

REPORT  
TO THE  
NATIONAL ENDOWMENT FOR THE HUMANITIES  
ON THE  
AMERICAN PHILOLOGICAL ASSOCIATION'S  
SUMMER INSTITUTE IN COMPUTER APPLICATIONS TO CLASSICAL STUDIES  
AT THE  
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN  
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Institution: UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Title: AMERICAN PHILOLOGICAL ASSOCIATION SUMMER INSTITUTE IN  
COMPUTER APPLICATIONS TO CLASSICAL STUDIES

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## SUMMARY

The Institute was originally proposed with a combined pedagogical and research orientation. In particular, certain projects in Greek and Latin literature were outlined for investigation using the computer. In the event, the pedagogical aspects predominated over the research applications. This was largely the result of the very diverse background and previous experience with computers of the nineteen participants. It seemed more immediately useful to concentrate on basic instruction in several computer languages which could illustrate and encourage a wide variety of approaches in the use of the computer. The time and energy of the staff were thus largely consumed in teaching though it should be noted that all instruction was essentially research oriented.

The University of Illinois Digital Computer Laboratory furnished all the physical facilities and equipment. The central system is an IBM 360/75 running under P.C.P. linked to an IBM 360/50 running under A.S.P. with a 2314 disk facility and 9 track 1600 BPI tape drives. The Institute had for its own use an IBM 2780 Reader-Printer and a teletype machine for remote entry to the Illinois system and to systems at other locations. Use was made especially of the General Electric 635 time-sharing system at the Kiewit Computation Center at Dartmouth College. Equipment and facilities were very good, despite the occasional inconvenience of the central system's being down, and contributed heavily to the success of the Institute.

Intensive instruction in FORTRAN was offered during the first part of the Institute followed by instruction in SNOBOL and PL/1 for those interested in these languages. Instruction was also given in the Assembler Language for the IBM 360. Initial instruction was organized in a classroom-laboratory situation. Lectures on the program languages were followed immediately by laboratory sessions in which programming experience was rapidly developed in the participants by submitting several short practice jobs with quick turnaround. Later in the Institute participants were encouraged to strike out on their own and instruction was provided mainly through a tutorial or supervising procedure.

Regular courses in statistics and computational linguistics were available throughout the Institute to interested participants. Somewhat over one-half of them seemed to have availed themselves of these opportunities. Instruction and general guidance in computer applications were also provided by the various seminars, colloquia and lectures given by the staff, visiting lecturers and the participants themselves. These events occurred almost daily throughout the six-week period of the Institute. The program of lectures was in particular one of the most successful parts of the Institute.

Thirteen different visitors contributed to the seminar series. The seminars investigated criteria for the recognition of special features

of style and originality in individual authors, Homeric epic and the formulaic style in Greek literature, Greek and Latin metrics, and various problems in computational linguistics. The seminars dealing with stylistic questions seem to have been the most popular among the participants.

Although basic instruction in programming was emphasized during the Institute, ample time and opportunity were provided for individual research. Research applications of the computer were demonstrated with a wide variety of techniques applied to Catullus 64, a poem of ca. 400 lines. Concordancing, automatic scansion, metrical indexing, and different statistical studies were performed on this sample text. The programs developed in this project were available to all the participants for their own work. Research was also conducted on photocomposition with special attention to Greek and Ugaritic where unusual alphabets and printing formats are required. This work will probably be in the long run the most valuable technical contribution of the Institute. The research of eleven participants is described in detail in the body of the report. Their research was performed on a wide range of Greek and Latin authors (and in one instance on Ugaritic texts) and centered on problems in stylistics, syllabification in natural languages, automatic scansion, phonology and morphology of Latin, concordancing, metrics and rhythmical features of poetry, automatic recognition of word and thought clusters, prose rhythm, sound patterning in poetry, statistics and stylistics, and computerized phototypesetting.

An extensive program of lectures by distinguished visitors was arranged with the assistance of a special grant to the Institute for this purpose from International Business Machines Corporation. The thirteen visitors came from the United States, Canada, the United Kingdom, and Italy. Because of the short time available for making arrangements these visits could not be spaced as advantageously as might otherwise have been done. Nevertheless, their overall contribution was substantial and received the highest acclaim from the participants. The visitors were a constant stimulus and source of new and different ideas, many of which were immediately tested on the computer. In this way they presented a broad panorama of possibilities in the use of computers and gave participants and staff alike much to reflect upon in the future.

## PART I

### NARRATIVE REPORT ON THE ACTIVITIES OF THE INSTITUTE

#### Introduction

It is a pleasure to report to the National Endowment for the Humanities on the results of the first Summer Institute in Computer Applications to Classical Studies. Since, so far as we know, this was the first Institute of its kind, there was some disparity between our expectations and our final results. Some of these results were gratifying and exceeded our expectations; others regrettably fell short. Our most important achievement should be mentioned first: we are confident that we have made a valuable contribution to Classical Studies and to the promotion of the use of computers by humanistic scholars through training a number of established and incipient scholars in the use of the computer in their work. Participants, who when they arrived at the Institute were completely unfamiliar with computers and computer applications, are now programmers able to return to their home institutions and carry on significant study with computers. From this pedagogical point of view the Institute has been a resounding success.

On the other hand we learned that it was impractical and perhaps undesirable to expect that the Institute could sponsor any solid scholarly production within its short six-week existence. Since the preparation of publishable materials was one of the Institute's stated goals, further explanation on this point is necessary. It had been our initial assumption

that the participants in the Institute who had no very specific goals of their own would cooperate in working on an Institute project. Many of the participants, however, did in fact have specific projects on which they wished to work, while the remainder wanted, quite justifiably, to be introduced to the entire spectrum of computer applications rather than to be enlisted on the more restrictive tasks involved in a single large project. Indeed some of them felt that it would have been unproductive for them, in view of their elementary knowledge of programming, to work on a project where their own contribution would have been slight and would have involved them in fairly routine, not to say tedious tasks such as proofreading. Also the small involvement which they would have had directly in the actual planning for a large research project would have been less productive for them than what they were actually able to do on their own. The staff also felt that it would not be proper or feasible to employ the participants in an essentially menial role in carrying out a research project. Consequently, none of the large-scale projects initially envisioned for completion during the Institute were carried out with the exception of a reverse concordance to Homer's Iliad which was produced by Professor David Packard early in the Institute. Rather than to bring a single large project to completion, we chose to illustrate a wide variety of approaches on sample materials. In our view this pedagogical approach helped to minimize the less challenging tasks necessarily present in the production of a single work and to maximize the possibility of illustrating a variety of computer applications. It is our belief that this approach

will garner, in the long run, a larger harvest of scholarly results. Some indication of this belief may be seen from the description of several individual projects, some of which are quite ambitious, which are presented below. It might be added that even within this circumscribed set of objectives, considerable strain was placed upon members of the instructional staff in attempting to meet pedagogical requirements of participants while trying to advance their own research projects.

#### Facilities

Space and physical facilities for the Institute were provided by the Department of Computer Science in the Digital Computer Laboratory. A large room was divided by a partition into two parts (see Appendix I). The inner room was used for a classroom with space for 28 persons. The outer room was the machine and work area. In it were installed the IBM 2780 Reader-Printer, two IBM 029 keypunches, a model 33 teletype machine for remote entry to the IBM 360 system in the Digital Computer Laboratory and to a General Electric 635 timesharing system at the Kiewit Computation Center at Dartmouth College. There were five 3' x 6' tables for work space. Several 18" deep shelves were attached to the partition wall for storing IBM cards, tapes, books and other materials. A storage cabinet and bulletin board completed the furnishings. A second classroom was available in another part of the building for the seminar in computational linguistics and occasionally for the lectures by visitors.

Although the work area was too small for the number of persons involved, the juxtaposition of classroom and work area was generally satisfactory and obviated some difficulties which would have otherwise arisen. The actual layout of the area helped to integrate the different aspects of the Institute and to promote a sense of unity among the participants. However, some participants were bothered by the noise from the equipment, and not everyone cared for the constant togetherness, although it was easy to escape at any time. Nevertheless, in our opinion, the advantages of a single teaching and work area clearly outweighed the occasional inconveniences. The noise nuisance could probably have been avoided if two adjacent rooms rather than a single partitioned one had been available. The only real inconvenience was the insufficient number of tables and inadequate working area. In retrospect, it would have been better to set up the classroom with small tables and chairs instead of the standard classroom seats employed.

A special collection of books on various topics in classics, computer science, linguistics and statistics was placed in the classroom. There was also a set of IBM manuals, several of them in multiple copies. Xerox copies were made and individually bound of almost every article which has appeared in the past decade on computer applications in classical and literary studies. The Institute thus had its own reference library immediately at hand.

The computer facility available to the Institute consisted of an IBM 360/75 with 500,000 bytes main storage running under P.C.P. linked

to an IBM 360/50 running under A.S.P. A 2314 disk facility was available as well as six nine track 1600 BPI tape drives, but no 2311 disk drives and no data cell. An 800 B.P.I. 7 and 9 track tape drive was available but could not be reached from the 360/75. It was necessary, therefore, to run separate tape copy jobs to convert 800 BPI tapes supplied by users.

Normal users of the computer center submit their jobs at a batching window where they also receive their output. Short jobs are read into a card reader at the window while the user waits, but longer jobs are put aside to be read later. In some cases members of the Institute made use of this arrangement, but the great majority of Institute jobs were submitted from the 2780 terminal in the Institute class room and printed by the 2780 printer. It was also possible to submit jobs at one place and have the output printed elsewhere. This proved useful for very long jobs which would have overloaded the printing capacity of the 2780 printer.

The system schedules jobs on the basis of their length. A job which required less than 40 seconds of 360/75 time and printed less than 500 lines received top priority. The next category extended to 2 minutes and 2000 lines. Most Institute jobs could be run on the two highest priorities; jobs which ran for more than two minutes were rare. For jobs in the first category turnaround service was normally excellent. Precise statistics were not kept but these jobs would often return within minutes, and a delay as long as 30 minutes was the exception. (see Appendix II).

The good service provided for very short jobs and the use of the 2780 terminal were absolutely vital for the success of the teaching effort. If participants had been required to submit these short jobs at the normal batching window, it is inconceivable efficient and satisfactory service could have been achieved. After the first week each participant was allowed to submit his own jobs from the terminal. This informal arrangement contributed greatly to the user's convenience. Twenty-five persons were using the terminal during the day, and we can report that hardware difficulties with the 2780 terminal were negligible. No skilled operator was provided or required for the 2780.

The IBM 2780 Reader-Printer used by the Institute was the first one to be installed in the Digital Computer Laboratory. During the first few weeks there were, therefore, a few systems programming problems. But these problems were soon almost completely eliminated. During the latter part of the Institute the terminal functioned smoothly. The local system programming did not provide for the punching of cards at the terminal, which could have been convenient. However, cards could be punched at the routing room which was only a short distance away in the building.

At a teaching institute the most important single factor is the turnaround time for short jobs. This was excellent. Some delay, however, was experienced in running longer jobs. On a few occasions several days elapsed between submitting a three-minute job and receiving the output. This problem became especially acute during the third week of the Institute when it was aggravated by persistent machine failure.



To some degree the combination of slow turnaround for long jobs and machine breakdown at this point interfered with the momentum of the Institute's program. Turnaround delay was compounded for jobs which required tapes or disks to be mounted. When it became clear that these delays were serious obstacles to progress on several Institute projects, we arranged for special priority for a limited number of Institute jobs. This relieved the problem to some extent but did not entirely solve it. As at other computing centers which employ large scale batch processing, the machine was frequently out of order. This was frustrating at times, but except during the third week of the Institute, did not pose a serious barrier to our work.

Computing facilities and service at the University of Illinois were considered excellent, but it does not yet have certain facilities which might be important in a future institute. For instance, an upper-lower case print train had been ordered but it did not arrive in time to be used during the Institute. A calcomp plotter was installed and operating, but functioned so erratically that we did not have the confidence to encourage participants to use it. No cathode ray tube plotter was available. A potentially serious deficiency was the lack of local time-sharing facilities. We were able to use the General Electric system at Dartmouth College via long distance telephone line as well as, on a few occasions, some systems in other states, but the expense of long distance telephone service did not permit the participants to make daily use of time-sharing systems. (However, in the end this policy turned out to be a false economy.) We believe that the availability of inter-

active time-sharing should not be overlooked in the planning of a future institute.

In general, as we stated above, local service was very good, and for running short instructional jobs it was excellent. The staff was very helpful and the System Director, Dr. H. George Friedman, assisted the Institute far beyond the call of duty. A major ingredient of the success of the Institute was the "hands on" philosophy which we were able to establish among the participants. The IBM 2780 terminal was available at all hours of the day and night to all participants. Many of the dedicated ones frequently stayed well past midnight working on their projects, and in these circumstances they were able to work with the machine without any restrictive supervision.

#### Instructional Program

The background of the nineteen participants varied widely, ranging from that of a professor of many years' standing in Classics but with no programming experience to that of an undergraduate who became a Classics major in the last year but was already a skilled programmer (see Appendix III). The majority of the participants were graduate students or junior faculty in Classics. They came from places as distant as California and New England, Mexico and Canada. Some came with specific plans for research projects; others with an unformed desire to learn to use a computer. Diversity in background and aptitudes provided some initial problems as individuals discovered which parts of the instructional

program were most appropriate for themselves and their particular interests. For the most part, these problems were minor and were resolved satisfactorily within the first few days of the Institute. However, a major difficulty was caused by the very short lead-time in making final plans. Many of the participants could not be notified of their final acceptance until May 30, a scant two weeks before the opening of the Institute. Advance planning on projects for their part was generally impossible. The staff labored under the same difficulty in trying to decide at the last minute whom to admit. In general it seemed that those participants profited most who had formulated fairly clear ideas about their goals and interests. Perhaps this should be a consideration in admitting applicants to comparable institutes or workshops in the future.

Since there was such a variety of interests and aptitudes, it seemed necessary to provide as many options as possible within the program. Participants had the opportunity to attend all sections of the program, but it was not expected that all parts of the program or that all the different visitors would be of equal interest to all. Furthermore, in order to stimulate interaction among all members, it was decided as an essential part of the program to schedule sessions at which participants would describe to the group the research plans or problems in which they were engaged. Questions, suggestions, and criticisms flowed freely from the audience, and it is clear that the thinking of all was stimulated by these sessions. In sum, we tried to do away as quickly as possible with the teacher-pupil relationship so

that participants could develop their independent approaches and attain the independence necessary to cope usefully with their home computer installations.

It was very gratifying to see how those participants who had made greater progress in programming became tutors and consultants to others who were not able to progress so quickly. Equal success was not achieved by all participants, but to a high degree they will all be able to work independently in this field. Indeed the field itself is so new that members of the staff believe that they too learned a good deal at the Institute.

Intensive basic instruction in FORTRAN was offered during the first two weeks with emphasis on how to use the language to solve non-numerical problems. Most FORTRAN textbooks and introductory courses do not explain how FORTRAN can be used for literary problems. For this reason, a mistaken notion has arisen that it is impossible or difficult to work with FORTRAN on non-scientific problems. With appropriate instruction, FORTRAN can in fact be used successfully for solving many important problems in humanities, and this fact was brought out by the exercises and programs which the participants wrote. Since FORTRAN is the only language available on many smaller computers, it is vitally important to dispel the idea that it is a restrictive language for humanities programming. The Institute did not, of course, neglect instruction in other languages such as SNOBOL and PL/I for those who will be able to use them at their home computers.

We were also fortunate in having the services of Mr. John F. Sowa of International Business Machines Corporation during the entire Institute. He gave a useful orientation to all participants with a series of lectures surveying the computer and systems organization. He also gave two weeks of instruction on SNOBOL 4 programming and two weeks of instruction on PL/I. He offered valuable services on an informal basis, tutoring participants with problems in various languages including FORTRAN and assembly language. He spent a considerable amount of time developing a sample program for typical problems in analyzing textual material.

It may be held that the introduction of more than one language was done at the cost of developing fuller competence within a single programming language. It may also be held that SNOBOL 4 or PL/I are languages more appropriate than FORTRAN to the character manipulation operations central to humanistic work with computers; and that one of these should, therefore, have been the first language introduced to participants. These are worthy views. On the other hand, the almost universal availability of FORTRAN and the possibility of extraordinarily swift processing of class assignments through the WATFOR compiler seemed decisive in selecting this language to begin with. The final result, while not completely satisfactory to all, seems to have been a reasonable compromise. Participants new to programming and returning to home installations where one or another of these languages is most readily available seem to have appreciated instruction in the particular language which they will be able to use. Furthermore, a strong argument can be made for

the case that a serious humanities programmer should be able to use assembly language as well as the higher level languages. Consequently, an introduction to Assembler was given during the first two weeks of the Institute, and several participants became quite proficient in writing in the IBM 360 language.

The availability of the 2780 remote access terminal in the Institute's room made it possible to submit jobs frequently. Particularly during the first weeks of the Institute, as the participants were learning FORTRAN, time was set aside before and after class sessions for laboratories, with every encouragement to submit small programs. During these periods, particular attention was given to submitting FORTRAN practice jobs, usually several at a time under the WATFOR compiler, which allows several jobs to be run together and provides extensive error diagnostics. The fast turnaround of jobs during this period was helpful in enabling beginners to understand their errors, often with the help of more experienced participants; this interplay was important in establishing contact among those with various degrees of programming proficiency.

To avoid the problems inherent in learning to operate a 2780 itself at the same time that participants were learning programming languages, the batched WATFOR jobs were generally submitted under the supervision of one of the staff members. (In the future it might be advisable during the initial stages of instruction to provide an assistant to help with the mechanical aspects of the procedure, leaving others free to advise on programming problems.) The importance of being able to

submit even small jobs as many times as necessary in quick succession cannot be overemphasized; it is chiefly through such repeated attempts that skill and confidence can be obtained. As participants gained experience and began using languages other than FORTRAN, the specific times for laboratory sessions were discontinued, and individuals began submitting their own programs directly.

Mr. Richard Montanelli, a graduate student in statistics, did a remarkably able job in contriving a course designed to present basic statistics, applications of statistics to literary studies, and an overview of statistical methods to humanists. Once again, we had no hope of creating finished statisticians in the short time available to us, and yet we dare say that this was one of the few times, if ever, that a statistics course for humanists has ever been designed and presented. Our major goal here was to offer enough insight into statistics to allow the participants to be able to judge for themselves the relevance of statistical applications to their problems.

The main purpose of the statistics course was to acquaint the participants with the basic ideas, assumptions, and techniques of statistics, especially as applied to literature. We began by discussing the problems of measurement, especially the different measurement scales from nominal to ratio. Next we discussed the basic elements of descriptive statistics including frequency distributions and measures of dispersion and of central tendency. Under the topic of inferential statistics, we discussed binomial distribution, counting rules (permutations and combinations) and hypothesis testing.

We began the second phase of the course by introducing and discussing applications of the chi-square test. Then the article, The Seventh Letter of Plato by Levison, Morton and Winspear, was analyzed in detail. Also, Studies in Latin Hexameter Poetry by Duckworth was discussed. Finally, more advanced statistical techniques such as analysis of variance, correlation, and measures of the strength of association in contingency tables were introduced.

Although no formal instruction was given in linguistics in the Institute proper, a group of the participants with prior familiarity with the field was able to profit from the Seminar in Computational Linguistics given by Dr. Bruce Fraser, Director of the Language Research Foundation, Cambridge, Massachusetts, at the Summer Institute of the seminar was moved into the Digital Computer Laboratory where participants were able to attend it. Ten of them became regular members of the seminar. Robert Dyer and John Sowa gave papers on semantic memory and the role of conceptual dependency grammars and lexical insertion, and on the analysis and generation of natural language. Others gave reports in the APA Institute on questions related to this seminar - Maurice Cunningham, Joyce Friedman, Edward Hirschland and Fred Householder. Dr. Fraser's course covered among other things: phonological and grammatical rule testing, translating logic into language and language into logic, historical linguistics, the automatic analysis of morphology and syntax from natural language, and semantic memory.

This group also conducted a series of seminars beginning in the second week. Mrs. Martha Laferrière, who teaches the course on



computing for linguists and humanists at Brown University and works with the collections of English texts made there, outlined the Brown system of "flagging" natural language with morphological and syntactic codes, and worked throughout the Institute to develop a systematic set of flags for Latin such that they could either be automatically assigned by the computer or manually coded. This "group project" took into account the system in use in Liège University and was able to work from July 22 on with the machine dictionary of Latin of Father Roberto Busa. The results of this project will be available by the end of the summer. The group was also able to test the inherent contextual features assigned to words and the legitimacy of transformations by using the well-known machine grammar tester of Professor Joyce Friedman, now at the University of Michigan. Several radical alterations were made as a result.

It can be argued, however, that either there should be a stronger component of elementary computational linguistics in any future institute, or linguistics should be restricted to a separate institute. If the inclusion of such a component is deemed advisable, advance consideration should be given in any future institute to preparing material for an elementary course to introduce literary scholars to the new techniques of analyzing linguistic and semantic information by computer.

### Research

Although the pedagogical aspects of the Institute maintained a dominant role throughout, we tried to keep them geared to research application. After the first two weeks of intensive instruction in programming, it was the original intention to provide a number of projects in which participants would play a role if they were not otherwise engaged in their own work. For the most part, it turned out that the majority of participants did have projects of their own which they wished to develop. However, it was possible to present a small program of research in Latin through the demonstration and development of a wide variety of techniques using Catullus 64, a poem of approximately 400 lines, as a sample text. The text of this poem was placed on the resident disk for immediate accessibility. Forward and reverse concordances were constructed. The text was scanned automatically and updating procedures were demonstrated. Indices were made according to the metrical word-type and also alphabetically. Correlation studies on the co-occurrence of word types were also performed. The sheaf of programs used on Catullus 64 was a valuable resource to participants working on other projects. The programs demonstrated here were adopted and adapted according to individual needs. In addition, although the studies on Catullus 64 are not publishable in their present form, they will remain available in machine-readable format both as exemplary applications of research procedures and as a significant store of data for comparative studies in Latin poetry.

A second line of research was conducted on photocomposition. Recent advances in computer printing and computer-aided photocomposition have been of central concern to some classicists using the computer. Richard Whitaker devoted most of his energy during the Institute to writing a program for computerized photocomposition of a concordance of Ugaritic texts which requires an unusual alphabet and format. David Packard also spent part of his time assisting with this project. He pursued his own investigation of methods of publishing computer-produced compilations such as concordances. Substantial progress was made for achieving an understanding of how the most recent photocomposition hardware actually works, and in understanding how to add special characters to a magnetic tape containing type fonts provided by a photocomposition manufacturer. It is hoped in this regard to produce Greek fonts which can be used separately and in combination with Roman fonts for photocomposition. To aid this research a copy of the RCA mathematical Greek characters was acquired. The availability of digitized fonts will be an important contribution to the publication of such materials as concordances, indices and bibliographic matter in Classical Studies.

#### Materials

Prior to the Institute and during its course, a large number of texts in Greek and Latin were prepared. The conversion of machine-readable materials which were brought from different institutions in

various formats proved to be a slow and distracting task. It was originally assumed that much of this conversion would have been done prior to the opening of the Institute. However, the very short time available for planning and also for selecting participants prevented this preliminary preparation. Consequently, most of the work had to be done during the Institute itself. Nevertheless, despite the limitations of time, the following texts were prepared or acquired:

Homer, Iliad and Odyssey

Homeric Hymns

Isaeus, Oration III and selections from other orations

Sophocles, Oedipus the King

New Testament

Ammianus Marcellinus

Ausonius, Mosella

Appendix Vergiliana: Culex, Ciris, Moretum

Cato, complete works

Catullus 64

Cicero, De Oratore, Bk. I

Juvenal, complete poems

Livy, selections

Lucan, Books I and X

Lucretius, complete works

Ovid, Metamorphoses, Bks. I, II, V, XII

Rutilius Namatianus, De Reditu Suo

Persius, complete poems

Plautus, five plays

Tacitus, Annales

Vergil, Eclogues, Aneid, Bks. I, IV, IX, XII

A dictionary of Latin

Corpus of Ugaritic texts

These materials comprise a valuable resource for future research. To prevent these texts from being dispersed and becoming difficult to obtain, Stephen V. F. Waite of Dartmouth College has been made temporary curator of the collection until final arrangements for its disposition can be made. The present understanding is that a library of tapes will be maintained at Dartmouth College. Copies of these tapes will be made available at cost to any researcher, although at present no responsibility is being taken by the Institute for guaranteeing the accuracy of the texts. It is hoped that these materials will be the nucleus of a growing collection of machine-readable texts in Greek and Latin which can become a repository of materials for future computerized research in classical studies.

### Results

While it is certainly not true that every participant emerged from the Institute a highly skilled programmer, all who devoted a reasonable amount of effort were able to acquire enough programming skill to be

able to write or understand useful programs. Those with previous programming experience were generally more successful in advancing their skills and learning additional techniques. Beyond the specific question of writing programs, there were also opportunities to learn what kinds of questions others had been asking or were thinking of asking in their own projects. A factor kept constantly in view was the necessity for a person to be able to explain his work to a skilled or professional programmer at his home institution. The success of this aspect of the Institute will be measured only in the future as participants put to use what they have learned here.

A partial description of the accomplishments of selected participants follows.

WILLIAM BAYLESS, a graduate student at Brown University, came to the Institute with some knowledge of PL/I and the text of the late Roman historian, Ammianus Marcellinus prepared in machine-readable format. He devoted the major part of his time to his specific project, studying the style of Ammianus. During the first weeks of the Institute, he acquired a reasonable competence in FORTRAN, learned some SNOBOL and improved his ability in PL/I. By the end of the Institute, Mr. Bayless was writing programs to improve the format of the text of Ammianus and had worked out, but not actually written and tested, programs to solve his major questions in stylistics.

PROFESSOR MAURICE CUNNINGHAM of Lawrence University, one of the foremost experts in the country on Latin grammar and the American representative on the international Thesaurus Linguae Latinae, came with

a vast store of knowledge and questions but with no experience in programming. He proved a vigorous and invaluable member of all discussion groups, particularly in linguistics, and developed skill in SNOBOL, as well as learning the fundamentals of FORTRAN and PL/I. He produced programs to analyze natural language for such things as syllables and participated in the linguistic group with a view to adapting Priscianic grammar to automatic analysis of Latin.

JAMES HELM, Assistant Professor of Classics at Oberlin College, was engaged in two major projects, one in Latin and one in Greek. He had already worked closely with Nathan Greenberg in perfecting Greenberg's program for the automatic scansion of Latin dactylic hexameter verse. During the first week of the Institute, he modified this program to suit the local system in order to make it available to other members of the Institute. While at the Institute, he expanded the program to scan elegiac verse as well as hexameter, and he made substantial progress on a program to "scan" Latin prose as an aid to automatic identification of Latin prose rhythm. Another Latin project of Helm's was a metrical line-type concordance which collects all lines with a given inner metric.

Helm had prepared part of Sophocles' Oedipus Rex in machine-readable form before the Institute. He wrote a format program to print the Greek accents in a notation suitable for proofreading, and he developed a collection of programs for use in analyzing and printing his Greek text. He prepared both forward and reverse indices of his Sophocles text.

EDWARD C. HIRSCHLAND, who is completing his A.B. and M.A. degrees at Brown University, came already trained in PL/I and computer applications in linguistics. He concentrated on a program to test phonological rules generating classical Latin forms from the forms found or postulated in early Latin. He worked on his rules with advice from Professor Fred Householder and presented provisional results which should lead to the publication of several new observations about Latin historical phonology.

Mr. Hirschland also learned to program in FORTRAN. He was a regular member of the computational linguistics group and seminar, and worked with Joyce Friedman in testing transformational rules on the Michigan grammar tester. He also participated in the Linguistics Institute.

LESLIE JOHNSON, a student preparing a doctoral dissertation at the University of California at Irvine, came to the Institute with a defined interest in the late Latin poetry of Rutilius and Ausonius. Although, like all participants, Mr. Johnson was only notified at a very late date that he might participate at the Institute, he managed to prepare in machine-readable form the De Reditu Suo of Rutilius and the Mosella of Ausonius. Mr. Johnson had had no experience with programming, but before the Institute was over he wrote the programs to produce forward and reverse indices of Catullus 64. He also produced frequency listings for this work. He has applied these techniques to his authors, Rutilius and Ausonius, and has produced the first concordance to Rutilius'



poem, a compilation which will be of great value to him in his further work.

JOE PARK POE, Assistant Professor of Classics at Tulane University, has a special interest in Latin metrics. His study, Caesurae in the Hexmeter Line of Elegiac Poetry, has been accepted for publication by Franz Steiner Verlag in Wiesbaden. Metrics is an area where successful computer applications have been developed, and Mr. Poe's purpose in coming to the Institute was to become acquainted with this work and to devise new applications for it. With no prior programming experience, he was able to acquire sufficient capacity to begin his long-range task. He gained a basic familiarity with automatic methods of metrical scansion and produced programs which isolated alliterative and assonated features in the sample text of Catullus 64. He cooperated in devising a test for the significant co-occurrence of metrical word-types and is working on a program whereby the semantic content of the first colon of a hexameter line may be analyzed.

Unlike most of the participants, who were Classics instructors or at least advanced graduate students, LARRY SHICK was an undergraduate who came with a shorter period of formal training in Classics. He more than compensated for this by his enthusiasm and his remarkable proficiency for computer programming. During the visits of the Homer experts, Larry wrote several programs, literally overnight, which answered important questions raised by the visitors. Several of these programs were placed in the program library for the use of other participants.

DR. CORA SOWA came with a well-formulated problem arising from her Harvard doctoral dissertation. She is examining the literary themes of the Homeric Hymns and other early epics and the way in which they are interwoven in composition. She gave an interesting colloquium and developed a number of programs to analyze literary texts for flagged thematic elements. She came with some knowledge of computers but no experience in programming. She learned to program in FORTRAN, and, with the help of her husband, John F. Sowa, Prof. Sidney Michaelson, and Larry Shick, developed sophisticated programs for her analysis. Her work is a good example of serious research assisted by the computer and informed dialogue with highly-skilled programmers.

WARREN VOLCHENBOUM, a graduate student at the State University of Iowa, came with the desire to analyze the prose rhythms of Cicero and his use of connectives. He had no programming experience but had made a good start on his project by the end of the Institute, using particularly SNOBOL and PL/I. Using a sample text of the De Oratore which he prepared here, he had outlined and was implementing the necessary preliminary steps and had a fair idea of the order of the rest of his project.

JOHN WALSH, a graduate student at the University of North Carolina working on a doctoral dissertation, has a basic interest in problems of style. Extremely fertile in creative hypotheses, he chose to limit his efforts at the Institute to (a) acquiring a greater familiarity with PL/I, (b) preparing the text of Juvenal and Persius in machine-readable form, (c) testing the aesthetic views on sounds of the ancient critic

Dionysius of Halicarnassus, by use of the computer. He was able to devise a procedure which showed that Ovid was significantly closer than Catullus to the norms of smoothness of sound stated by Dionysius. He intends to extend these tests to the works of Sappho and Pindar. He is also interested in comparing the Greek Text of the Phaenomena of Aratus with the Latin translation made by Cicero.

PROFESSOR RICHARD F. WEVERS, of Calvin College, came to the Institute with a well-defined goal. A specialist on the Greek orator, Isaeus, Professor Wevers has just published Isaeus: Chronology, Prosopography, and Social History (Mouton, The Hague, 1969). With no preceding experience with computers, Professor Wevers came to find out to what extent the manual procedures used in his book could be automated and extended so as to include other writings and other modes of analysis. He also had a particular interest in statistics, consulted extensively with Rev. A. Q. Morton on statistical approaches to Greek prose, and intends to continue his work in statistics when he returns to Calvin College. Before arriving at the Institute, Professor Wevers prepared large portions of the text of Isaeus in machine-readable form. He has since developed a repertoire of programs to deal with this material. He isolated a significant number of stylistic peculiarities in Isaeus 3 and perfected a way of representing Greek with diacritics in computer output.

RICHARD WHITAKER made substantial progress toward developing programs for computer phototypesetting his Concordance to Ugaritic.

This concordance will be published by the Harvard University Press and includes all the texts discovered in the excavations at Ras Shamra in Syria. These texts, comprising epic, mythology, letters, and economic texts are of fundamental importance for the interpretation of the ancient near east and in particular of the Old Testament, since Old Testament poetry is a later product of the same poetic tradition which can be studied at an earlier stage in the Ugaritic texts. Printing these texts presents difficulty since about a dozen non-standard characters are required. Recent advances in computerized photocomposition will allow computer compilation such as this one to be set in type in an elegant and economic format, but a great deal of computer programming is required to produce the desired result. Whitaker's concordance promises to be a model to other humanists of what can be done with computer composition of texts in unusual alphabets.

#### Visitors

One of the most popular and successful aspects of the Institute was the program of visiting speakers (see Appendix IV). This program was supported partially by the grant from the National Endowment for the Humanities, and partially by a grant of \$5,000 from International Business Machines Corporation. Three different types of visitor were sought:

(i) distinguished Classical scholars interested in observing the applications of computer techniques and advancing suggestions for work at the Institute or in the future; (ii) scholars with experience in computer-

assisted projects in the humanities; (iii) scholars with research expertise in areas of interest to participants. As it turned out, those from (i) who were able to come also qualified under (iii), but more visitors from (i) would have been welcome. The visitors who participated were as follows:

|                               |                |
|-------------------------------|----------------|
| Professor Louis T. Milic      | June 17-18     |
| Professor Joseph Raben        | June 23-26     |
| Professor Sidney Michaelson   | June 23-July 8 |
| Professor Mark W. Edwards     | June 26-July 1 |
| Dr. J.B. Hainsworth           | June 26-July 7 |
| Professor Michael M. Nagler   | June 26-30     |
| Professor Joseph Russo        | June 26-July 1 |
| Reverend A.Q. Morton          | June 30-July 9 |
| Professor Joyce Friedman      | July 17-18     |
| Professor Fred W. Householder | July 18-21     |
| Father Roberto Busa           | July 19-26     |
| Professor Brooks Otis         | July 19-21     |
| Professor Gregory Nagy        | July 20-23     |

Each visitor was asked to contribute to a series of seminars while he was at the Institute. These seminars fell into four general classes: (i) criteria for the recognition of individual style and originality; (ii) Homer and the formulaic style in Greek literature; (iii) Latin and Greek metrics; (iv) computational linguistics. Of these the first was generally acclaimed as the most useful and interesting, although no clear definition was ever reached as to what the important criteria of style are. The first speaker, Louis Milic, gave a lucid and provocative outline of the problem. He gave the Institute a working definition of individual style as a subset of the rules and items of a language, where

the individual habitually selects from alternatives in language a set of options which may be regarded as his personal stylistic options.

Andrew Morton of Culross, Fife, is the scholar most experienced in the statistical measurement of stylistic features in Greek. His experience, wit, and patience endeared him to all participants working in this area. In the statistics class, participants had the opportunity to examine in detail the tests Morton had applied and the assumptions about stylistic invariance which he had made. As Morton is the first to say, there is need for much more evidence before these assumptions can be validated, but his cheery willingness to press on to new theories in the face of scepticism gave courage to others.

On a different tack, Joseph Raben outlined his study of Miltonic word echos in Shelley and suggested ways in which this study of tradition and originality could be extended.

It was originally intended that a research project on Homer would form a major component of the Institute, and a research colloquium on the formulaic style was organized. Unfortunately, to accommodate all four invited speakers, the colloquium took place mainly over a weekend, and it proved difficult to disseminate the ideas of the colloquium among all participants. However, it provided the visitors, Edwards, Hainsworth, Nagler, and Russo, together with those participants who had the knowledge and stamina to keep up with them, and unparalleled opportunity to discuss aspects of oral epic style which have not yet been examined, and to suggest computer applications to their study. David Packard prepared a reverse concordance to the Iliad and various metrical analyses

for use at the Institute, and these stimulated many fresh ideas. The results of this colloquium cannot be measured so much in terms of definite results at the Institute as in the stimulus to fresh ideas given to all members of the colloquium, each of whom has written to the staff with warm gratitude.

The seminars on Greek metric by Gregory Nagy were also related to the formulaic style except that he was interested in the computational "switches" which allowed cola appropriate to the hexameter to be moved into lyric meters and vice versa. His ideas interrelated with those presented in the early colloquium and allowed participants an unusually clear glimpse into how a computer program could be used to track metrical cola in different compositional structures.

Brooks Otis lectured on problems on Latin hexameter poetry. His guidance was particularly valuable to the Latin project, and the entire Institute admired his willingness to stay through the quick-turnaround-hours of the early morning suggesting new theories to test.

Of the linguists, Joyce Friedman gave seminars explaining her transformation grammar tester and spent generous hours on the teletype to Michigan demonstrating the system. Her scheme, with its intricate insertion of contextual and inherent features along with lexicon insertion, was a revelation to those who regarded Chomskian grammar as inappropriate to systematic machinery.

Fred Householder gave a talk on the sorts of machine dictionary look-up necessary for simple grammars such as those to generate hexameter verse from Latin prose. In this he obliquely underlined the enor-

mous proportions of the dictionary problem in any grammatical analysis.

Father Busa brought with him from Pisa, Italy, the gigantic machine dictionaries of Latin associated with his concordance of St. Thomas Aquinas. He explained the project and gave a clear account of his morphological coding, as well as of the problems of ambiguity which he had faced. His talks brought out better than any other aspect of the Institute the energy and ingenuity a scholar must possess before he attempts to handle any of the large-scale problems for which the computer seems at first so easy an answer.

The lead time for arranging for visitors and a coherent schedule of seminars was impossibly short, and the visitors themselves had little time to prepare what to say. The arrangement was originally predicated on a series of seminars in the early weeks on stylistic problems followed by discussion groups around specific projects. However, this schedule was repeatedly altered to accommodate the earlier commitments and alterations in the plans of the visitors. As a result, the Homer colloquium was advanced uncomfortably early, and an unexpected cluster of visitors gathered during the last weekend. Such difficulties would easily be remedied with more leisurely planning. But the participants responded well to the stimulus of ideas in the seminars, which seemed to distract little from the practical work of the Institute. In fact, by opening up vistas outside the narrow confines of the Digital Computer Laboratory, they took away some of its claustrophobic effect. In addition, visitors who did not have prior exposure to computer techniques took away



a heightened awareness of what could be done by computer, and the program thus chipped away at the irrational prejudice caused by the idea of a computer in the humanities.

### Evaluation

During the last week of the Institute, an evaluation questionnaire was distributed to all the participants (see Appendix V). There was general agreement on their part that the Institute had succeeded in introducing beginners to programming techniques, and in suggesting ways in which the computer might be used in Classical Studies. They were also satisfied with the amount of time available to them to work on their individual projects. Opinion appeared to be divided about whether FORTRAN on the one hand, or SNOBOL and PL/I on the other were preferable languages for programming. The individual's own feelings about competence in these languages varied, but there was a general feeling that more than one language should be introduced. From the point of view of the participants, then, the decision to have elementary instruction in at least three different programming languages was the right one. There was a virtually unanimous negative response to the suggestion that there be an Institute project with individuals responsible for specific parts of it. It thus appears that what had occurred almost by accident was, in fact, the right thing to do. In this regard the participants strongly felt that a series of projects tailored to their individual needs and interests was preferable and most beneficial to their future work.

The program of visitors met with great approval as one of the most important aspects of the Institute. Particular praise was given to the efforts of A.Q. Morton and Louis Milic. The scheduling of the visitors was subject to some criticism, which, in view of the time factor, is not surprising. There was also a general feeling that participants had learned much from the experiences of their fellows at the Institute. It seems clear, then, that considerable provision should be made at an institute for mutual inter-action.

The course in statistics met with more or less approval according to the preference of the participants for this kind of study. However, the general consensus was that the course should definitely have been given, and this kind of knowledge should be made available. The association with the Linguistic Institute was approved of in general, but the level at which the seminar in computational linguistics was conducted was, by and large, too advanced for most of the participants.

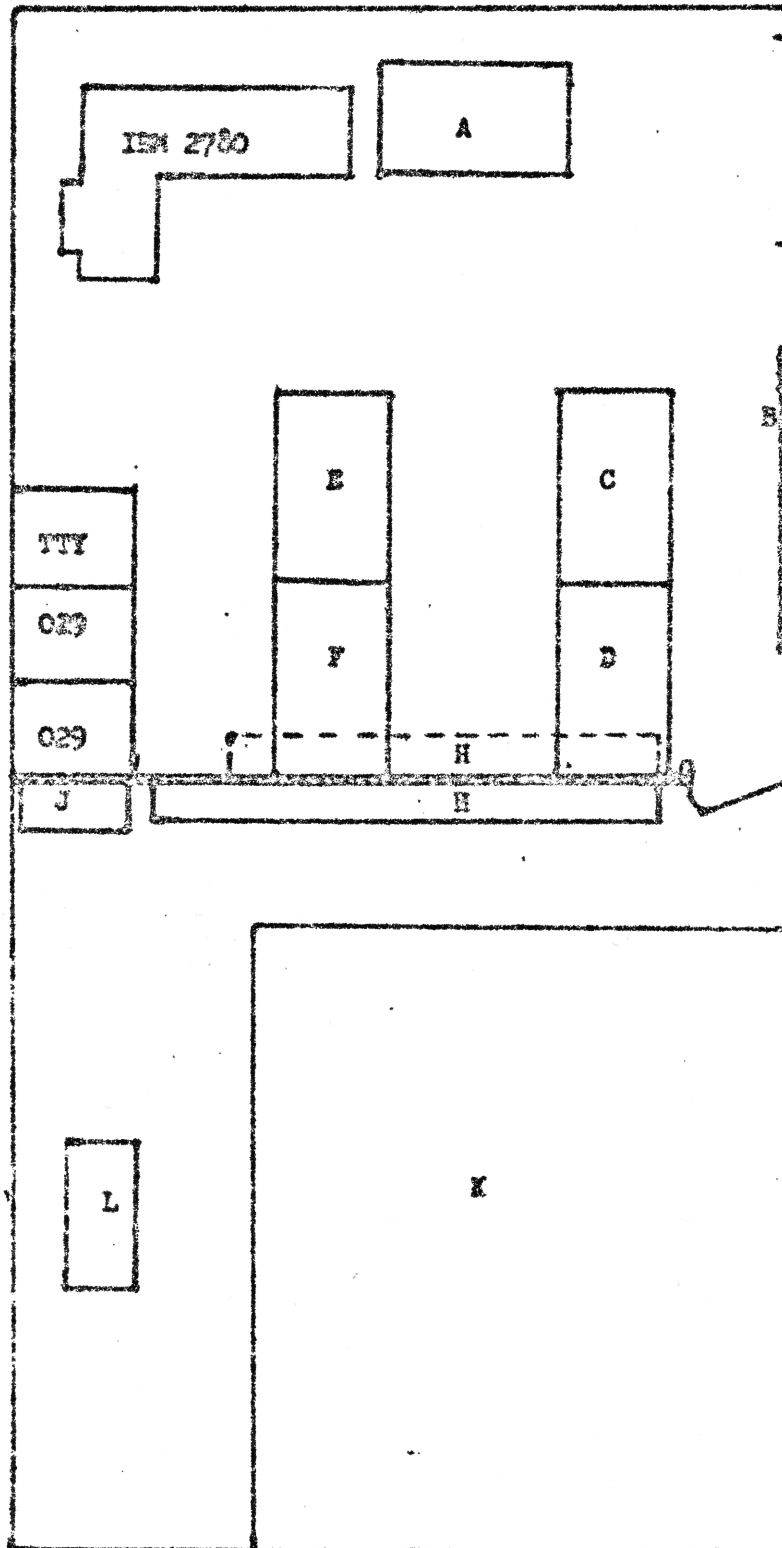
The main deficiency in the instructional program was felt to be in the area of traditional Classical philology and literary criticism. The participants would have liked to have seen more ways in which the computer could be applied to traditional kinds of questions. Obviously, some limits should be put on the degree of innovation attempted in a program like the one undertaken in the Institute. Opinion was almost evenly divided about the performance of the computer itself. The crowded and often noisy conditions of the Institute's workroom were widely criticized. There do not appear to have been any other serious criticisms of the way in which the Institute was managed.

It was felt that future institutes should repeat especially the emphasis on the teaching of programming and computer techniques, the program of visitors, and should allow persons of various levels of skill and knowledge about computers to participate. At the same time, there was a frequently-made suggestion that the formal classes and sessions be scheduled carefully in advance and kept smaller in number in order to allow more time for laboratory work and independent study. It appears that the majority of the participants would have preferred a learning situation which combined the minimum amount of necessary formal instruction with a larger amount of free time for individual study and access to consultants on a tutorial basis.

#### Conclusion

In sum, therefore, the Institute has been judged a success by both staff and participants. It was not possible to achieve everything that was initially hoped and planned for. The original conception was too ambitious to be realized in the actual time available for final planning and launching the Institute. Certainly the serious doubts about the financing of the Institute and indeed the question as to whether it could even take place kept many potential participants from applying. Nevertheless, one result must be kept firmly in view. Nineteen persons have either been initiated into the mysteries of the computer or have been advanced in their previous abilities. The contribution which they can now make, and hopefully will make to classical studies will be the final judgment on this past summer's achievement.

Institute Class and Work Room



Furniture and Equipment.

TTY - Teletypewriter with dataphone

029 - Keypunches

A - 60" tables for input and output

B - Bulletin board

C, D, E, F - four 60" tables with 12 armless chairs

G - Floor to ceiling partition with 30" door

H - Shelves, 18" deep

J - Steel cabinet (locked) 18" x 36"

K - Four rows of seven chairs each

L - Table and chair

Each room also had blackboards along one wall.

## APPENDIX II

### Data on Computer Usage

#### I. Cards Read

|                            |         |
|----------------------------|---------|
| 1. Remote (IBM 2780):      | 533,860 |
| 2. Local (central system): | 73,827  |
| Total                      | 607,687 |

#### II. Cards Punched

|                |         |
|----------------|---------|
| 1. Local:      | 22,269  |
| 2. Keypunched: | 5,250   |
| Total          | 27,519* |

III. Lines Read -- U. I. Timesharing: 163

Lines Filed - U. I. Timesharing: 475

#### IV. Lines Printed

|                            |           |
|----------------------------|-----------|
| 1. Remote (IBM 2780):      | 938,233   |
| 2. Local (central system): | 327,819   |
| Total                      | 1,266,052 |

#### V. CPU Time

1. IBM 360/75: 101,713 seconds
2. IBM 360/20: 694 minutes

#### VI. Timesharing at Kiewit Computation Center, Dartmouth College

1. Terminal time: 13.1733 hours
2. Mod37 Terminal time: 0.0367 hours
3. CPU time: 1744.6000 seconds
4. Storage: 6.2286 units (1 unit equals 1000 words)

\* This is probably not an accurate figure for the total number of cards punched since cards were made at several places in the Digital Computer Laboratory.

APPENDIX III

PARTICIPANTS

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(Calvin College)

Richard E. Whitaker, 1000 Sunset Ave., Pella, Iowa 50218 (Harvard  
University and Central College)



## APPENDIX IV

### Visiting Lecturers

- BUSA, Roberto, S.J., Professor of Theology, Istituto Filosofico Aloisianum, Gallarate, Italy; Director, Centro per l'Automazione dell' Analisi Linguistici, Pisa, Italy; Director, Index Thomisticus Project, IBM, Boulder, Colorado. Author of Index Thomisticus (forthcoming), and numerous articles on St. Thomas Aquinas and lexicography.
- EDWARDS, Mark W., Professor of Classics, Queens University, Kingston, Ont., Canada (-1969); Professor of Classics, Stanford University, Stanford, Calif. (1969-). Author of numerous articles, including "Some features of Homeric craftsmanship", TAPA 97, 1966, 115-179.
- FRIEDMAN, Joyce, Associate Professor of Communication Sciences, University of Michigan, Ann Arbor, Mich.; formerly Director, Stanford Computational Linguistics Project. Author of A Computer Model of Transformational Grammar (forthcoming) and numerous articles and reports on computational linguistics.
- HAINSWORTH, John Bryan, Fellow in Literae Humaniores, New College, Oxford, U.K., formerly of University of London. Author of The Flexibility of the Homeric Formula (Oxford, 1968) and various articles, including "Structure and content in epic formulae: the question of the unique expression", CQ 14, 1964, 155-164; "Joining battle in Homer", G&R 13, 1966, 158-166; "A note on elision in Homer", BICS 14, 1967, 17-21.
- HOUSEHOLDER, Fred W., Jr., Research Professor of Classics and Linguistics, Professor of Uralic and Altaic Studies, Indiana University, Bloomington, Ind. Author of Literary Quotation and Allusion in Lucian (1941), English for Greeks (1954), Reference Grammar of Literary Dhimotiki (1964, co-author), Basic Course in Azerbaijani (1965), Critical Linguistics (forthcoming) and numerous articles and reviews on linguistics and classics.
- MICHAELSON, Sidney, Professor of Computer Science, University of Edinburgh, Edinburgh, U.K.; Director of the British Academy Computing Centre.
- MILIC, Louis T., Professor of English, Teachers' College, Columbia University, (1969); Professor and Chairman of English, Cleveland State University, Cleveland, Ohio (1969-). Author of A Quantitative Approach to the Style of Jonathan Swift (1967), various articles on stylistic analysis including "The computer approach to style" in The Art of Victorian Prose (ed. G. Levine and W. Madden, 1968), pp. 338-361, and a bibliography, Style and Stylistics (1966). Review editor of Computers and the Humanities.

- MORTON, Reverend Andrew Q., The Abbey Manse, Culross, Fife, U.K. Consultant for computer projects, in various capacities, to the British Academy, the Universities of Edinburgh, Glasgow and Strathclyde (Scotland), and the University of Calgary. Co-author of Christianity and the Computer (1964), The Structure of Luke and Acts (1964), Paul, the Man and the Myth: a study in the authorship of of Greek prose (1966), and numerous articles on stylometry.
- NAGLER, Michael N., Assistant Professor of Classics and Comparative Literature, University of California, Berkeley, Calif. Author of "Formula and Motif in the Homeric Epics" (Diss. Berkeley, 1966), "Towards a Generative View of the Homeric Formula", TAPA 98, 1967, 269-312.
- NAGY, Gregory, Assistant Professor of Classics, Harvard University, Cambridge, Mass. Author of "Preliminaries to a new criterion for a classification of the Greek dialects" (Diss. Harvard, summarized HSCP 71, 1966, 333-5), "Observations on the sign-grouping and vocabulary of Linear A", AJA 69, 1965, 295-330; co-author, Trends in Current Linguistics, vol. (forthcoming).
- OTIS, Brooks, Professor and Chairman of Classics, Stanford University, Stanford, Calif.; Visiting Professor, State University of New York, Buffalo, N.Y. (1968-69). Author of Virgil, a Study in Civilized Poetry (1963), Ovid, as an Epic Poet (1965), and numerous articles on Latin Literature.
- RABEN, Joseph, Associate Professor of English, Queens College, The City University of New York, Flushing, N.Y. Editor, Computers and the Humanities. Author of various articles, including "A Computer-aided investigation of literary influence", Proceedings of the Literary Data Processing Conference, 1964, 230-74, and a forthcoming book on Shelley.
- RUSSO, Joseph A., Associate Professor of Classics, Yale University, New Haven, Conn. Author of various articles on Homer and Greek metrics, including "A closer look at Homeric formulas", TAPA 94, 1963, 235-247; "The structural formula in Homeric verse", YCS 20, 1966, 217-240.

## APPENDIX V

### Evaluation Questionnaire

During the last week of the Institute, participants were asked to fill out a questionnaire giving their views of different aspects of the Institute. With varying degrees of thoughtfulness and care, every participant responded fully. Given the varied backgrounds of the participants, it is not surprising that there was considerable difference in their responses. A summary of these responses follows, question by question.

"The Institute was conceived with several goals in mind, including introducing beginners to programming techniques, preparing some sort of joint institute project, suggesting ways in which computers might be used in the study of the classics, and allowing time to work on individual projects."

1. How well has each of these goals been attained?

With regard to programming techniques, ten participants thought this part of the Institute was good or very good; six said it was only fair; three expressed strong criticism.

Two participants felt that too many programming languages had been introduced with the result that they did not have the chance to become proficient in any single one. Three were of the opinion that the introduction to FORTRAN was too energetic. Two felt that they could have done better if there had been more tutorial help.

With regard to a joint institute project, one participant felt that the Institute's goals were best attained here. Four thought it was

good; nine said fair; four said poor; and one said he did not participate. Among specific comments on this aspect were the following: there was not enough cooperation; poorly organized; it was unsuccessful since participants had little interest in it; the data amassed was of potential interest but lacked scope; it was a good teaching device for beginners; it was good for those who wished to participate.

With regard to computer applications, twelve said good or very good; five said fair; two said poor. Specific comments: good but with not enough illustrations of actual working programs; good because of visitors' and participants' seminars; much more should have been done here; good because a workable understanding for applying computers to literature was received.

With regard to individual projects, reaction was also mixed. Ten said good; five fair; and one said he had no profit; three expressed dissatisfaction. Among specific comments, eight felt that there was not enough time available for individual projects and that there were too many distractions in the program. One said he found sufficient time for his own work only by finally refusing to go to many scheduled events. Another believed that it would have been better if all classes and other events had been concentrated in one part of the day.

## 2. Which do you think the Institute has failed to fulfill?

Four participants mentioned the joint project, saying that there had been little involvement on their part; that it lacked organization; that it was perhaps not worth doing at all. Four mentioned the introduction to programming techniques, saying: there was not enough preparation;

they were not taught effectively; the teaching was not elementary enough. Three mentioned the applications to the study of the classics, saying that some of the visitors were not sufficiently acquainted with computers. Two mentioned the individual projects, saying that not enough time was available for them.

3. What programming languages do you feel you will find most useful?

Eleven said FORTRAN; nine said PL/I; five said SNOBOL 4; and four said Assembler. Several of these were multiple responses.

4. How many times and in what language(s) have you submitted programs?

One participant submitted no jobs at all. One did the bulk of his work in SNOBOL 4; one in PL/I; and two in Assembler. The rest did the bulk of their work in FORTRAN. Two participants estimated that they had each submitted 200 jobs in FORTRAN, the highest estimates for any language. Six participants submitted jobs in three languages and ten submitted jobs in two languages.

5. What languages do you feel competent in? Which of these did you learn here?

Answers here were quite varied. Six felt that they were now competent in FORTRAN which they had learned at the Institute. Three mentioned FORTRAN and SNOBOL 4. There were many other combinations of the four languages taught. Four participants who already knew FORTRAN reported competence in Assembler which they learned at the Institute.

6. Should an institute concentrate intensively on one language or offer partial introductions to several?

Eleven felt that the institute should concentrate on a single

language. Five preferred a partial introduction to several languages. One wanted even more languages. One wanted more in Assembler. One participant said that no training in programming languages should be given.

7. Should an institute work cooperatively on one project with specific assignments given to individuals?

Three said yes, that this was the best way to make progress.

Three said yes, provided that participation was voluntary. Two said such a project should be provided only for beginners. Four agreed, provided that separate individual projects were not hindered. Two disagreed on the grounds that individual learning opportunities would be hindered.

Five had no opinion.

8. Do you think that you have made satisfactory progress in your own work? If not, why not?

Sixteen indicated satisfaction. Three were dissatisfied. Among the comments of the former group: got basic skills so I can go on; could have learned more in a more organized program; came as a dilettante to satisfy curiosity--and I did, I can go on. Comments of the latter group were: teaching was not done patiently, but other participants helped; not what I wanted, too much scheduled activity to allow me to work on my own project; confused by the multiplicity of languages.

9. There has been a rather extensive program of visitors though not as many as originally hoped. Was this program a help or a hindrance?

All participants agreed that the program of visitors was a help, not a hindrance. Some comments: very good because of fresh ideas, best part of the Institute; wide range meant someone of interest to everyone;

good and just the right number; good, gives perspective on what is being done. But many reservations were also expressed: too often an interruption; should have been no visitors during the last two weeks; some visitors were verbose and vague.

10. Which visitors do you think contributed most and why?

Eleven mentioned Morton, seven Milic, six Busa, three Otis and Raben, two Hainsworth, Nagy and Michaelson. Householder, Friedman and the Homer group (Edwards, Hainsworth, Nagler, Russo) were mentioned once each. The variety of reasons given for these preferences is too great to be reported here.

11. Which visitors contributed least?

Five mentioned Michaelson, three each mentioned Householder and Raben, two Otis. Morton, Milic, Nagy and the Homer group were each mentioned once.

12. Did you find yourself profiting from the experiences and trials of the other participants? How?

Sixteen said yes; three said no. Among comments were: we consulted at our own level; glad at the end when I could give some help too; good to see how to do things successfully; no, I learn only from my own mistakes.

13. Did you feel that the statistics class was a worthwhile adjunct of the Institute?

Sixteen said yes; three said no. Among the comments: too advanced at the end; a textbook should have been provided; not related enough to our own work; should be learned at home.

14. Did the association of the Linguistics Institute enrich or dilute the work of the APA Institute?

Opinion here was mixed, but the consensus was that for those interested and competent in linguistics there was a definite advantage. In any case those not interested could stay away. Three commented that the material offered was too advanced for them.

15. Should the nearby location of such coordinate institutions be a consideration in choosing the site of an institute?

Fifteen of the participants said yes, but seven of them added that this factor should be low on the list of priorities. Four disagreed altogether.

16. Should there have been more emphasis on philology and literary criticism?

Four gave a simple no; five a simple yes. Three others said that more time should have been spent on philological applications or on other fields such as epigraphy and papyrology. One said the level of work was superficial. Three felt that enough work was done in the time available.

17. Did you find the performance of the computer satisfactory?

Nine said yes; eight said no. Among the comments: too many delays; down too often; poor at the beginning, better at the end.

18. Given the constraints of the total space available, was the physical arrangement of the room satisfactory?

Nine participants said yes, and nine said no! Among their comments: too crowded; excessive togetherness was irritating, but also led to cooperation.



19. How would you suggest improving it?

Among suggestions here were: better soundproofing; more work tables; separate chairs; lecture room elsewhere; more storage space.

20. Did you find the collection of articles useful?

Fourteen said yes, three said no. One person took this opportunity to remark that not enough reference manuals were available.

21. Were the financial arrangements satisfactory?

All agreed that these arrangements were satisfactory. Two felt that the reimbursement for travel by private automobile was too low. Three noted that earlier payment of stipends would have been helpful. [Stipends were paid on July 1 and 25.]

22. What aspects of this Institute should be repeated in any future institute?

In general, though individual responses differed considerably, every part of the Institute program was referred to by at least one participant. Some comments: allowing persons of all levels of ability to participate; keeping emphasis on beginners and their problems; the presence of a man like John Sowa; use of a remote terminal; statistics but with a textbook.

23. What aspects should be avoided?

Here the major comments had to do with over-busy scheduling and the lack of careful organization. Some comments: too many meetings- too many lectures; time too fragmented; more visitors toward the beginning, fewer toward the end.

24. Further Comments.

The following comments were added:

"I will now be able to work on my own. I concentrated on developing programming skills."

"More successful than I expected. Better for beginners than advanced people."

"It might be advisable to spend two weeks on applications before beginning training in actual programming."

"More patience in teaching and a slower introduction."

"A privilege to be here. A good staff."

"A good first Institute."

"Scheduled events should not be scattered throughout the day."

"Eight weeks would have been better with more careful scheduling."

"A great success."

"Too much pulling in different directions."

"Interesting and exciting."