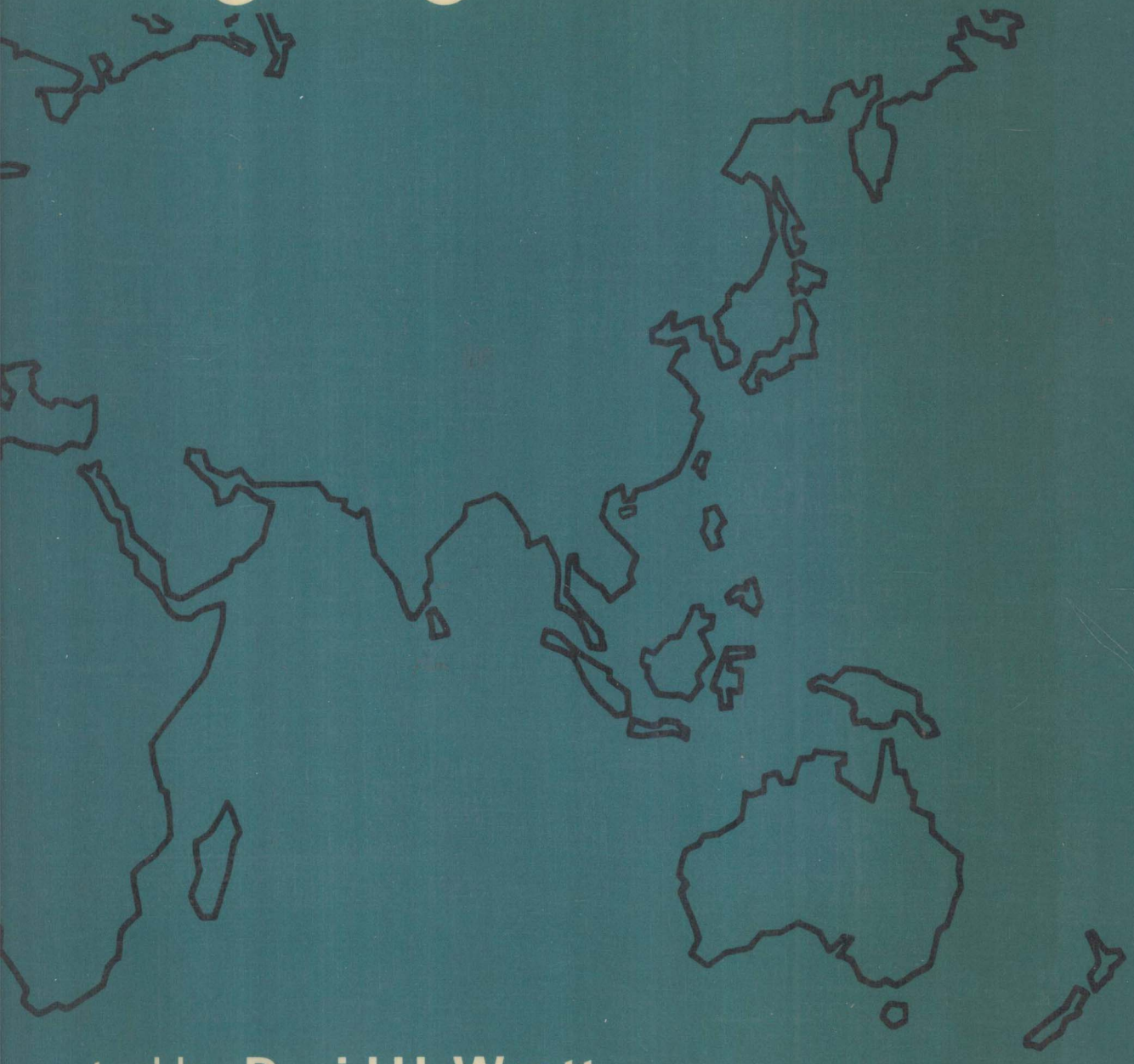
Computer-Assisted Language Instruction



ted by **David H. Wyatt**

Computer-Assisted Language Instruction

Edited by

DAVID H. WYATT

American Language Academy, Rockville, Maryland, U.S.A.

PERGAMON PRESS

Oxford · New York · Toronto · Sydney · Paris · Frankfurt

U.K.	Pergamon Press Ltd., Headington Hill Hall, Oxford OX3 0BW, England
U.S.A.	Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, New York 10523, U.S.A.
CANADA	Pergamon Press Canada Ltd., Suite 104, 150 Consumers Road, Willowdale, Ontario M2J 1P9, Canada
AUSTRALIA	Pergamon Press (Aust.) Pty. Ltd., P.O. Box 544, Potts Point, N.S.W. 2011, Australia
FRANCE	Pergamon Press SARL, 24 rue des Ecoles, 75240 Paris, Cedex 05, France
FEDERAL REPUBLIC OF GERMANY	Pergamon Press GmbH, Hammerweg 6, D-6242 Kronberg-Taunus, Federal Republic of Germany

This edition 1984

Library of Congress Cataloging in Publication Data
Wyatt, David H.
Computer-assisted language instruction.
(Language teaching methodology series)
1. Language and languages—Study and teaching—Data processing—Addresses, essays, lectures. 2. Electronic data processing—Computer-assisted instruction—Addresses, essays, lectures. I. Title. II. Series.
P53.28.W93 1984 418' .028'5 84-416

British Library Cataloguing in Publication Data
Wyatt, David H.
Computer-assisted language instruction.—
(Language teaching methodology series)
1. Language and languages—Computer-assisted instruction
I. Title II. Series
407'8 P53

ISBN 0-08-030327-7

First published as a special issue of the journal SYSTEM: The International Journal of Educational Technology and Language Learning Systems, Volume 11, Number 1 and supplied to subscribers as part of their subscription.

Printed in Great Britain by Grillford Limited, Stony Stratford, Milton Keynes

PERGAMON INSTITUTE OF ENGLISH (OXFORD)

Language Teaching Methodology Series

Computer-Assisted Language Instruction

Other Titles in this series include:

ALTMAN, Howard B and C Vaughan James *Foreign Language Teaching: meeting individual needs*

BRUMFIT, Christopher J *Problems and Principles in English Teaching*

CARROLL, Brendan J *Testing Communicative Performance: an interim study*

DUFF, Alan *The Third Language: recurrent problems in translation into English*

FISIAK, Jacek (ed) *Contrastive Linguistics and the Language Teacher*

FREUDENSTEIN, Reinhold *Teaching Foreign Languages to the Very Young*

FREUDENSTEIN, BENEKE, PONISCH (eds) *Language Incorporated: teaching foreign languages in industry*

JOHNSON, Keith *Communicative Syllabus Design and Methodology*

KELLERMAN, Marcelle *The Forgotten Third Skill: reading a foreign language*

KRASHEN, Stephen *Second Language Acquisition and Second Language Learning*

LEONTIEV, Aleksei A *Psychology and the Language Learning Process*

LEWIS, Glyn *Bilingualism and Bilingual Education*

NEWMARK, Peter P *Approaches to Translation*

ROBINSON, Pauline C *ESP (English for Specific Purposes): The present position*

SHARP, Derrick W H *English at School: the wood and the trees*

STREVENS, Peter *Teaching English as an International Language*

TOSI, Arturo *Immigration and Bilingual Education*

CONTENTS

Special Issue: Computer-Assisted Language Instruction

INTRODUCTION

This special issue of *System* is devoted to computer-assisted language instruction, an area of the profession which has been receiving an increasing amount of interest in the last few years. Computer-assisted instruction (CAI) is by no means a new concept, having been first introduced in the early 1960s. A tremendous amount of pioneering work took place during the 1970s, with language teaching receiving a considerable amount of attention. However, the implementation of CAI was greatly restricted by the expense of the computers then used for its delivery. With the advent of the new microcomputers, the cost of CAI systems has been dramatically reduced. This has been a large factor in the recent growth of interest in computer-assisted education.

In the first article of this special issue, I attempt to provide a general overview of the field of computer-assisted language instruction in all its diversity as it now exists. Some important points for future consideration are emphasized. In the second, third, and fourth articles, the spot-light is turned onto questions regarding courseware for CAI. Joan Jamieson and Carol Chapelle provide a valuable introduction to the types of language lesson which are already available on one of the older mainframe-based CAI systems—the Plato IV system. The diversity of the different types of courseware provides considerable food for thought for those who associate CAI only with structuralist grammar drill. Glyn Holmes then provides some essential insights into the different approaches to creating CAI courseware. The article points the way to some techniques which permit relatively rapid creation of programmed material. The article by David Sanders and Roger Kenner then sounds a warning note concerning the nature of much existing courseware. As they point out, it is indeed surprising that much of the CAI material demonstrated at recent professional conferences has not come in for harsh criticism in terms of its approach to language teaching.

The next two articles deal with the potential impact of the videodisc on language teaching and CAI. Ed Schneider and Junius Bennion describe a state-of-the-art videodisc project called Montevidisco. This resulted in a microcomputer/videodisc simulation in which the student "pays a visit" to a Mexican village, interacting with its inhabitants and observing the results. As they point out, both the development and delivery of this type of CAI material is presently expensive, although there are prospects for future reductions in cost. In the second videodisc article, Sue Otto describes a project with a much lower cost—the use of the videodisc as a storage medium and resource for teacher video presentations. It may well be that, in the short term at least, this type of low cost/high utility project will be the main usage of the videodisc.

In the final two articles the focus is on the way in which computers process and respond to relatively free student input of language. Difficulties in processing this type of input are currently a serious restriction on language activities in CAI material. In his article, Jim

Pusack provides an excellent introduction to the different types of answer-processing and error correction which are commonly used. Many such techniques operate without any reference to a model of natural language. However, in their article Larry Markosian and Tryg Ager describe a parsing system which does make use of a linguistic model of the target language in analyzing student input.

Naturally, the articles in this issue do not cover the whole range of important topics in computer-assisted instruction for language teaching. In one issue, all we can hope to do is to focus on some of the areas of main interest. Hopefully, future issues of *System* will carry an increasing number of articles on CAI which will help to cover other areas.

Rockville, Maryland, October 1982 DAVID H. WYATT

COMPUTER-ASSISTED LANGUAGE INSTRUCTION: PRESENT STATE AND FUTURE PROSPECTS

DAVID H. WYATT

American Language Academy, Rockville, Maryland, U.S.A.

This article presents an overview of some of the major areas of interest in computer-assisted language instruction. It presents and explains important contrasts between the older terminal-based and newer microcomputer-based CAI systems. Significant problems and concerns in the present state of the art are discussed, and three specific directions for future development and resolution of difficulties are outlined.

1. INTRODUCTION

One of my favorite Dickens novels begins with the words "It was the best of times, it was the worst of times . . .", an observation which epitomizes the state of educational computing as we move into the 1980s. Dickens' novel deals with revolutions, and indeed the adjective 'revolutionary' can be accurately applied to many of the developments of the last five years. Perhaps the most striking of the changes has been the emergence of the microcomputer as a new vehicle for the delivery of computer-assisted instruction (CAI). Without exaggeration, it can be said that microcomputers have completely changed the rules by which the field of educational computing has previously operated. These inexpensive new devices heralded the start of an era in which all educational institutions could realistically look forward to using CAI and other forms of educational computing as a major element in their curricula (Coburn *et al.* 1982). At a stroke, the way was cleared for CAI to make an impact on a much wider section of the educational community.

However, this expansion of our horizons was far from an unmixed blessing. One result has been the fragmentation of what was previously a rather closely-knit community of CAI developers and users. The important differences between microcomputer-based CAI and CAI based on mini- and mainframe computers will be discussed in more detail later in this article. These differences have been quite large enough to cause sharp divisions in approach and implementation between users of the different types of system. Workers in the area of microcomputer-assisted instruction have suffered particularly seriously from a lack of mutual communication of methods and results. Users of large and small computer systems have both suffered from a lack of appreciation of the significance of each other's work.

The problems for the microcomputer-oriented CAI user have become acute in the last two

years as a bewildering number of new brands and models has appeared on the market. Pitfalls, such as the non-transferability of software from one microcomputer to another, have become particularly obvious, although this is an area in which microcomputers may make a very positive contribution in the longer term (Bork 1981). Financial pressures engendered by the expansion in the personal computer market have had the welcome effect of bringing the price even more closely within the reach of most educational institutions. In sum, the present position is one of great promise and great complexity.

2. ACCEPTANCE IN THE FIELD

A number of factors have contributed to the growing acceptance of the potential role for the computer in the language teaching curriculum. However, it is probably true to say that a majority of the profession is still unaware of or unfamiliar with the concepts of CAI, and that the use of CAI is still a subject which can arouse considerable controversy. Some of the objections which are raised to CAI involve general philosophical notions about language as a humanities subject to which a mechanical device such as the computer can make no contribution. Other criticisms of CAI are often founded on particular instances of CAI courseware (programmed materials).

In these circumstances of only partial acceptance, it is important to remember that there is a sizeable area of language learning to which virtually all of the objections to CAI do not apply—the receptive skills (Wyatt 1982). Both reading and listening skills are, by their very nature, highly individual and idiosyncratic. Activities in these skill areas in the traditional classroom take a number of different forms. In some cases, the teacher will select an 'average' speed for the delivery of the listening comprehension passage or for the reading of a text. Whatever speed is selected by the teacher, it will inevitably be too rapid for the weaker students and yet present no challenge to the skills of the more able. In response to this kind of situation, some teachers use a partially individualized approach such as the SRA Reading Laboratories (Parker 1963). However, such 'reading laboratory' materials could potentially be made far more effective by taking the logical step of turning them into computer-based reading materials. The same comments apply to course segments which are designed to increase students' reading speed and fluency. One example of such an attempt in a traditional print medium is to be found in a textbook by David Harris (1966). Again, the potential for increased impact and effectiveness through computerization is very large. Many types of homework or self-study assignment in reading and listening would also lend themselves ideally to computer implementation.

In all of these cases, computerization could bring the full benefits of CAI to bear upon the learning process. Some of the main advantages are: interactive learning, with the student receiving immediate feedback on answers; highly individualized instruction, with the shape of the lesson adapting automatically to the student's demonstrated ability so far; student-centered instruction, with the speed of the lesson directly controlled by the student or based upon his responses so far; and the inherent power and motivating influence of the CAI medium.

As CAI techniques and materials become more widely known in the language teaching

community, attention is already shifting from the means of delivery to the content of the computerized material. The medium of delivery is likely to be less and less a source of controversy within the profession. The focus of discussion, comment and criticism is shifting to the nature of the materials, particularly those which are being demonstrated at professional conferences. In the future, then, CAI seems likely to be judged much more on the nature of its teaching materials. Unfortunately, many teachers seem automatically to associate CAI with structuralist-inspired grammar exercises. In the current climate of communicative language teaching theory, this is a serious problem which CAI designers and users should be working to correct.

3. HARDWARE

The advent of the microcomputer means that there are now two principal classes of computer systems for educational purposes: terminal-based and microcomputer-based.

3.1. *Terminal-based systems*

The older computer-assisted instructional systems operate with extremely powerful 'mainframe' computers, such as the PLATO system, based on CYBER computers. In a mainframe system, each student works at a computer terminal comprising a typewriter-like keyboard and a video unit. The terminal is entirely dependent on the mainframe computer, to which it is connected via microwave hookups, telephone lines, or the like. All lesson materials are stored in the mainframe computer, which may be on the same campus as the terminal or several thousand miles away.

A very similar type of system can be based on relatively smaller computers known as minicomputers. A well-known example of this is the TICCIT system (Hall 1979). In this type of system, approximately 120 terminals may use the central minicomputer at any time, as compared with 600 terminals which can be in use simultaneously on the University of Illinois PLATO mainframe system (Hart 1981). Users of minicomputer CAI systems are generally limited to campus terminal locations, with each institution possessing its own minicomputer, in contrast to the frequent use of PLATO via long-distance networks by institutions which have terminals but no PLATO mainframe computer.

3.2. *Microcomputer-based systems*

The second main type of computer-assisted instructional system involves the use of individual microcomputers in place of terminals. In its most common configuration, each system includes the microcomputer, with a typewriter-like keyboard, a video unit, and one additional component: a disk drive. The lesson materials are usually stored on computer diskettes (approximately the size of a 45 rpm record), and the disk drive is required to load the programmed exercises from the diskettes into the computer. Such microcomputer systems are entirely independent, needing only a normal power supply for operation, although they can also be connected into microcomputer networks or to larger computers.

There are important differences between these two types of system, but before any comparisons are drawn, one main point should be emphasized: both types are capable of providing most of the outstanding benefits of CAI.

The terminal-based systems are expensive and require considerable expertise for their installation and maintenance. It is likely that the introduction of PLATO terminals, for example, would require considerable inter-departmental planning and budgeting. Microcomputer-based systems are relatively inexpensive and require very little technical knowledge. A 'learning center' of microcomputers could quite easily be established and run by a language department acting alone.

Terminal systems are generally more powerful than microcomputers, being capable of displaying more text on the video screen and providing convenient student performance record-keeping. Other advantages include access to a large array of student aids, such as a comprehensive computerized dictionary, during exercises. However, some microcomputers have built-in features such as sound generation and color video which may not be available on many terminals. Also, some extremely powerful microcomputers are now becoming available.

Within the developed world, therefore, the choice between the two main types of system will partly be a question of budget. Once teachers are convinced of the value of CAI, the choice becomes a matter of which system is financially feasible. In those parts of the world where spare parts and technical expertise are in shorter supply, however as they are the choice is much easier. The decision to purchase microcomputers for educational purposes in these countries is not surprising: microcomputer systems are more reliable and, independent, the failure of one does not affect the others. With terminal systems, a failure in the mainframe or microcomputer prevents all of the terminals from operating.

Within the near future, many authorities in the field see the microcomputer becoming the predominant means of implementation of CAI. According to Paul Tenczar, "Microcomputer stations offer more performance at a fraction of the cost of a terminal networked to a central timesharing system" (Tenczar 1981). This will certainly be true as microcomputers such as the Regency, developed specifically for educational purposes, begin to emerge. Alfred Bork (1981), whose work recently has been based on the TERAK microcomputer, argues that microcomputers may also help to solve the problem of transporting courseware to run on computer systems other than those for which it was originally programmed. A survey by the U.S. Department of Education (1982) shows that, for elementary and secondary schools in the U.S.A., the number of microcomputers in use tripled between fall 1980 and spring 1982. In these schools, microcomputers now outnumber terminals by a ratio of four to one.

In any case, the distinction between mainframe and microcomputer systems is now beginning to blur. The PLATO system, for example, is now developing 'terminals' which are also microcomputers, solving some of the problems of telephone connection charges as well as unreliability. It seems likely that CAI systems will ultimately consist of powerful microcomputers capable of being connected to central mainframe systems from time to time when necessary.

To complement these basic CAI systems, a number of high-technology options are becoming available. These hardware developments, such as the videodisc, are discussed in a later section.

4. READY-TO-USE COURSEWARE

In the present state of development of hardware, the principal question that must be asked about courseware is "Which computer system will it run on?" The present state of affairs in educational computing is a close parallel to the Tower of Babel. In general, courseware designed and programmed in one computer language to run on one computer system will not run on any other computer system. Materials programmed on mainframe computers are extremely unlikely to run on microcomputers, and materials programmed on one microcomputer are unlikely to run on any other brand or model of microcomputer. It is wisest to assume that courseware cannot be successfully transported to any other computer without detailed testing of that assumption.

In the short term, this is where mainframe and minicomputer systems have a tremendous advantage, because systems such as PLATO or TICCIT already have a large amount of courseware available. At present, microcomputers have much less ready-to-use courseware available for them. With microcomputer-based CAI, it is very likely that an institution will have to spend at least some time on developing its own courseware. This has led to an intense interest among microcomputer users in methods of authoring courseware, a subject which will be discussed in the next section. The availability of 'utility' software to aid in the development of CAI courseware is also an important factor in the selection of microcomputer systems. This tends to make the older microcomputers a more attractive proposition despite some of the advanced features of newer microcomputers.

The courseware situation for ESL and foreign languages for microcomputers is now beginning to improve, with both educational institutions and commercial publishers beginning to produce effective materials. Another sign of the growing importance of microcomputer-based CAI is that materials programmed on mainframe and minicomputer systems are now being adapted for use on microcomputers such as the Apple II and Texas Instruments TI 99/4A. However, redesigning and reprogramming materials from these older systems for use on microcomputers is an extremely time-consuming task, and this will limit the rate at which transported courseware becomes available. On the other hand, translation of courseware from one microcomputer to another should in principle be a much simpler operation.

5. AUTHORING COURSEWARE

The design and production of effective CAI courseware can be approached in a number of different ways which demand very different levels of expertise. At first sight, there is very little agreement among authorities in the field on how this process may best be accomplished. At the level of least sophistication, there are CAI authoring systems which demand virtually no knowledge of programming whatsoever on the part of CAI course writers. These systems are aimed at experienced teachers or materials developers who wish to produce CAI materials without having to invest time in learning to program. Such 'template' systems offer a variety of pre-designed formats into which the teacher can enter new exercise material. Considerable variation in content may be possible within the parameters of the fixed lesson template. Single exercises, groups of exercises, and sequences of groups can be developed by a user with no knowledge of programming.

A second method which is frequently advocated (Bork 1981), and which requires no knowledge of programming, is the "team" approach. In this case, the experienced teacher/materials designer works with qualified programmers, who do all the necessary programming and then submit the courseware for review and editing by the teacher. The only restrictions in this 'free-form' approach lie in the teacher's ability to communicate effectively to the programmers what is desired. However, this can involve time-consuming cycles of design, programming, editing, and reprogramming, and it is beneficial for the teachers to have some knowledge of instructional programming. One advantage of this approach is that the programs can be written in widely available general-purpose programming languages, which enhances their transportability from one computer to another.

A further approach, identical in many respects to the team approach, is possible if experienced teachers/materials developers are available who are also well qualified programmers. Such individuals could themselves carry out all of the functions of the team, while greatly reducing the amount of time required for courseware development. Unfortunately, such individuals are relatively scarce.

Another method involves using an educational authoring language with powerful functions designed specifically for educational purposes. Such languages can be much simpler to learn than general purpose programming languages. They are therefore very appropriate for teachers who would be willing to invest some time in learning to program, but who would be deterred by the difficulty of learning a general-purpose language. Using an educational programming language, the teacher/programmer has a great deal of flexibility in the development of courseware.

In the past, one of the major obstacles to the widespread use of CAI was the high cost of development of acceptable courseware. In general, this is still the case today. High quality materials are being developed using 'free-form' approaches, but the rate of their production and testing is slow and the expense correspondingly high. Although there is no general agreement on which approach to take, there does seem to be a significant movement towards the adoption of authoring systems and template approaches to CAI. At the moment, the materials produced by this approach are less sophisticated and more restricted than with other approaches. However, it appears likely that sound and worthwhile courseware can be developed in this way at far greater speed and far less expense.

6. ADVANCED TECHNOLOGY

Exciting developments are under way in a number of areas of CAI technology which will permit the attachment of advanced new hardware, or 'peripherals', to the basic main-frame, mini-, or microcomputer system. Many of them have important applications for future language instruction *via* computers.

Perhaps the most exciting of these developments is the videodisc. Modern videodisc technology permits the storage of up to 55,000 still frames on a single side of the disc. A videodisc player can very rapidly display any of these 55,000 still frames, or begin to

show a movie sequence of frames starting at any point. Videodiscs also include two independent high fidelity audio channels. When linked to the basic CAI system, videodiscs have a host of important language teaching applications. For example, they can provide listening comprehension materials in which the usual audio presentation is accompanied by a rich visual context. Proposals are already being made for the development of entire textbook series in which class activities are highly integrated and in many cases preceded by visual and audio materials presented through a classroom microcomputer and videodisc player. Interactive simulations are also being designed in which the student is transported through a series of carefully planned language experiences, watching movie sequences on the screen which show the results of the language decisions he makes.

A similar but more restricted type of peripheral is the random-access audio-recorder. This functions in a similar way to a cassette recorder, but with enormously more power for language teaching applications. Consider the situation in which students are listening to brief recorded passages and then answering questions about them on the computer system. As with the videodisc, random access audio devices are entirely controlled from the CAI system, so that from the student's point of view the lesson runs automatically. Suppose that the student's inaccurate answers demonstrate that the listening passage just attempted was presented at too rapid a speed. With a random access audio device, the lesson can immediately branch to an entirely different part of the audio disk so as to present the student with a similar listening passage but at an appropriately slower speed, again followed by questions. On the other hand, if a student demonstrated full comprehension after the first listening passage, branching could take place to a similar but relatively faster listening passage stored at a different point on the audio disk. This type of response and adaptive branching based on the student's performance is slow and difficult with a sequential medium such as audio tape. For the same reason, the videodisc represents a much more powerful medium than the videotape.

A third peripheral worthy of mention is the touch-sensitive or light-sensitive video screen (Marty 1982). With a touch-sensitive screen, very rapid drill on certain types of language materials is possible because the student needs only to touch the correct answer on the screen. Another approach is to provide the student with a special wand known as a 'light pen' with which to point to the screen. All of these facilities can generally be added to mainframe, mini-, and microcomputer CAI systems.

Another area of advanced technology receiving a great deal of attention at the moment is that of speech synthesis and digitization. The production of extremely life-like synthesized speech is a reality today, but unfortunately involves the use of very large amounts of computer memory. Less memory can be used, but the quality of the synthesized speech suffers greatly. As much larger amounts of memory become available at reasonable prices, this area will be of increasing interest to language teachers. At present, however, affordable speech synthesizing and digitizing hardware generally produces speech which is not suitable in quality for language teaching applications.

7. DIRECTIONS FOR DEVELOPMENT

Computer-assisted language instruction is an area of our profession in which rapid growth is beginning to take place. At the same time, we have reached a crossroads in a number

of areas and will need to make important decisions which will affect CAI activities for years to come. Let us look at some of the important problem areas and discuss directions for their solution.

One of the main obstacles to the expansion of CAI is undoubtedly the lack of communication between microcomputer users and large system users. One has the sense that similar projects are being conducted simultaneously in many different locations, with tremendous wastage of time and energy. Organizations such as CONDUIT[1] and SMALL[2] must be made to play a much larger role in the distribution of important information of this kind.

Another area of real concern is the question of courseware quality versus courseware sophistication. There has been an increasing tendency for CAI professionals to criticize other CAI courseware on grounds of style such as sophistication and special effects. This tendency can be expected to grow as more and more courseware is produced by non-professional programmers or by using authoring systems (Wyatt 1981). However, it is perfectly feasible to produce valid, effective courseware of good quality which is relatively unsophisticated. If such courseware serves its educational purpose effectively, and holds student interest, it seems counter-productive to criticize it. Criticism should be based primarily on educational quality, not matters of taste such as sophistication and style.

A final and most important crossroads for CAI is the amount of attention being paid to advanced technology CAI systems. At present, for example, a highly sophisticated educational microcomputer may cost 15 times as much as a simple basic system. In terms of financial realities, a decision might have to be made between the acquisition of one or two extremely advanced systems or 15–30 basic systems. Some experts have taken a strong position in favor of the absolute need for powerful, advanced systems. Unfortunately, if this attitude becomes widespread, we will be returning to the mid 1970s, when the growth of CAI was extremely slow due to the very high cost of installing CAI systems. This author firmly believes that a very wide range of important language teaching applications can be fulfilled with relatively simple CAI systems, and that an interest in future possibilities should not deter us from the practical implementation of what is now affordable and feasible.

NOTES

[1] CONDUIT is an organization which helps to distribute courseware in versions which will run on different types of computer. It publishes the journal *Pipeline*. Address: P.O. Box 388, Iowa City, IA 52244, U.S.A.

[2] SMALL is the Society for Microcomputer Applications in Language and Literature. It publishes a quarterly journal, *MALL* (formerly *MICRO*). Address: University Station, Box 7134, Provo, UT 84602, U.S.A.

REFERENCES

BORK, A. (1981) *Learning With Computers.* Bedford, MA: Digital Press.

COBURN, P. *et al.* (1982) *Practical Guide to Computers in Education.* Reading, MA: Addison-Wesley.

HALL, J. W. (1979) The microcomputer and foreign language instruction, unpublished thesis, Brigham Young University, Provo, UT.

HARRIS, D. (1966) *Reading Improvement Exercises for Students of English as a Second Language.* Englewood Cliffs, NJ: Prentice-Hall.

HART, R. (1981) Language study and the PLATO system. *Studies in Language Learning,* **3** (1): 3–6.

JAMIESON, J. and Chapelle, C. (1982) ESL on the PLATO IV system. *English for Specific Purposes* 58/59.

MARTY, F. (1981) Reflections on the use of computers in second-language acquisition—II. *System* **10** (1): 1–11.

PARKER, D. H. (1963) *SRA Reading Laboratory IIIb.* Chicago, IL: Science Research Associates.

TENCZAR, P. (1981) CAI evolution: mainframe to micro. In *Proceedings of the International Conference on Cybernetics and Society,* October, 1982.

U.S. DEPARTMENT OF EDUCATION (1982) *Instructional Use of Computers in Schools* (fast response survey system). Washington, D.C.

WYATT, D. (1981) Using visual and sound effects to enhance non-professional CAI language programs. *MICRO,* **2:** 11–14.

WYATT, D. (1983) Teaching the receptive skills. In *Proceedings of the* 1982 *FLINT Conference* (forthcoming).