise and knowledge in the areas of their respective specialisms. For instance, Edinburgh University would gain from Queen Margaret College’s phonetics expertise (especially with regard to acoustic phonetics and children’s speech) and from Moray House’s educational experience in language text appropriacy, presentation and sequencing of materials. Staff and students at Queen Margaret College and Moray House would benefit from Edinburgh University’s expertise on Scots, English dialects generally and historical and literary linguistics.

Good practice in the matter of package authoring and materials resource building was also envisaged as a product of the experience of producing, implementing and evaluating the ‘Click and Listen’ learning technology package. The information, skills and materials thus made available to staff would allow these to be successfully applied not only in the specific subject areas here, but to be disseminated and integrated into Arts subject teaching generally. Staff training and the professional development consequent on this was therefore another hoped-for benefit of the project.

As can be imagined, some of our hopes were translated into reality and others were transformed by reality. The varying outcomes of our project experience will be discussed later: most of these happily come together and can be focused on rather nicely in a consideration of integration. First, however, we will briefly described the development of the package and its evaluation.

## **3 Development and Implementation**

These have involved making use of existing multi-media and WWW facilities, together with the capabilities of current sound cards and medium-performance PCs. An interactive ‘click-and-listen’ package has been developed and implemented. In so doing, we have followed the established development models for educational materials [10]. In particular, the project was broken down into the following major activities:

1. setting up a WWW server<sup>1</sup>, based in the English Language Department, Edinburgh University which operated, via the EaStMAN, as the server for twelve client machines (four PCs per site) and setting up client hardware and software, including network access;
2. defining the package. This was determined by the Scots and Scottish English phonetic and phonological content required at each of the institutions in line with courses, number and levels of students, as well as what was feasible technically. The latter was partially informed by a survey of the few existing 'click-and-listen' software packages and of current learning technology and CAL materials, authoring packages and literature. Several click-and-listen- systems for teaching and learning phonetics were available from American sources (e.g., Ladefoged's), in addition to packages for foreign-language teaching and learning. They were concerned, however, with general linguistics materials and did not deal with or contain any Scots dialect or Scottish English materials and did not therefore meet our needs. They tended also to be in CD-ROM format which meant they were inflexible and not adaptable to courseware development requirements or in response to user feedback as readily as a networked package. The 'Click and Listen' package has avoided these difficulties and as a result has distinct advantages over existing ones;
3. producing the package in the light of the above and, more practically, by linking the IPA symbols and transcriptions with their associated sounds to teach basic phonetics and phonology first-of-all. These concepts were then applied to Scots, Scottish English and RP making use of a high-quality audio database we created specially by recording and digitising isolated vowels, word-lists and Modern Scots poetry. Time and funding did not permit including treatments of consonants or passages of natural speech;
4. making these data accessible using a combination of HTML, JavaScript and Java applets to create a truly interactive click-and-listen user interface using mainstream WWW browser technology (Netscape Navigator 3). The integration of sound, explanatory and literary text and graphics (e.g., dialect maps) were also necessary;
5. evaluation of the package in each institution.

## 4 Evaluation

The evaluation of the impact of new technologies in education is fraught with difficulties [1]. Not least of these is that it is usually impractical to try to obtain objective evidence for the impact on learning outcomes [2]. However, useful information can still be gathered using more informal evaluation instruments.

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<sup>1</sup><http://wheecher.arts.ed.ac.uk>

For this project, we have adopted (and adapted) the “integrative methodology” of CAL evaluation [2]. In particular, at this early stage in the package’s development, we have focused on learner-centred instruments such as student attitude surveys and confidence logs. These have enabled us to isolate areas of the material content and structure for modification prior to beginning intensive use of the package later this year.

## 4.1 Methodology

The package was evaluated by undergraduate students at each institution by means of questionnaires administered pre-task and post-task. Subjects were given a short introduction into the objectives and use of the package and then began to work their way through a set of package materials. The average time spent on the task was about fifty minutes.

## 4.2 Materials

These are intended to aid learning about the vowel phonetics and phonology of Scottish English, Standard Southern British English and Scots, in particular:

1. understanding the principles of vowel description;
2. learning to recognise and transcribe some reference vowel qualities;
3. becoming familiar with the vowel patterns of Scottish English and Standard Southern English and learning appropriate vowel symbols for transcribing these accents;
4. learning something of the regional accents and dialects of Scotland.

There are four modules, sequenced in the order now given.

### 4.2.1 *Basics of vowel production*

This first, stand-alone module provides a description of how vowel sounds are produced by movements of the relevant articulatory organs: tongue and lips, for example (for further information on speech sounds and their production see, for instance, Giegerich [3]). Three key questions introduce the phonetic parameters relevant to the system for classifying vowels in terms of quality – vowel height, front – or backness and rounding. They function as clickable links which provide the appropriate information and simultaneously produce an ellipse highlighting the appropriate part of the vocal tract on an accompanying cross-section diagram of the tract (see Figure 1). Understanding of these phonetic concepts is furthered by a series of moveable vocal tract diagrams showing articulation and how this changes with a series of moves through high/close to open/low and from front to back or rounded to unrounded. These movements are activated by the student passing the mouse over one or other set of IPA symbols embodying these parameters. The IPA symbols also have a

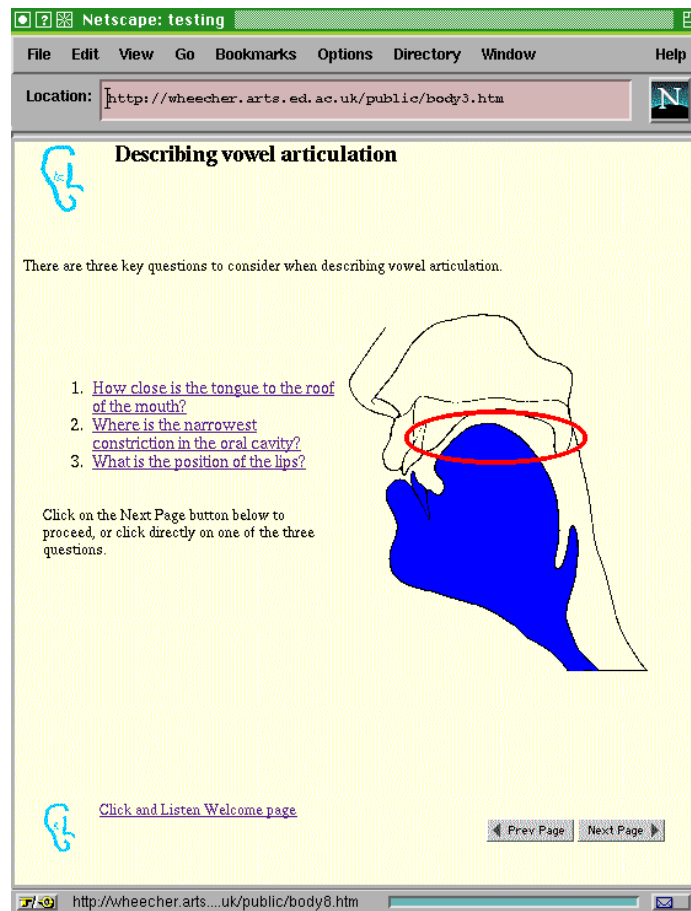


Figure 1: Basics of vowel production.

button function; when clicked on, they playback the vowel sound in question (see Figure 2).

#### 4.2.2 Introduction to the Cardinal Vowels

The Cardinal Vowel System designed by the phonetician Daniel Jones as a means of establishing fixed reference points for the phonetic description of vowel quality is next introduced. The eight primary and eight secondary cardinal vowels are defined in terms of their articulation and/or their perceptual distance from other vowels (once again, for further details see Giegerich [3]). So, for instance, a description of Cardinal Vowel (CV) 1 [i] is given as being the sound produced “when the tongue is a high and as forward in the mouth as is possible while still producing a vowel” and “the lips are held in a spread position”. Clicking on the ‘Picture’ button which follows then allows the superimposition

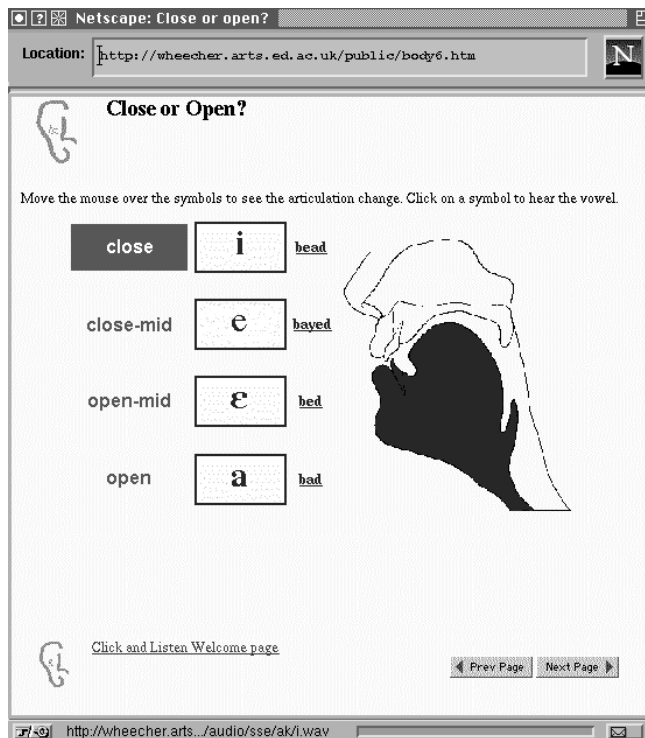


Figure 2: Phonetic parameters for classifying vowels.

on the screen of a cross-section vocal tract diagram of CV1; clicking on the IPA symbol which appears with the diagram plays back the sound of CV1. Figure 3 illustrates the process.

#### 4.2.3 *Vowel Systems of Scottish English and Standard Southern British English (RP)*

This third module contains charts showing the monophthongal and diphthongal vowel sounds, together with a keyword for each vowel found in these two standard accents of English. Clicking on the IPA symbol allows the vowel to be heard in isolation and on the keyword, in context. Clickable links focus the student's attention on the systemic differences between the two accents in the matter of number of vowel contrasts, differing contrasts and structural features like Scottish English's monophthong plus /r/ which compares with RP's monophthong or diphthong less /r/.

#### 4.2.4 *Scots and Scottish English in Poetry*

Module four presents a small collection of poems reproduced from 'The Kist' [8] — an anthology of Scottish writing and audio recordings produced to meet



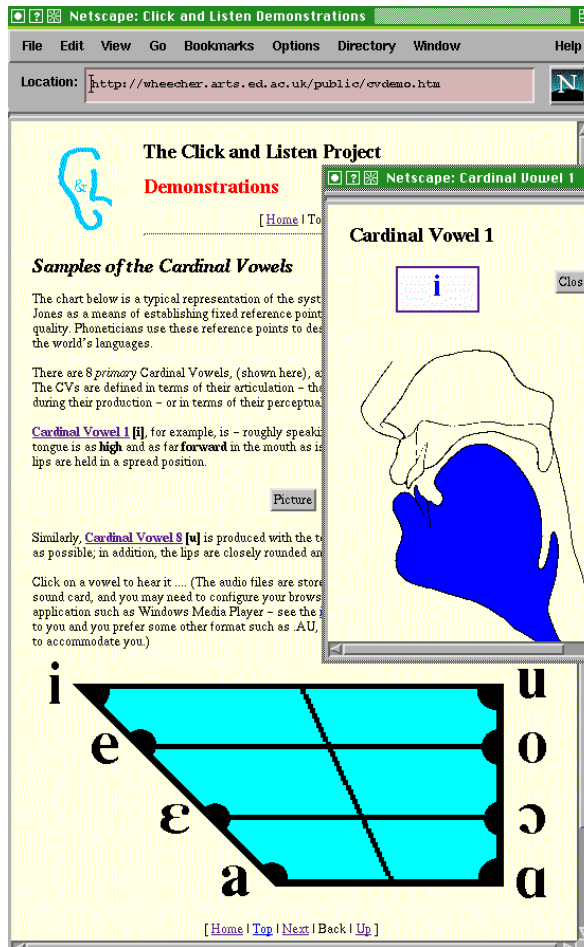


Figure 3: Cardinal vowel system.

demand in primary and the first two years of secondary schools for Scottish literary materials. Those poems chosen to exemplify a very small proportion of the regional and sociolinguistic range of dialects within Scots and accents within Scottish English, spanning five regions from the North East to the Central belt and Borders of Scotland. These can be accessed either by clicking on a regional location — say Glasgow, Wick or Edinburgh — on a map of Scotland or by clicking on a particular poem's title. Once the link is followed up, a whole poem can be heard by clicking on its title or on the first word of any of its stanzas. 'Background' on the writer, the poem and the circumstances of its writing can be selected by the student, as can 'Questions for discussion' on the language of each poem. These questions either relate to sociolinguistic issues (embracing concepts like code-drifting, attitudes towards Scots as a non-standard language

variety or linguistic insecurity) or the spelling of Scots (it has no standard spelling system). They also encourage comparison by students of several poems with each other in terms of their individual Scots dialect features, reasons for using Scots and consequent literary or stylistic effects. (For information on Scots and Scottish English and further reading, reference may be made to King [6], [7] and Jones [5]).

### 4.3 Results and discussion

Subjects were asked to assess by completing confidence logs on a scale of 1 to 5 (1 = no confidence, 5 = very confident) their knowledge of phonetics, Scottish English, RP and Scots with respect to five specific topics. For subjects attending the Scots 1 course in the Department of English Language at the University of Edinburgh, the topics were as follows:

- A. ability to recognise IPA symbols for vowels and relate them to the sounds they represent
- B. ability to recognise and transcribe vowels of RP and Scottish English
- C. application of vowel transcription to analysis of whole words and utterances
- D. understanding of the differences between RP and Scottish English accents
- E. operation of interactive multi-media resources as a support for study

For subjects attending teacher training courses at Moray House Institute of Education, the topics were as follows:

- A. handling accent/dialect features of selected texts in a variety of Scots dialects
- B. recognition of spoken differences among selected Scots dialects
- C. recognition of accent differences between RP and Scottish English
- D. understanding of the influence of accent features in shaping social attitudes
- E. operation of interactive multi-media resources as a support for study

The results of the mean values of the pre-task and post-task confidence logs of seven teacher training students and seventeen English Language students for the topics listed above are shown in Table 1. To avoid distortions due to ceiling effects, pre- and post- score pairs have been omitted where the corresponding pre-task score was 5 (very confident). The results show uniformly an increase in post-task confidence for all topics listed. Since confidence logs are not a demonstration of knowledge, these results should be interpreted with caution, but they are nevertheless encouraging.

Topic	Mean Score			
	English Language		Teacher Training	
	Pre-task	Post-task	Pre-task	Post-task
A	3.3	3.8	3.0	3.7
B	3.2	3.9	3.1	3.8
C	2.9	3.6	3.8	4.5
D	3.3	3.5	3.7	4.0
E	2.8	4.3	3.0	4.7

Table 1: Mean Pre-task and Post-task confidence scores.

In the post-task questionnaire, subjects were also asked to record their impression of what they thought they had spent most their time doing during the task on a scale 1 to 5 (1 = spent all the time trying to understand how to use the package, 5 = concentrated on the material all the time). The mean value for all subjects was 4.3, indicating that they felt they were able to focus on the material for the most of the time spent using the package.

This positive assessment is also reflected in subjects' answers to the question: "Would you use the package again?" (1 = definitely would not, 5 = definitely would). Of those subjects who were students of English Language, the majority of responses were in the 'likely to use again' and 'might use again' categories, whereas of those subjects who were following teacher training courses at Moray House, the majority of responses were in the 'definitely would use again' and 'likely to use again' categories. Finally, those subjects who were students of English Language were asked the question: "How useful do you think future students would find the package when learning phonology?" (1 = irrelevant, 5 = essential). The majority of responses were in the 'essential' and 'very helpful' categories.

## 5 Issues of Integration

### 5.1 Functional Integration

In the course of the project, we encountered some difficulties with functionally integrating audio materials in the form and presentation we desired with the available platforms, browsers and authoring tools.

Project implementation has been in two phases. Phase One involved organising instructional material into WWW pages as an 'electronic book'. It exploited the WWW's capacity to create a series of linked pages through which students can browse (though in a loosely guided way) and access sound, explanatory text and graphics which present phonetic and phonological concepts and data. Our experience of the WWW thus far indicates that it was well-suited as a platform for the needs of Phase One. The learning curve was quite gentle: HTML is quite a simple language to use and led to quick results. This has been of significant benefit to those personnel working on the 'Click and Listen'

project with little or no previous experience of multi-media authoring, as well as to users of WWW materials.

A combination of HTTP and network latency continues to pose some problems in the project because of our specific requirement to deliver as speedily as possible high quality audio files. The materials in these files range, as we have already indicated, from fairly short examples of vowel and consonant production, through to longer samples illustrating dialectal variation evidenced in read poems. A very short response time is needed between users clicking on an item to hear it, and the delivery of the corresponding audio file, particularly for the shorter items. Users may be happy to wait one or two seconds for playback of an extended passage, but are not so tolerant of a similar delay in playback of an item which itself lasts only a few hundred milliseconds. RealAudio and Iwave sampling formats, which use compression techniques to reduce storage and transmission requirements, were trialed early on in the project, but gave an unacceptable loss of quality. We therefore settled on sampling the original DAT recordings in WAV format.

Further technical and integration problems occurred with Phase Two of the project which involved expansion and greater specification of material, as well as a more 'instructionally informed' presentation — for example, students being able to attempt exercises, answer questions, etc. and obtain feedback on their answers as well as any guidance needed at a level structured to match their state of knowledge at any particular point. Phase Two materials have also had to be more flexibly structured so as to offer individual students (and institutions) greater choice of subject areas and approaches to pursue. Our main problem here has been that the WWW is essentially a tool for information organisation and access, based upon a rather unsophisticated model of interaction. Consequently, the facilities provided by HTML (and HTTP) fell short of these more specialised educational needs. Proprietary authoring tools — such as 'Authorware' or 'Toolbook' — which provide a model of the requisite kind, have several disadvantages for our purposes, the main one being the problem of integration with network-based materials delivery. Another important consideration here is the overheads educators would have incurred by having to learn another (and in some ways quite different) authoring language and environment. Undoubtedly the WWW, as a basic tool for the authoring, dissemination and browsing of information, will continue to figure large in our (and other CAL materials makers') development, delivery and use of on-line educational materials. Equally clearly, it would be preferable if more support for specific teaching and learning goals and materials could be integrated within it as seamlessly and straightforwardly as possible with no loss of its virtues of flexibility, economy and simplicity.

## 5.2 Cultural Integration

Leaving on one side some of the problems of functional integration, the largesse of opportunities made possible by adopting a multi-media based approach to preparation, presentation and use of materials has been a great aid in integrat-

ing linguistic data with non-linguistic information. It has provided the educator (or educator-author) and student with a very attractive menu of options which offers variety, flexibility, ease of incrementality, choice and up-to-the minute presentation modes. The integration of linguistic data and information with those social, historical and cultural dimensions which underlie and partly condition their forms and functions is positively facilitated and encouraged by the multi-media format.

1. This means of accessing, approach and presentation seems to have better met student learning needs than the traditional modes in use at present for teaching phonic material. There are various reasons for this. Because the system is network-based, it is open and flexible to rapid adaptation in response to user feedback. It has the advantage over access to subject matter via books in that it is non-linear: the provision of a variety of routes through the same body of information means that students have been able to, and do, choose individualised pathways/access to material ('naive' learners can have access to introductory or less challenging material, while more advanced learners can by-pass this and access advanced, more detailed material rapidly). Students can therefore work at varying depths of need and individual pace.

Additionally, the evaluation has shown that the multi-media presentation of data and information is most attractive to the student. Given that the future work environment of the undergraduate student will become more and more computer-based, this is significant in that we hope that it will go some way towards introducing non-computer-literate students — still too numerous in Arts subjects — to IT in a user-friendly way and help to break down possible initial student reticence. Where students are computer-literate, the multi-media presentation of subject matter has served to augment and enhance their acquaintance with and skills in computer-based work.

The interactive nature of the 'Click and Listen' package has enhanced the student learning process in other ways in that it has allowed students to gain a multi-dimensional understanding of the subject-matter and enabled them to approach it from a diverse, sometimes unfamiliar series of angles and perspectives. Browsing too has allowed the student to explore a largish corpus of information by following the links and relationships of his or her choice. The interactivity factor then has enriched the learning process since implicit, as well as explicit, learning has occurred, leading in turn to better and readier assimilation of knowledge and student empowerment.

2. It is common to focus on the impact of the WWW and CAL materials and methods on the student learning culture, but this is to ignore the wider question of the insertion and integration of these into existing curricular and academic structures. Our experience of this has been that the present culture of higher educational institutions is still in the

main too traditionally-oriented and restrictive to straightforwardly welcome and facilitate at departmental and institutional level innovations like ‘Click and Listen’ in teaching and learning. It would seem that the most significant learning outcomes do not involve students, but educational institutions and their staff. Individually, this relates to staff members being willing to acquire relevant skills and understanding of the technology and collectively, it relates to the development of appropriate institutional strategies to encourage such take-up. In general, earlier attempts to introduce computer-assisted learning have not fulfilled expectations and one important factor in their failure was the allocation of insufficient human resources to CAL and a lack of adequate staff support. Experience in the ‘Click and Listen’ project — certainly at Edinburgh University — suggests that there may still be an inadequate appreciation at both the departmental and institutional level of the need to provide staff with proper encouragement, support and training when undertaking innovations like this in teaching and learning. It should not be assumed that the necessary cultural changes or adaptations in educational institutions have taken place or are taking place across the board, readily or of their own accord. Indeed a change in the culture of learning in higher education institutions will, we believe, be crucial to the success of computer-aided higher education — whether WWW-based or not — in the long term.

## 6 Conclusions and Future Perspectives

Overall, the evidence so far gathered indicates that substantial progress has been made towards achieving each of the project’s principal goals. The hoped-for impact of the ‘Click and Listen’ package on phonetics and phonology learning and teaching, and its relevance and value as a linguistic resource on Scots and Scottish English, have both been confirmed by the evaluation results. The evaluation has also helped to reveal where modifications could be made to the selection, organisation and presentation of the courseware materials.

In addition to the subject areas described above, ‘Click and Listen’ materials are potentially of value in the following related range of specialisms, wherever (in Scotland or UK-wide), or at whatever level of education they are taught and learnt:

- Higher Education and Research in the fields of — Dialectal variation; (T)EFL; Child Acquisition of Language; English Language – particularly as it relates to Social and Regional Variation; Linguistics; Historical Linguistic Studies; English Literature and Scottish Literature.
- Vocational Pursuits — the project’s potential is not, of course, confined to the academic community or indeed to the UK. Given that it is networked, professionals in a wide and related range of occupations who have an interest in speech variation would find the resource of great use – actors, speech therapists (especially if moving to Scotland from another area),

trainee teachers and those seeking in-service training in English Language and, especially, Scots.

- Primary and Secondary Education — with a little modification, the ‘Click and Listen’ materials would prove invaluable in primary and secondary schools. The present lack felt by many teachers of knowledge, experience and skills in recognising, describing and demonstrating differing accents could in this way be met.

## Acknowledgements

The authors would like to acknowledge the valuable contributions of Eddie Rooney, Janet Beck, Tom Somerville and Kenny MacDonald to work of the project. The project was funded by the Scottish Higher Education Funding Council.

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