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Abstract

A report on a study of the use cf space facilities in universities in England is mainly concerned with the methodology invclved in the study. An extensive appendix prcvides information on 24 different technical aspects of the study. (FPO)

USE OF SPACE AND FACILITIES IN UNIVERSITIES

Report

February 1968

Unit for Architectural Studies,
Bartlett School of Architecture,
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Gower Street, WC1.

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Introduction

The Unit for Architectural Studies was set up in July 1967 to carry out a study of the use of space and facilities in universities. A research grant was made to the Unit by the Department of Education and Science making it possible to extend the study beyond that already planned (and financed) by University College London (UCL). Details of the inception of the project are contained in Paper 4 (see Appendix 1 page 27) which also sets out the aims of the research in general terms.

The research team will receive guidance from a Consultative Committee (see Appendix 2 page 28) set up jointly by the Department of Education and Science and the Vice-Chancellors' Sub-Committee on the Use of Capacity.

Surveys of space have been carried out in UCL and in the University of Leicester. Preparatory arrangements only have been made for similar surveys in the Universities of Sussex and the City. Because a major survey of space and facilities was made internally by the University of Sheffield in 1966, Autumn Term, the Vice-Chancellor has reluctantly decided to ask for the University to be excluded from the survey. The results of the internal

survey at Sheffield have been made available to us, however, and we hope to be able to make some use of these on a comparative basis.

A note on the selection of the other centres and progress to date is given in Appendix 3 page 29 and brief comparative descriptions in Appendix 4 pages 30-32.

The team's thanks are due to numerous members of the staff of UCL for assistance of many kinds and for their tolerance during the period when survey techniques were being developed, and equally to the members of the staff at the University of Leicester where the later techniques were operated for the first time.

Metric measurements and scales have been adopted throughout. A note appears in Appendix 5 page 33.

The activities of the team to date fall into three main categories:

1. Survey of space and facilities (comprehensive Inventory)
   - 1.1 Data recording
   - 1.2 UCL Survey
   - 1.3 Leicester Survey
   - 1.4 Tabulation and Analysis

2. Preliminary activity studies (including timetabling)

3. Collection and classification of relevant information from elsewhere (especially from the USA).

Appendix 6 page 34 shows diagrammatically which operations are sequential and which concurrent. It is not based on a time-scale and shows only the inter-relationships. There is a brief note about programming following in Appendix 7.

SECTION 1

Survey of Space and Facilities

It was decided by the team after preliminary discussions at UCL that very little progress could be made until a comprehensive inventory of space and facilities had been made.

The available timetables were collected from departments in parallel with the space survey but as interviews with departmental heads proceeded, it became apparent that such documentation only provided a small part of the room use information required to build up reliable pictures of university activity patterns.

The space survey is therefore proceeding independantly and is described below while the space use study is discussed in Section 2.

SECTION 1.1

Data Recording

The method of collecting data on IBM Port-A-Punch Cards will be discussed in Section 1.3. The card is illustrated in Appendix 8 page 36, the method of punching in Appendix 9 page 37 and the data so recorded is listed in Appendices 10-13 pages 38-43.

The range of information has been modified somewhat from that which was originally recorded on the handwritten cards at UCL, illustrated in Appendix 14 page 44. The modifications resulted from the experience gained at UCL, from study of literature and from our discussions with the UCL Computer Centre and IBM United Kingdom Ltd. It may still be found that some of the information collected is redundant.

SECTION 1.2

UCL Survey

The first stage of the work was to record in standard form the sizes and characteristics of all the spaces which go to make up University College. This task proved to be more time-consuming than the team expected but was a spur in refining survey and recording techniques. Similar surveys in the other centres are being put through more speedily (see section 1.3 below). The aim of the survey was to record in an easily retrievable form all the characteristics of rooms which might be required as factors in determining the suitability of spaces for specified functions.

At UCL the available data consisted of room schedules prepared by the Bursar for the purpose of making his return to the University Grants Committee, and drawings of most of the departments from the Bursar's records. As might be expected, these were not always up-to-date and, of course, varied widely, both in scale and information content. Nevertheless, these records formed the basis of the survey work and were extremely useful.

Before the physical survey began Introductory Note

No. 3 (see Appendix 1 page 27) was circulated to all heads of academic and administrative departments, about sixty in number, all of whom were visited by members of the team to discuss the purpose, scope and method of study. The process of discussion with the departments took more than two months, but was found to be of great value, both in the establishment of good working relations and in pinpointing problems relating specifically to individual departments. These interviews also provided an opportunity to learn something of the organisational structure of the College. It was decided in preliminary discussions to do a comprehensive job of recording on the UCL survey material because it was felt that this was essential to the development of more sophisticated techniques. This has proved to be the case; the hand-punched computer card method now being used stemmed directly from a fuller appreciation of the nature and scale of the work made possible by the team's experience in handling the UCL survey data as described below.

Survey Data Recording and Retrieval

The survey itself was carried out with the aid of duplicated cards (see Appendix 14 page 44). Survey

staff, who were all students from various departments in UCL, (see Appendix 15 page 45) visited every room in the College and noted the details on these cards. During the survey numerous people assisted by showing the surveyors the extent of their department, arranging entry to each room, notifying their staff, drawing attention to special services in laboratories etc. The information from these cards was then transferred to Visipost Cards (VP Cards) illustrated in Appendix 17 page 47, each of the latter representing a particular room characteristic such as "good daylighting" or the presence of a "cold water supply". Thus the information is now available in two visual forms. First, a duplicated card for each room giving all the characteristics of that room and, secondly, a Visipost Card for each classification of each room characteristic. From the Visipost Cards the number and location of each room with a specified characteristic or any combination of characteristics can be determined. (The method of data retrieval from the Visipost Card system is illustrated in Appendix 18 page 48 and explained in Appendix 19 page 49. The same system is used for the keyword information storage and retrieval system described in Section 3).

With the information now punched on the Visipost Cards, it is possible to make some preliminary analyses of the UCL data (see below). However, it will be seen from Section 1.3 below that computer techniques are being developed which will supersede the manual operations on the Visipost Cards. The use of hand-punched computer cards, punched on the spot, (a method developed from the UCL study) combines the advantages of the visual survey cards with the technical advantages of the computer card. Direct punching minimizes intermediate manual processes, errors and checking. As these techniques are developed, the UCL data also will be transferred to the IBM cards for computer analysis.

The functions of the Visipost Cards are therefore:

1. to provide almost instant access to the UCL data.
2. to permit manual examination of data.
3. to simulate computer programs.

Since the extension of the Study, the third of these functions has become paramount as the quantity of data would render manual analysis a long and tedious process. Thus the Visipost Cards will not be used for the other centres.

Preliminary findings based on the Visipost Card data processing system are described and documented in Appendices 20-27 pages 52-64, but it must be emphasized that these results are exploratory only and will eventually be superseded by more accurate computed data. It will also be possible to present these findings in other forms that are not practicable at present because of the amount of calculation involved.

Drawings

Whilst carrying out the survey at UCL it became apparent that the efficient use of space might depend upon some method of zoning the facilities available in parcels larger than those represented by single departments. For UCL it was decided that a full set of diagrammatic drawings, showing every room on the campus, was needed so that this possibility could be studied objectively. Diagrammatic drawings of the College, located on the National Grid, are therefore being prepared showing each floor of every building. Rooms have been numbered using the four-figure Visipost Card numbers so that the information contained on the room survey cards can be related to rooms on the drawings.

The drawings are to a scale of 1:100 and are of standard format. A typical sheet, one of about 400, is shown in Appendix 28 page 65, reduced in size from A2. The drawings will be required for later stages of the detailed UCL surveys, especially for studies of staff and student movement patterns in relation to circulation spaces. They will also provide a check on the completeness of the carded data since there should be a card for every space and every space within the external walls of buildings has a defined size and code number. The drawings, which have been largely taken from existing record drawings, will be checked and brought up-to-date and it is hoped that once the carded data is stored on the computer, a reporting system will be instituted so that information on room stock will always be up-to-date and immediately available. Such a system of space data recording and updating is already in partial operation in Brown University, Rhode Island, but it is the team's view that it will fail there because the data being recorded are too detailed.

Zoning

Each university will be divided into 'zones' of which there are about 30 at UCL as compared with about 60 departments. A zone is a geographically defined group of facilities in which change and sharing can be accommodated on a more rational, open-ended basis than is possible with unique academic or administrative units. A zone can loosely be described as an area within which journeys are insignificant. A 'journey' is the normal pedestrian route. A 'significant' journey is assessed in terms of its distance and nature. Furthermore, a zone must be easy to comprehend and will therefore generally correspond to a building, a group of buildings or to a definable part of one building.

Initially, the concept has been extended further so that within a zone, the areas of all constituent spaces on each floor can be computed and checked against that measured within external walls. This leaves freedom to combine these smaller zones in various ways in the later stages of the study.

SECTION 1.3

Leicester Space Survey

A higher degree of sophistication has been possible in the space survey at Leicester because:

(a) Considerable experience has been gained at UCL

(b) Investigation showed that computer techniques can be used to advantage on the extended study (the UCL survey began before extension became possible)

(c) Techniques were developed in parallel with the survey activities at UCL

(d) Because a larger proportion of the campus consists of recent buildings, documentation was more up-to-date.

The method was still based on the preparation of one information card for each space in the University, but the duplicated card was superseded by a specially printed IBM Port-A-Punch (PAP) Card (see Appendices 8-13 pages 36-43).

The prodedure at Leicester was as follows:

1 Examination of drawings and obtaining copies from architects and from the Bursar.

2 Each space allocated a four-digit 'Room Code Number'.

3 Nett areas for each space calculated.

4 Codes established for Zones and Departments.

5 PAP Cards prepared as far as possible from drawings.

6 Cards completed in-situ (each space was visited).

7 Cards checked and filed in Room Code Number order.

A survey staff of seven, six of whom were local people who replied to an advertisement in the newspaper (see Appendix 16 page 46) completed the collection of room data in four weeks. They had to be trained in the carding techniques and in making consistent subjective judgements of such things as the quality of daylighting.

In allocating Room Code Numbers a ten per cent overflow allowance was made on each floor of each building and a further ten per cent for the building as a whole. This permitted re-allocation of Room Numbers during the survey where building alterations had taken place. A part of a typical working drawing is shown in Appendix 29 page 66. The room code numbers (actually in red) and area calculations appear on the drawings. Zone and departmental codes were similar to those used at UCL. Each drawing had a summary sheet attached, one of which is shown in Appendix 30 page 67.

Surveyors generally prepared a set of cards for one floor of one building and took these and the corresponding drawing out on survey. It was usually possible to complete columns 2-32 and 38 from the drawings. Where alterations had occurred, the new room configuration was sketched in, the prepared cards scrapped, room code numbers re-allocated, the numbers used or unused noted, and new cards made out. The revised areas were calculated back in the office. Surveyor, date and room name were written and non-coded data (notes) kept to a minimum.

Card checking was done by another surveyor who

examined each card and ticked the room code number on the drawing. Each number was accounted for either as a space and corresponding card or as unused. Computer programs and sortation techniques are being used to eliminate errors as far as possible but certain types of errors that could only be recognised by re-visiting rooms, once made, cannot be eliminated. Finally, the area within external walls of buildings, floor by floor, was calculated (see Appendix 30 page 67) and will be checked with computer calculations making an estimated percentage allowance for internal walls.

Appendix 31 page 68 shows the progress at Leicester in bar-chart form.

More detailed accounts of this and other surveys, developments of computer programs etc. will be published separately from time to time as the study proceeds.

SECTION 1.4

Tabulation and Analysis

The quantity of data associated with this study is considerable and the facilities of the UCL Computer Centre are being used. Trial programs have been run on the IBM 360 Computer in Fortran IV programming language.

[illegible] the basic set of PAP room survey data cards a duplicate set is being produced which will be more robust and easier to read electronically. Errors that can be recognised by the computer, will be located and corrected.

A program has been written to compile the data from Port-A-Punch cards in a form suitable for tabulation. Another program tabulates one variable against a second and a third program will perform this operation a number of times having first sorted the data with respect to a third variable.

With these programs, tabulations similar to that shown in Appendix 23 page 58 will be printed out by computer. This will eliminate considerable manual preparation and analyses of the data. These programs may be extended to include calculation of means and standard deviations of individual variables and tests of significance of the tabulations.

SECTION 2

Preliminary Activities Study

The collection of information on timetabling has been referred to in section 1. Existing room uses have been recorded on room survey cards in terms of primary use or primary and secondary use (see columns 42, 44, 46 and 48 of the IBM PAP card Appendix 8 page 36). This is for preliminary analyses only because it is hoped that from the remaining data on room characteristics it will be possible to invent a new method of room nomenclature, as mentioned in Note 4 (see Appendix 1 page 27). Greater flexibility of use might be obtained by classifying in terms of size and fixed facilities. These characteristics will be analysed in relation to the concept of zoning (see section 1.2) and the results will be given in later reports.

Preliminary inquiries have been made in each of the centres about the nature of courses, method of timetabling and personnel records kept. It is interesting to note that the four universities represent a variety of academic and administrative systems. Students at UCL taking the London science degrees work to a course unit system; other UCL degree structures are more traditional. At Leicester

many take Combined Studies in four or five subjects. Sussex has nine Schools of Study instead of the traditional faculties and departments, while the City is industry-oriented and divided into half year semesters.

Lectures in the UCL B.Sc. courses that are attended by students from more than one department are timetabled by computer. Timetabling at the City is entirely centralised. Room and course structure data at Sussex are stored on an ICT 1905 computer.

Brief notes on the four centres are given in Appendix 4 page 30 and notes on personnel records at UCL and on timetabling and personnel data at Leicester appear in Appendices 32 and 33 on pages 69 and 70.

More detailed studies of room use are under way at UCL in the Departments of Chemical Engineering and English. These departments were chosen as being widely dissimilar and representative of many aspects of university functions. Rapid recording methods are being developed before extending the study to other academic and administrative departments.

SECTION 3

Information Search

Relevant material from all over the world is being assembled as a basic information library to which others as well as ourselves can refer. A system of information handling has been developed to cope with what will eventually be a considerable volume of material, and is described in Appendix 34 page 71. It is based on keywords, a list of which appears in Appendix 35 page 75 and those who advised the team in setting up the system are listed in Appendix 36 page 78. The process of collecting material, particularly unpublished work, is a slow one, but is rewarding in that it is uncovering related, though generally less detailed work in a number of centres, especially in the USA. Bibliographies are being sought and examined.

The team proposes to publish annotated bibliographies and evaluations of selected items from time to time.

List of Appendices

List of Appendices (continued)

APPENDIX 1

Publications

1. Introductory Paper — February 1967.
   A preliminary paper presented to the UCL Professorial Board.

2. Introductory Note No. 2 — March 1967.
   A more detailed note presented to the Use of Capacity Sub-Committee of the Vice-Chancellors' Committee.

3. Introductory Note No. 3 — April 1967.
   A consolidated version of the two previous papers, circulated to the heads of departments at UCL and other interested parties.

4. Paper 4 — November 1967.
   An up-dated version of Note 3 for circulation to the heads of departments in the other centres.

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APPENDIX 2

The Consultative Committee

The members of the Consultative Committee are:

Chairman and members of the Vice-Chancellors' Sub-Committee on the Use of Capacity

Mr G. B. Oddie	Department of Education and Science
Mr J. A. Humphreys	Department of Education and Science
Mr E. Williamson	University Grants Committee

APPENDIX 3

Note on selection

Four universities were suggested originally by the Vice-Chancellors' Sub-Committee on the Use of Capacity. They were suggested because they included "a large red-brick university in an industrial town (Sheffield), a newer university with a recent period of rapid growth (Leicester), a former CAT (City), and a new university which has existed for long enough to have settled habits (Sussex)."

Progress to date

Progress at the other centres to date is as follows:

City of London:	Discussions with Vice-Chancellor and Pro-Vice-Chancellor.
	Meeting with all Departmental Heads and Paper 4 circulated.
	Survey to begin in late March.
Leicester:	Discussions with Bursar.
	Letter to all Departmental Heads enclosing Paper 4.
	Drawings obtained.
	Space survey carried out in February.
Sheffield:	See main text.
Sussex:	Discussion with Bursar.
	Survey to begin during Easter Vacation.

APPENDIX 4

Notes on the four Universities

University College London

Founded in 1826 the College has developed on a highly urban ten-acre rectangle in Gower Street. The buildings are very mixed, covering the whole period of its history and a number of neighbouring buildings are also used.

Over 3,000 undergraduate students and 1,500 post-graduates study a wide range of subjects in nearly fifty departments. About 55% of the students study science subjects. 33% of the students are from London and 22% from abroad. 25% live in Halls of Residence, 25% at home and 50% in flats and lodgings.

City of London University

City University was originally a polytechnic (1891-1956) and then Northampton College of Advanced Technology until it became a University in 1966. It, too, is on a highly urban site near The Angel, Islington. The main building dates from the end of the nineteenth century. Neighbouring buildings are now used and major extensions are under construction on an adjoining site.

There are about 1,800 undergraduate and 100 post-graduate students studying in eleven departments, the emphasis being upon technical subjects. The academic year is unusual in that it is divided into two twenty-week semesters, students taking either a three-year course or a four-year sandwich course. Halls provide accommodation for about 35% of the students, 30% live in lodgings and flats and the remaining 35% at home.

University of Leicester

This was founded as a College in 1921, becoming the University of Leicester in 1927. It is situated on a 25-acre site on the edge of a large park one mile from the centre of the city. The original building is early nineteenth century but most of the buildings now used have been constructed since the war.

The University has more than forty departments in which about 2,000 undergraduate and 350 postgraduate students study. Many take Combined Studies degrees covering four or five subjects. The majority of the students, 60%, live in Halls and only 2% at home.

APPENDIX 4 (cont.)

University of Sussex

Sussex was founded in 1961 as a new university. It is situated in a 200-acre park, four miles from Brighton. A variety of buildings are spaciously arranged around a large grassed court.

Nine Schools of Study cater for about 1,750 undergraduate students and 350 postgraduates. Courses are aimed at providing both a general and a specialised education. Only 10% of the students live in Halls, 5% at home, 35% in guest houses in Brighton and 50% in flats and lodgings.

(This information is derived from:

Which University?

Cornmarket Press Ltd.

London 1967.

More comprehensive and up-to-date statistics and comments will appear in later reports).

APPENDIX 5

Metrication

Metric measurements and scales are being adopted throughout this study since, by the time the work is completed, the change to metric will be well advanced. In the meantime, some mental manipulation will be necessary and the following conversion factors are given for your convenience:

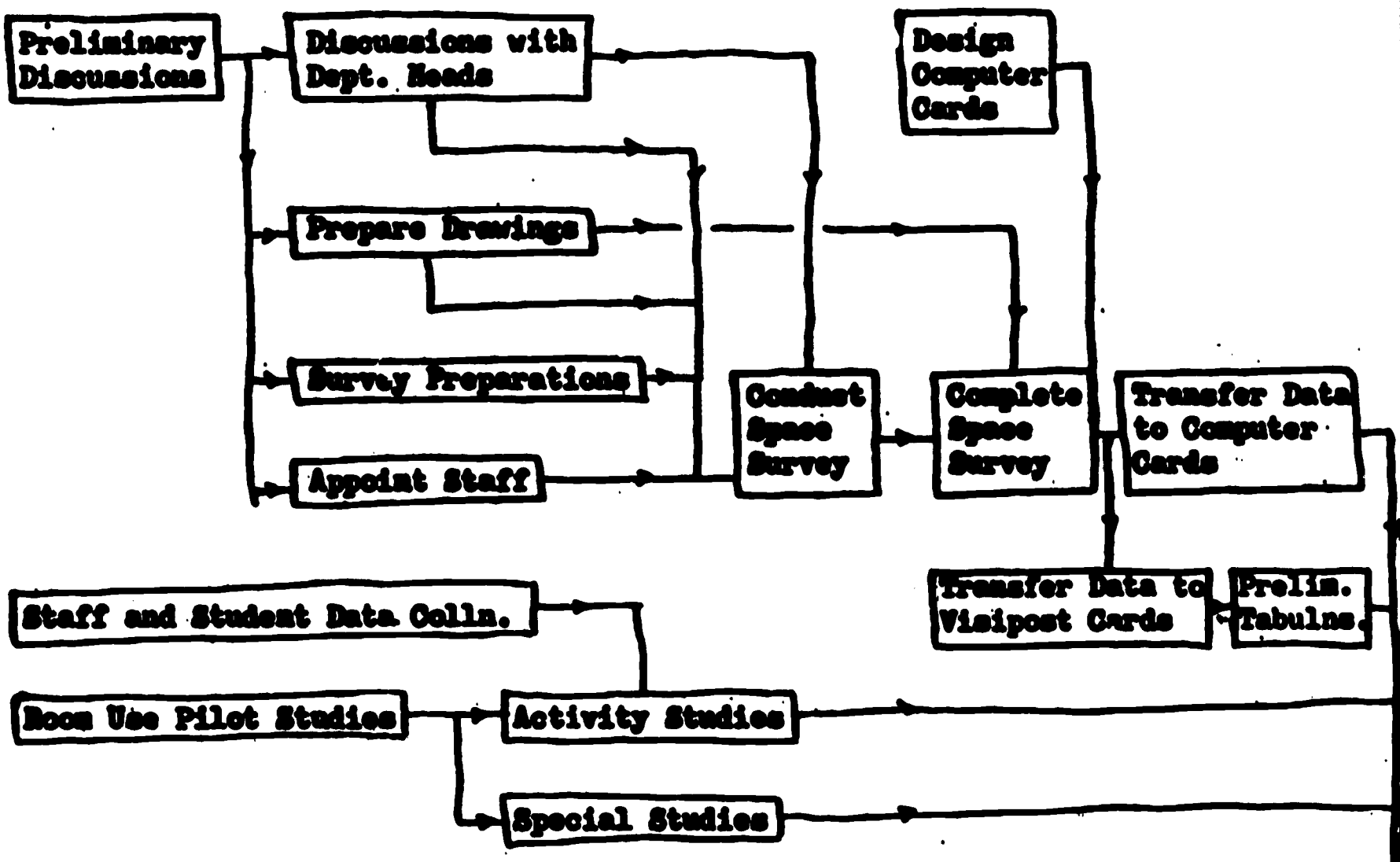
1 metre	3.28 feet
1 square metre	10.76 square feet

1:100 is approximately equivalent to $\frac{1}{8}$":1 foot.

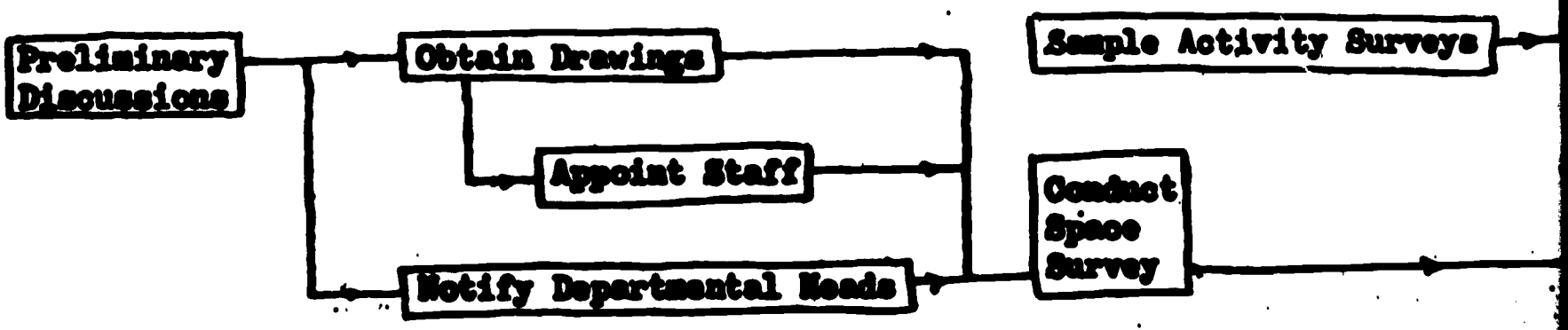
APPENDIX 6

OUTLINE PROGRAMME OF THE PROJECT

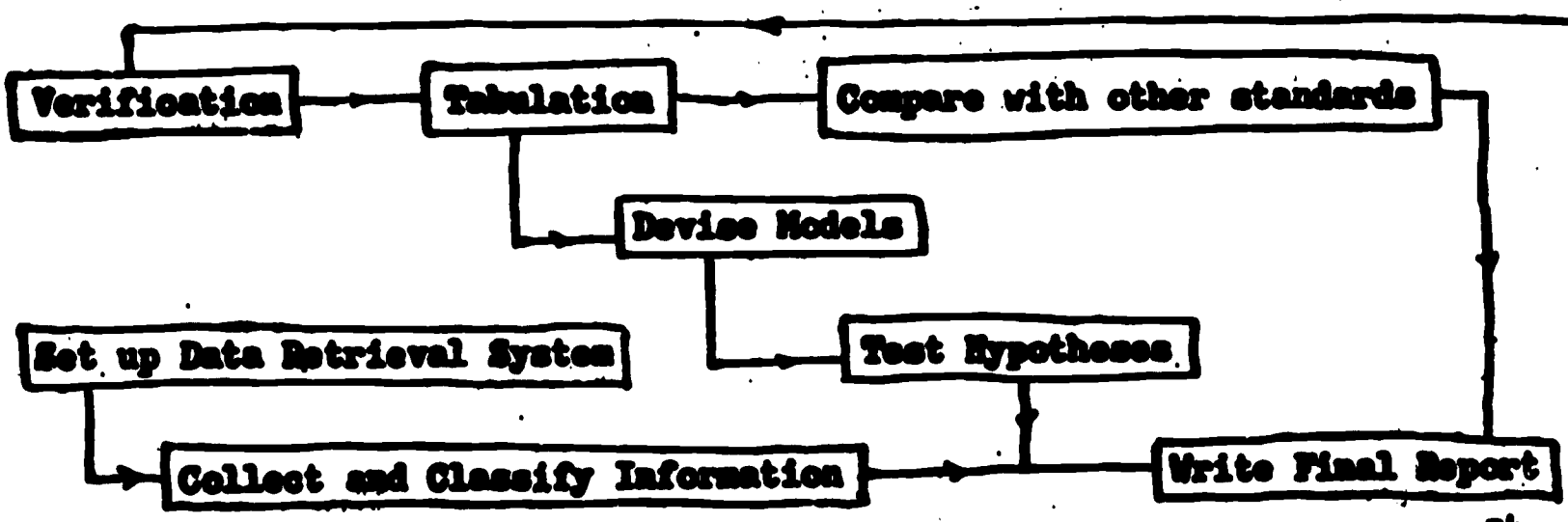
UNIVERSITY COLLEGE LONDON



CITY, LEICESTER, SUSSEX



GENERAL



APPENDIX 7

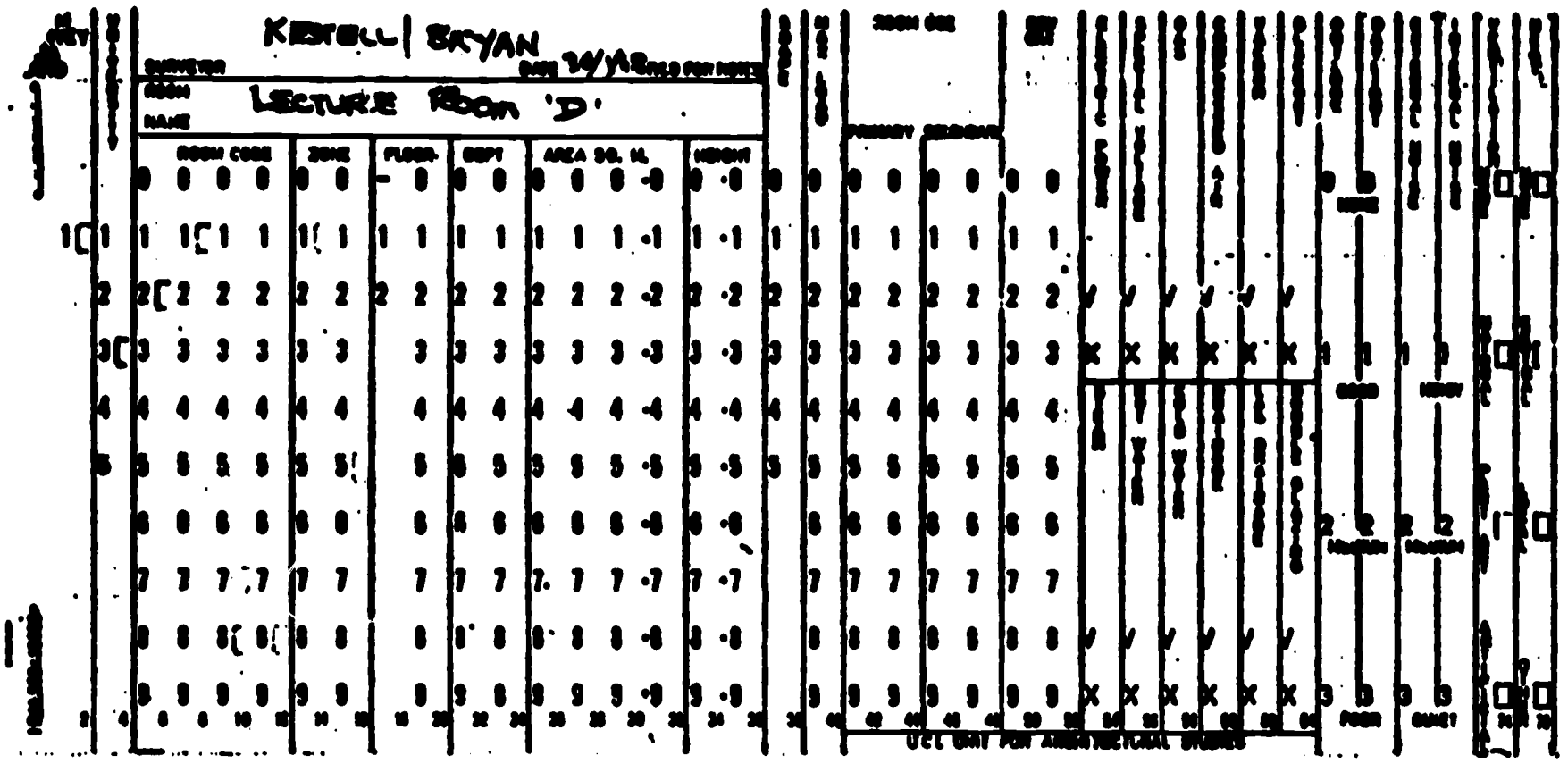
Programming Note

Programming of the project is based on a link diagram shown in Appendix 6 page 34. Each operation is listed and its relationship to other operations indicated by arrows.

It is a simplified version of the working programme which will be constantly updated by inserting and excluding complete operations, adjusting their relationships and by programming certain periods in more details as and when necessary.

APPENDIX 8

Port-A-Punch Card

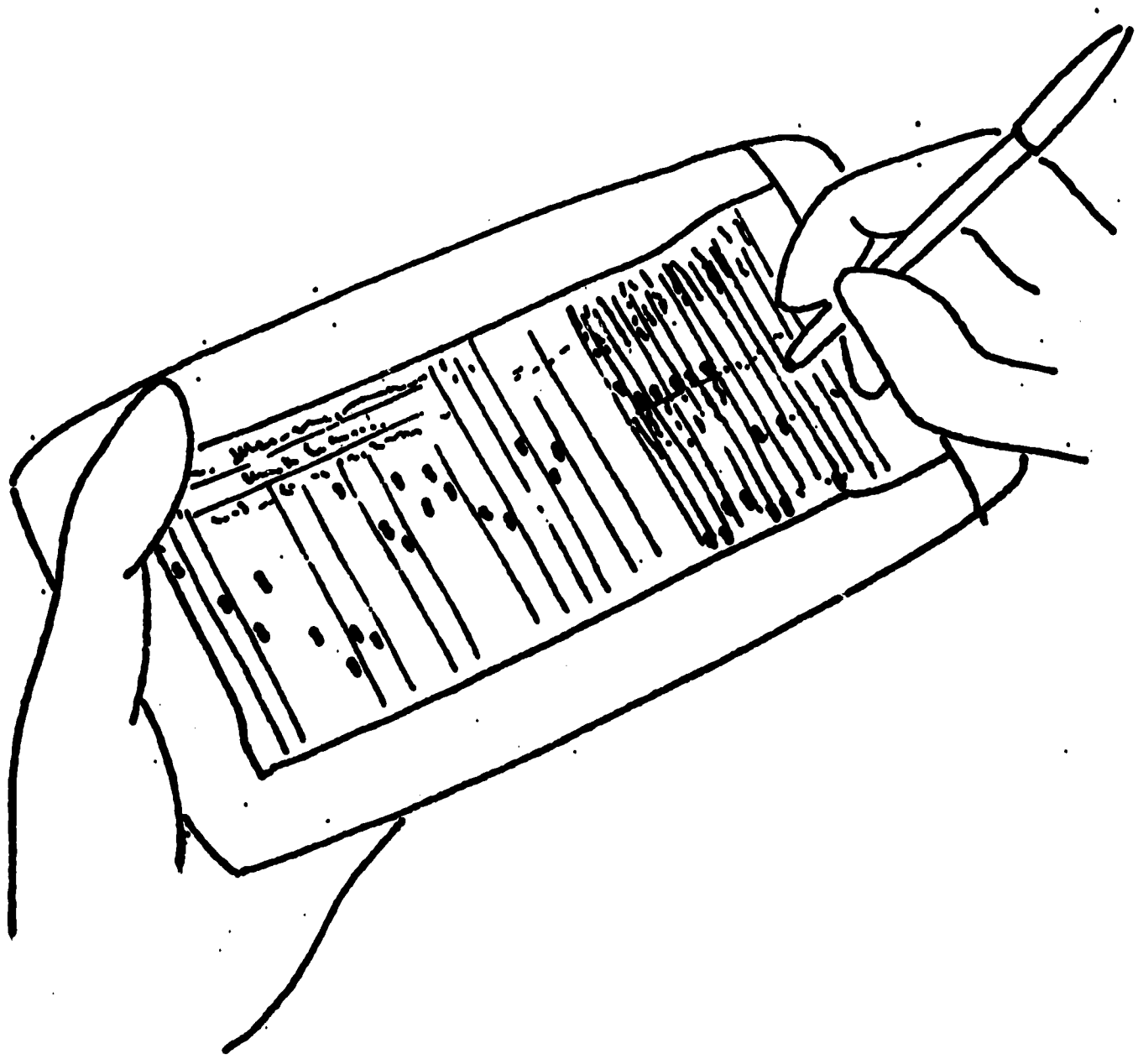


The Port-A-Punch Computer Card used to collect room survey data. To the right of each symbol is a chad, a pre-scored rectangle, which can be punched out by hand. The actual technique of punching using a Port-A-Punch Board is illustrated in Appendix 9 page 36 and notes on completing the cards are given in Appendix 10 page 37 .

APPENDIX 9

Port-A-Punch Board in Use

While actually surveying the room its computer card is put into the Port-A-Punch Board and the appropriate chads punched out.. The plastic Board has a rubber base to facilitate punching by means of a simple pencil-like instrument. Underneath is a magazine which stores about fifty cards.



APPENDIX 10

Completing the Port-A-Punch Computer Cards

The card shown in Appendix 8 page 36 is used in conjunction with an IBM Port-A-Punch Board illustrated in Appendix 9 page 37. Information is recorded by punching out "chads" to the right of the appropriate number or symbol. The following notes explain column by column the information recorded:

Columns	Notes
2	1 informs computer that this is a room survey data card.
4	1-4 identifies the University.
6-12	Four-digit code identifies the space.
14-16	Two-digit number locates the space in a zone (see section 1.2 page 9). A zoning code is worked out for each university.
18-20	0 = ground floor 1 = first floor 2 = second floor etc. -1 = the floor below the ground floor -2 = the second floor below the ground floor etc.
22-24	Two-digit code for department worked out for each university (see Appendix 11, page 40).

Columns	Notes
26-32	Nett area of space in square metres.
34-36	Height in metres.
38	Shape code - see Appendix 12 page 42.
40	A loading code that will be used at a later date if required.
42-44	Primary Use code - see Appendix 13 page 43.
46-48	Secondary Use code as for Primary, indicated where a space has a significant secondary use.
50-52	Revised category reserved for a potential rather than an actual room use classification.
54-64	Indicating the presence or absence of various services and facilities.
66-76	Self-explanatory. The numbers in columns 66-72 are to aid transference from the UCL cards to PAP cards.
78-80	Left space for later information to be included.

The surveyor writes by hand his name, the date and the present Room Name. Notes are dealt with as soon as possible.

APPENDIX 11

Departmental Coding at Leicester

01	Non-classifiable
10	Archaeology
11	Astronomy
12	Chemistry
13	Classics
14	Economics
15	Economic History
16	Engineering
17	English
18	English Local History
19	French and Italian
20	Geography
21	Geology
22	German
23	History
24	History of Art
25	History of Science
26	Law
27	Mathematics
28	Museum Studies
29	Music
30	Philosophy
31	Physics
32	Politics
33	Psychology

APPENDIX 11 (cont.)

34	Sociology
35	School of Social Work
36	Biochemistry
37	Botany
38	Genetics
39	Zoology
40	General Physiology
41	Medical Research Council Microbiol Systematics Unit
42	School of Education
43	Adult Education
44	Centre for Mass Communication Research
45	Victorian Studies Centre
46	Central Photographic Unit
47	Biology
80	Centrally Allocated Rooms
81	Catering and Social Facilities
82	Finance
84	Administration and Works
85	Computing
86	Libraries
91	Student Health Service
99	Non College Spaces

APPENDIX 12

Shape Coding

1	Square
2	1 x $\sqrt{2}$ rectangle (i.e. 1 x 1.4)
3	1 x 2 rectangle
4	1 x 4 + rectangle
5	L-shape where dimensions of re-entrants are both between $\frac{1}{4}$ and $\frac{3}{4}$ of room-dimensions
0	Irregular

APPENDIX 13

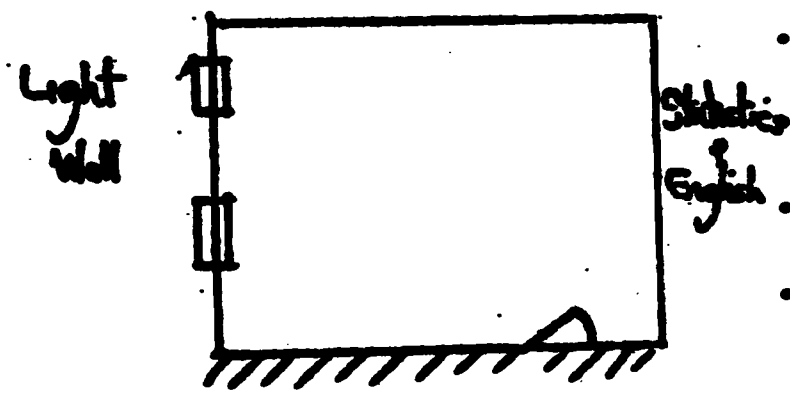
Room Use Classification

00	Other rooms
01	Staff Office (assumed suitable for teaching 2 or more students) + Research Students' Office
02	Teaching 10 or less people
03	Teaching 11-30
04	Teaching more than 30
05	Library
06	Lecture Room with stepped floor
07	Studio or Drawing Office
08	Laboratory
09	Common Room
10	Workshop
11	Plant spaces, ducts, tanks etc.
12	Cleaning, Maintenance etc.
13	Toilets, cloakrooms etc.
14	Catering Rooms
15	Store
16	Administrative Office
17	Vertical circulation space (stairs and the landings, lifts etc.)
18	Horizontal circulation space
19	Not yet classifiable

UOL Room Survey Card

3	Outlook	Electric Power
3	Daylight	Special Voltage
	Artificial Ltg.	Heating
2	External Noise	Gas
1	Internal Noise	Compressed Air
1	Ventilation	Vacuum
		Special Gasses
		Steam
		Hot Water
		Cold Water
		Drainage
		Lab. Drainage

SKETCH not to scale



NOTES :

1420	Visipost Number
Architecture Building	Location
Basement	
Architecture	Department
B1	Present Room No.
workshop and laboratory	Present Use-Name
1	Shape Number
9(B)	Furnishings
	Revised Category
21.5	sq.metres Area
3.0	metres Height
	lbs/sq.ft Load

APPENDIX 15

Work and Staff, July-December 1967

Month	July					August				September				October					November				December			
Date	3	10	17	24	31	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11	18	25
Week Number	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Activities																										
Seeing Heads of UC Departments	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Surveying UC	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
UC Survey Data on to VP Cards	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Preparation of UC drawings	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Permanent Staff																										
John Musgrove	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Charles Doidge	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Miss Virginia Middleton-Smith	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Temporary Staff																										
Part-time secretarial help	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roger Styles	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
Hin Chan	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arinze Agbim	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Malcolm Morrison	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Miss Wendy Parrott	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
David Banks	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Gabriel Onochie	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0
Miss Valerie Seddon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0

1 = working on project
0 = not working on project

APPENDIX 16

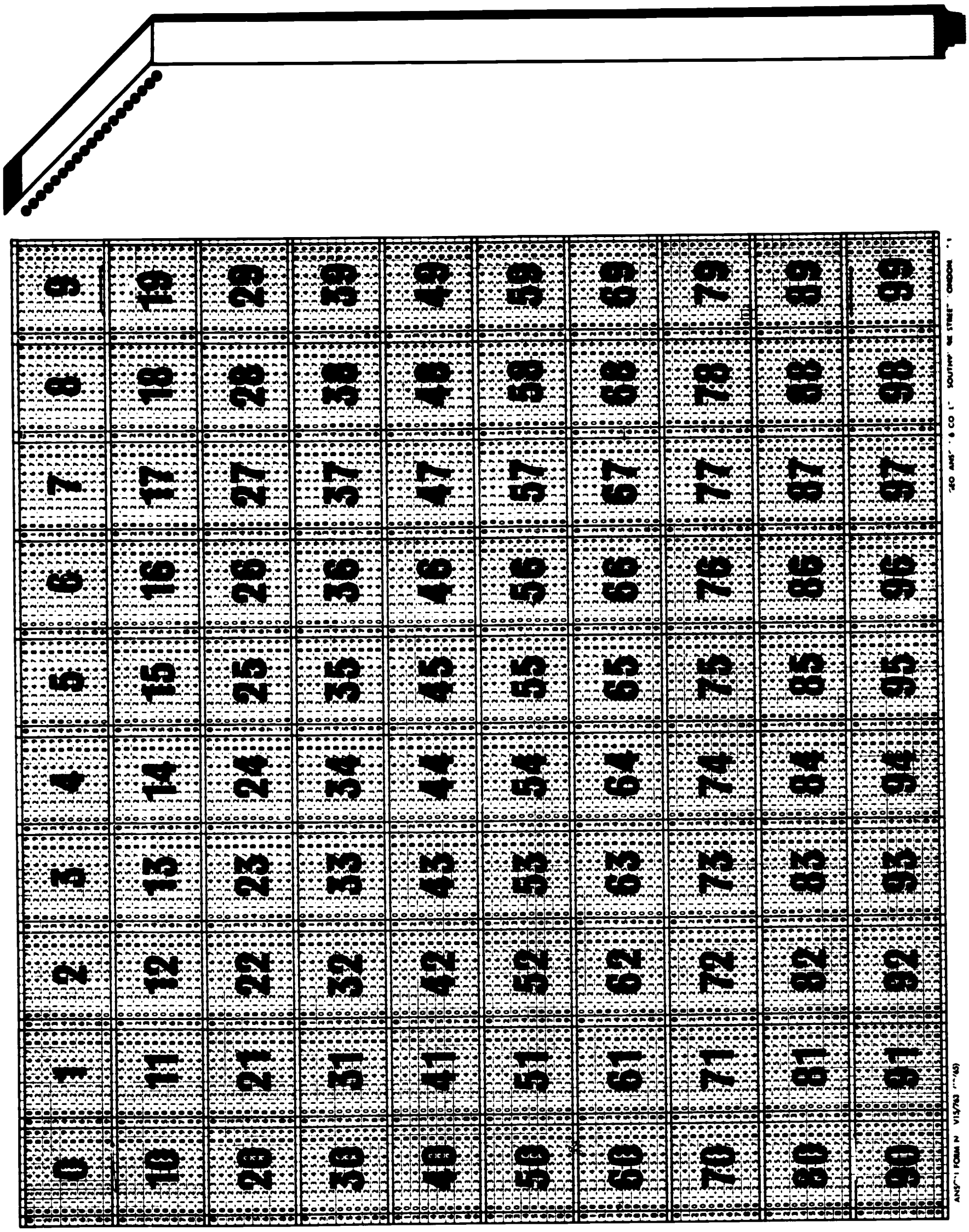
Work and Staff, January-February 1968

Month	January					February			
Date	1	8	15	22	29	5	12	19	26
Week Number	27	28	29	30	31	32	33	34	35
Activities									
UC Survey Data	1	1	1	0	0	0	0	0	1
Leicester Survey Data	0	0	1	1	0	0	0	0	1
Leicester Survey	0	0	0	0	1	1	1	1	0
Computer Programming	0	0	0	1	1	1	1	1	1
Permanent Staff									
John Musgrove	1	1	0	0	0	1	1	1	1
Charles Doidge	1	1	1	1	1	1	1	1	1
Mrs June Hines	0	0	0	1	1	1	1	1	1
Miss Virginia Middleton-Smith	1	1	1	1	1	1	1	1	1
Temporary Staff									
Miss Wendy Parrott	1	1	1	1	1	1	1	1	1
Miss Valerie Seddon	1	0	0	0	0	0	0	0	0
Roger Kestell	0	0	1	1	1	1	1	1	1
Mrs Isobel Brown	0	0	0	0	1	1	1	1	0
Christopher Bryan	0	0	0	0	1	1	1	1	1
Mrs Lorna Eyre	0	0	0	0	1	1	1	1	0
Miss Christine Gask	0	0	0	0	1	1	1	1	0
Mrs Betty Jones	0	0	0	0	1	1	1	1	0
Mrs Irmgard Watson	0	0	0	0	1	1	1	1	0

1 = working on project
0 = not working on project

APPENDIX 17 — The Anson Visiposr Card

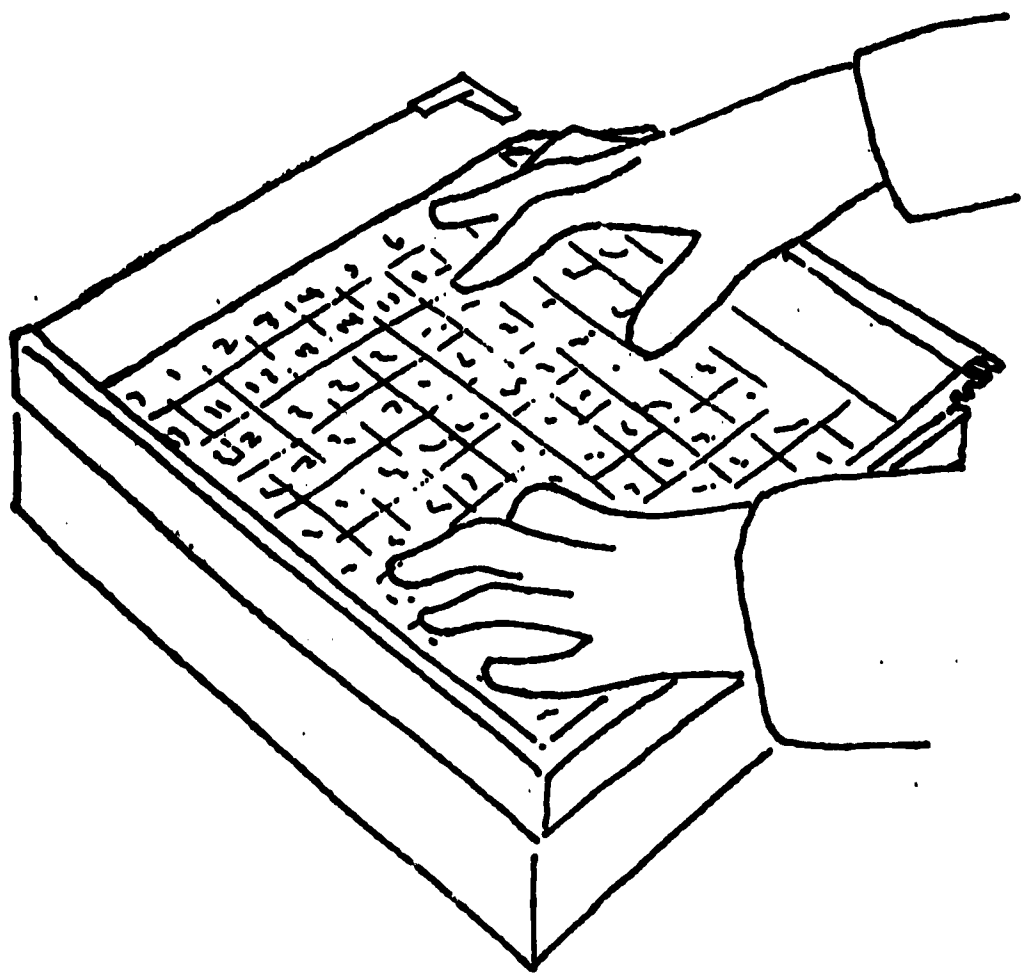
The Visiposr Card used in the NSL Space Survey and in the Keyword Data Retrieval System. The actual Card is 9½ x 21.5 centimetres (3.7" x 8.4"). Circular holes, the size of one square, are punched using a special hand punch.



APPENDIX 18

Illustrating Data Retrieval from Visipost Cards

The Visipost Cards are placed on a light box and "read" by optical coincidence of holes punched in the Cards.



APPENDIX 19

Data Retrieval from Visipost Cards

Room use is not determined by one factor alone but by a combination of factors. The data collected in the course of the room survey at UCL has been transferred to Visipost Cards (see Appendix 17, page 47) so that combinations of factors can be studied by optical coincidence of holes punched in the Cards (see Appendix 18, page 48).

Each Visipost (VP) Card is divided into ten thousand numbered squares. Each of the five thousand or so spaces in UCL has a four-figure code number which corresponds to a square on the VP Card. There is, in effect, a Card for each classification of each characteristic. Thus there are six different Cards for shape, etc. However, to reduce the amount of punching necessary in most cases one of the classifications of each characteristic has been left out since its data can be deduced by elimination. Thus there is a Card for the presence of a cold water supply but not for the absence; there are Cards for good daylighting, bad daylighting, none, but not for moderate daylighting.

The distribution diagrams in Appendices 22-27 on pages 57-64 have been drawn to illustrate data deduced from the VP Cards. One set of twenty-two Cards covers room height and from these a diagram can be drawn showing the distribution of room heights in the College by counting the number of holes on each Card which covers a certain range of heights, and adjusting the area under the graph in that range to represent the number of holes (see Appendix 22 page 57). Another set of forty Cards covers room areas in 15% steps from which can be drawn a room size distribution diagram for the College (see Appendix 25 page 62).

However, the main potential of these Cards is their use in combination. The Cards representing certain requirements are withdrawn and placed one on top of another on a light box. By examining each of the Area Cards in turn with the Card for the Department of English, for instance, it is possible to draw a room size distribution diagram for that Department (see Appendix 26 page 63).

Any number of Cards can be superimposed. The

diagram showing the distribution of laboratories in the Department of Chemical Engineering (Appendix 27 page 64) was drawn from data deduced using groups of three Cards, i.e. an Area Card with those for laboratories and Chemical Engineering.

As mentioned in section 1.2 the preliminary analysis illustrated in this report will be superseded when the UCL data is transferred to computer cards and the programs run. The VP Cards will not be used in the other centres. Their main uses are mentioned in section 1.2.

APPENDIX 20

Preliminary Findings at UCL

The data and diagrams in Appendices 21-27 show the distributions of various factors as deduced from the information now punched on Visipost Cards. These are given to illustrate the nature only of pilot analyses and are not accurate in detail.

The UCL data, when stored on computer cards, tapes or disks, will be capable of presentation in a number of ways that are not practicable as yet. For instance, room volumes and the total aggregate areas of rooms and different height ranges will be compared (to show the space lost at UCL because of the nature of so many of the old buildings).

Appendix 21 shows the percentage of rooms of various shapes. Shape was recorded because it has an appreciable effect on room use, particularly for small group teaching.

Appendix 22 illustrates the distribution of room heights, the room heights in metres being plotted along the x-axis and the number of rooms within the various height ranges along the y-axis. Where the height range has been increased the number of rooms has been reduced proportionately so that each 0.2

metre range represents the approximate number of rooms in UCL of that height. (It is expected that, compared with elsewhere, the rooms at UCL will be generally higher because they have to fit old building exteriors.)

Appendix 23 shows in tabular form various room size distributions. The area ranges represent approximately 15% steps in size, this being considered as the smallest functionally significant step. The steps were approximated to ease the task of transferring to Visipost Cards and vary in fact from 10-18%, although only 8 of the 39 steps are outside the range 13-17%. The varying widths can be seen in the logarithmic diagrams. These differences are important in that individual results are affected and account, for instance, for most of the "jump" from 93 to 195 rooms in UCL for the ranges 10.0-11 and 11-13 square metres respectively, the latter representing an area percentage range almost twice as great as the former. But taken over the whole diagram the effect can be ignored, and since the Visipost system is to be used for pilot investigations only, does not matter. Written into the computer program is a sub-program which will separate data into precise 15% ranges.

The Departments of English and Chemical Engineering have been compared in Appendix 26 since they are the two selected for the pilot study of room use. Similar information can be deduced for each department.

The distribution of laboratories in Appendix 27 illustrates one of several use types that could be examined, and the distribution of laboratories in the Chemical Engineering Department has been established by extending the Visipost Card process a stage further. The actual techniques of data retrieval were described in Appendix 19.

Appendices 24-27 illustrate graphically the data tabulated in Appendix 23.

In Appendix 24 the area of individual rooms is plotted along the horizontal axis and the number of rooms within that range of areas along the vertical axis. On the linear scale the 15% steps become steadily larger and the "long tail" in fact represents only a very small number of large rooms (only 34 out of over 2,400 larger than 200 sq. metres). Much of the significant information on the graph is contained in the bottom right-hand corner but is not discernible. Such graphs have therefore been plotted on double

logarithmic scales which in effect enlarge the detail in that corner. Appendix 25 shows the same data plotted in this way from which it is easier to see the significant aspects of the distribution.

Appendix 26 compares the room size distributions in the same way for two departments and in Appendix 27 the distribution of laboratories in UCL as a whole is compared with that in the Department of Chemical Engineering.

In conclusion it must be repeated that these graphs are plotted on logarithmic scales, that the information is incomplete, that certain approximations have been made, that these are exploratory findings only and that they will be superseded by more accurate, computed data in due course.

APPENDIX 21

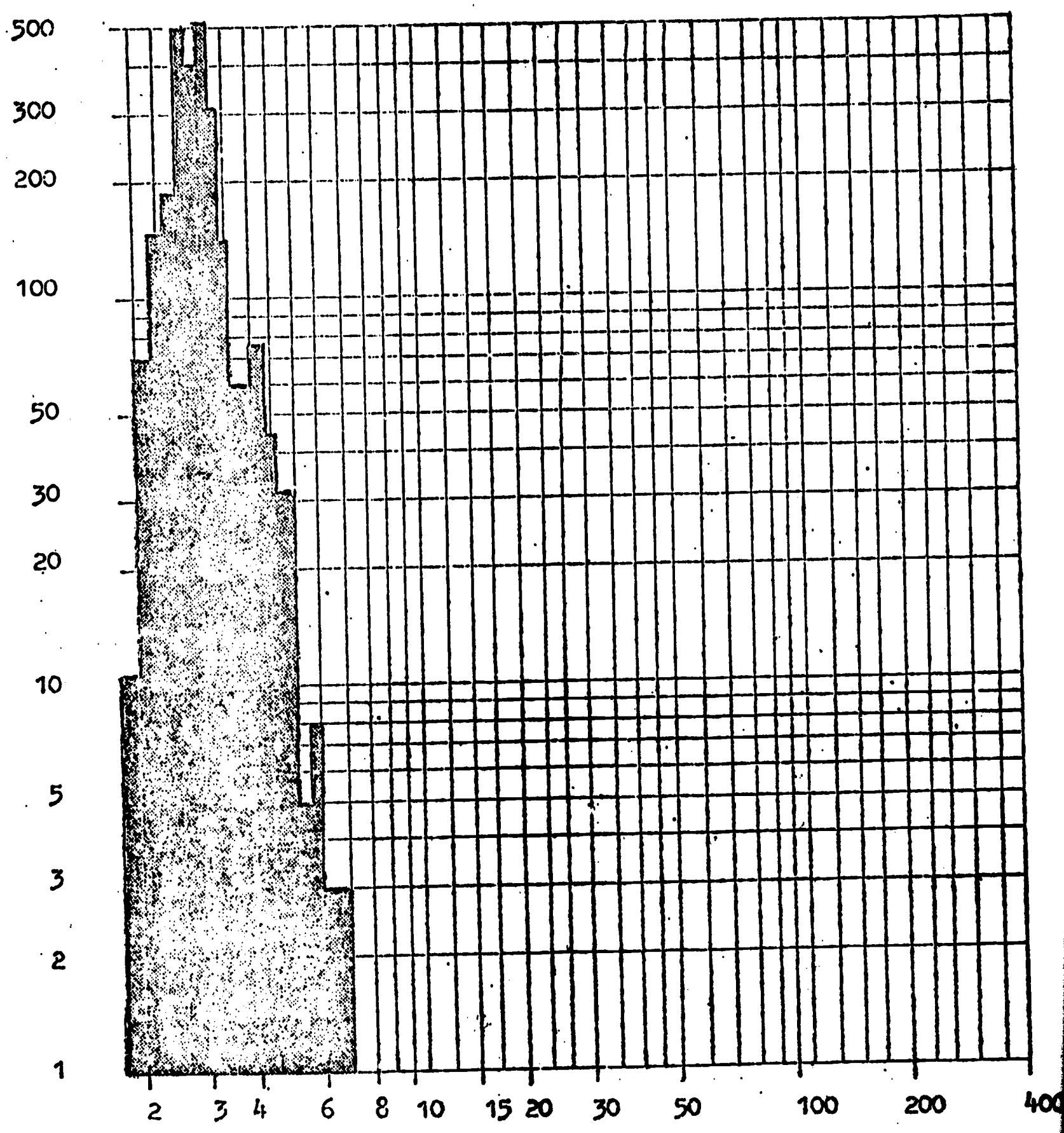
Distribution of Room Shape at UCL

1	Square	20%
2	1 x 2 Rectangle	42%
3	1 x 2 Rectangle	24%
4	1 x 4 + Rectangle	4%
5	L-shaped	5%
0	Irregular	5%

APPENDIX 22

Distribution of room heights in UCL

(Note that both scales are logarithmic)



2

APPENDIX 23

Room Size Distribution Table.

Area in sq. metres	UCL total no. of rooms	Dept. of English no. of rooms	Dept. of Chem. Eng. no. of rooms	Total no. of laboratories	Dept. of Chem. Eng. no. of laboratories
0-2	82	0	3	4	0
2.0-2.3	22	0	0	0	0
2.3-2.6	18	0	0	3	0
2.6-3.0	31	0	0	2	0
3.0-3.5	34	0	0	0	0
3.5-4.0	32	0	0	1	0
4.0-4.5	31	1	0	6	0
4.5-5.2	54	0	3	7	0
5.2-6.0	40	1	3	7	0
6.0-7.0	77	0	2	16	1
7.0-8.0	99	0	0	17	0
8.0-9.0	83	0	5	19	2
9.0-10.0	94	4	2	20	1
10.0-11	93	2	1	13	0
11-13	195	7	5	36	2

APPENDIX 23 (cont.)

Area in sq. metres	UCL total no. of rooms	Dept. of English no. of rooms	Dept. of Chem. Eng. no. of rooms	Total no. of laboratories	Dept. of Chem. Eng. no. of laboratories
13-15	197	2	5	39	1
15-17	230	1	4	45	1
17-20	183	1	3	56	1
20-23	164	1	2	43	1
23-26	89	1	0	21	0
26-30	85	0	3	19	1
30-35	85	5	5	21	4
35-40	62	2	2	21	1
40-45	38	0	1	13	1
45-52	40	0	0	14	0
52-60	52	0	6	24	5
60-70	35	1	2	7	0
70-80	24	0	2	8	2
80-90	19	0	0	3	0
90-100	12	0	0	4	0

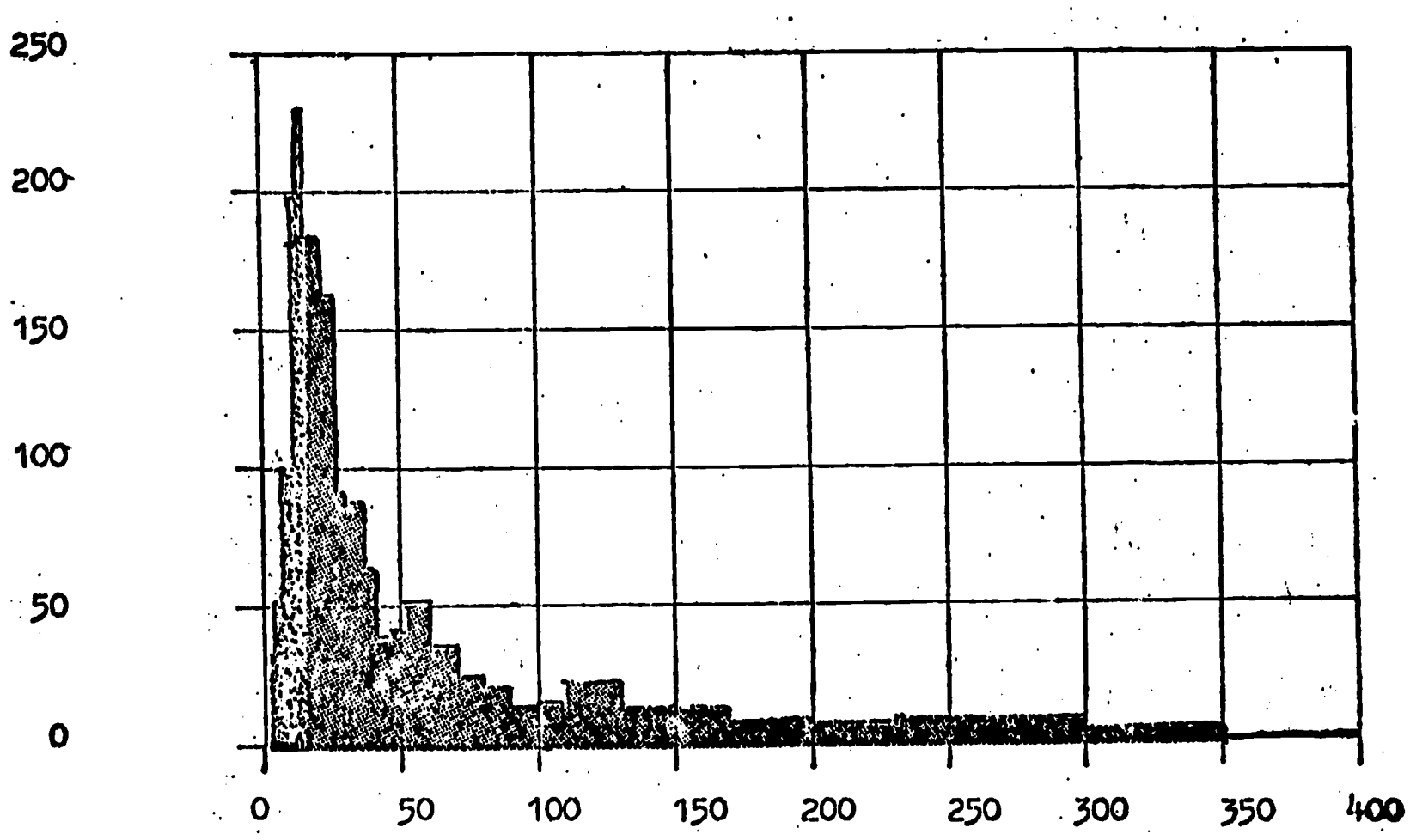
APPENDIX 23 (cont.)

Area in sq. metres	UCL total no. of rooms	Dept. of English no. of rooms	Dept. of Chem. Eng. no. of rooms	Total no. of laboratories	Dept. of Chem. Eng. no. of laboratories
100-110	16	0	0	7	0
110-130	25	0	0	5	0
130-150	12	0	0	2	0
150-170	12	0	3	2	1
170-200	7	0	0	1	0
200-230	6	0	1	4	1
230-260	8	0	0	2	0
260-300	8	0	0	6	0
300-350	4	0	1	2	1
350-400	1	0	0	0	0
400+	7	0	1	4	1

APPENDIX 24

Distribution of room sizes in UCL as a whole

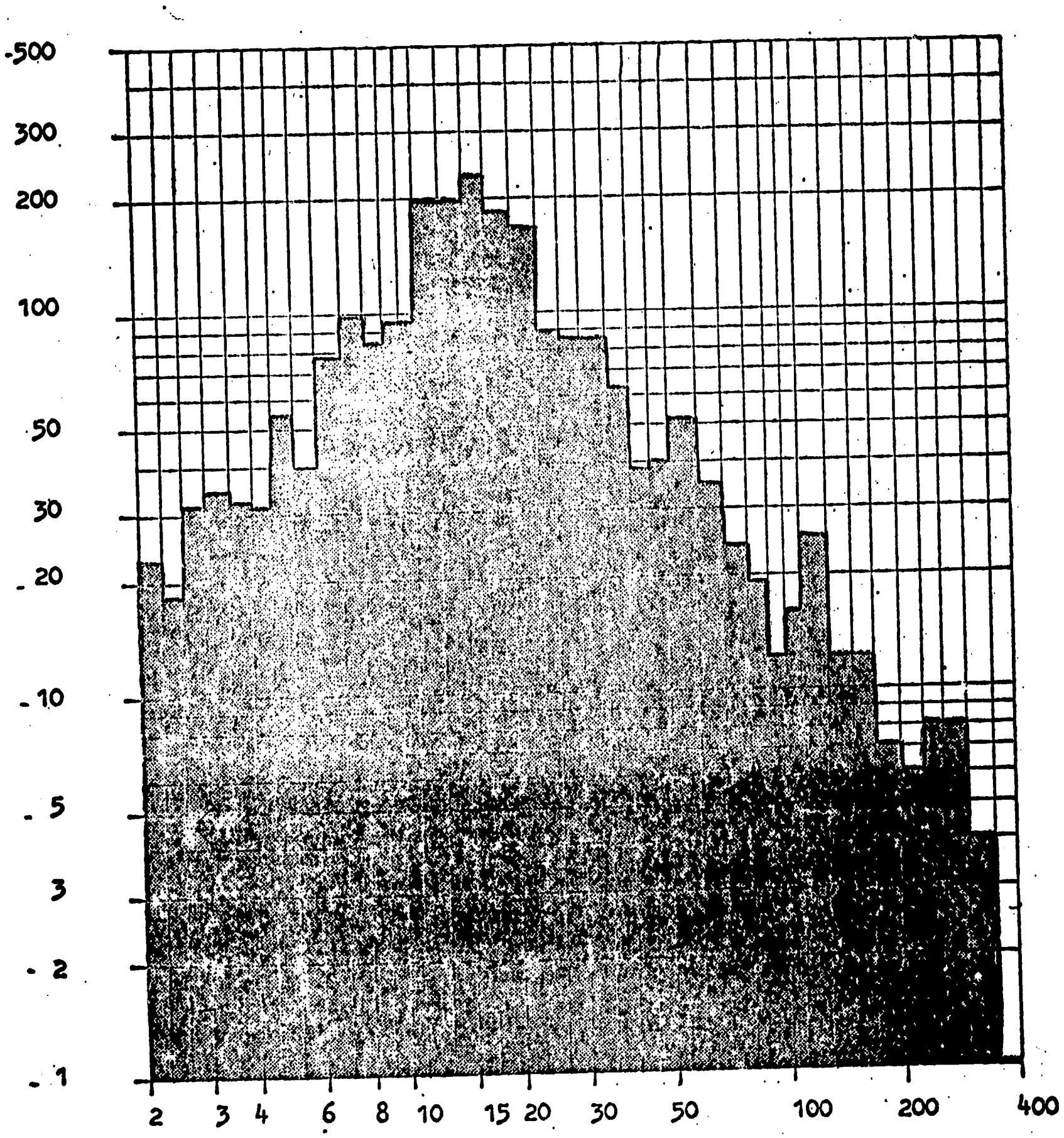
(Linear Scales)



APPENDIX 25

Distribution of room sizes in UCL as a whole

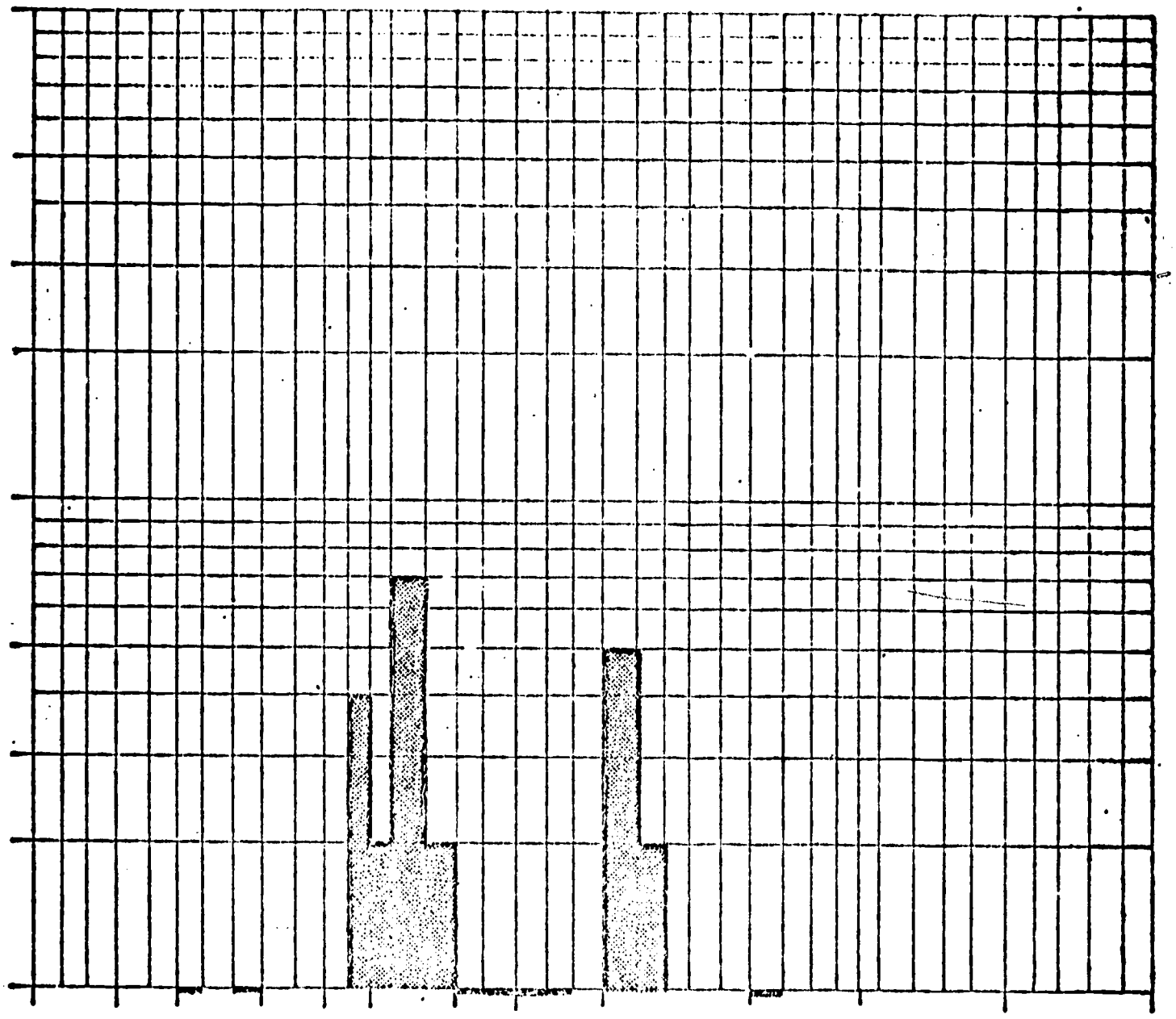
(Note that both scales are logarithmic)



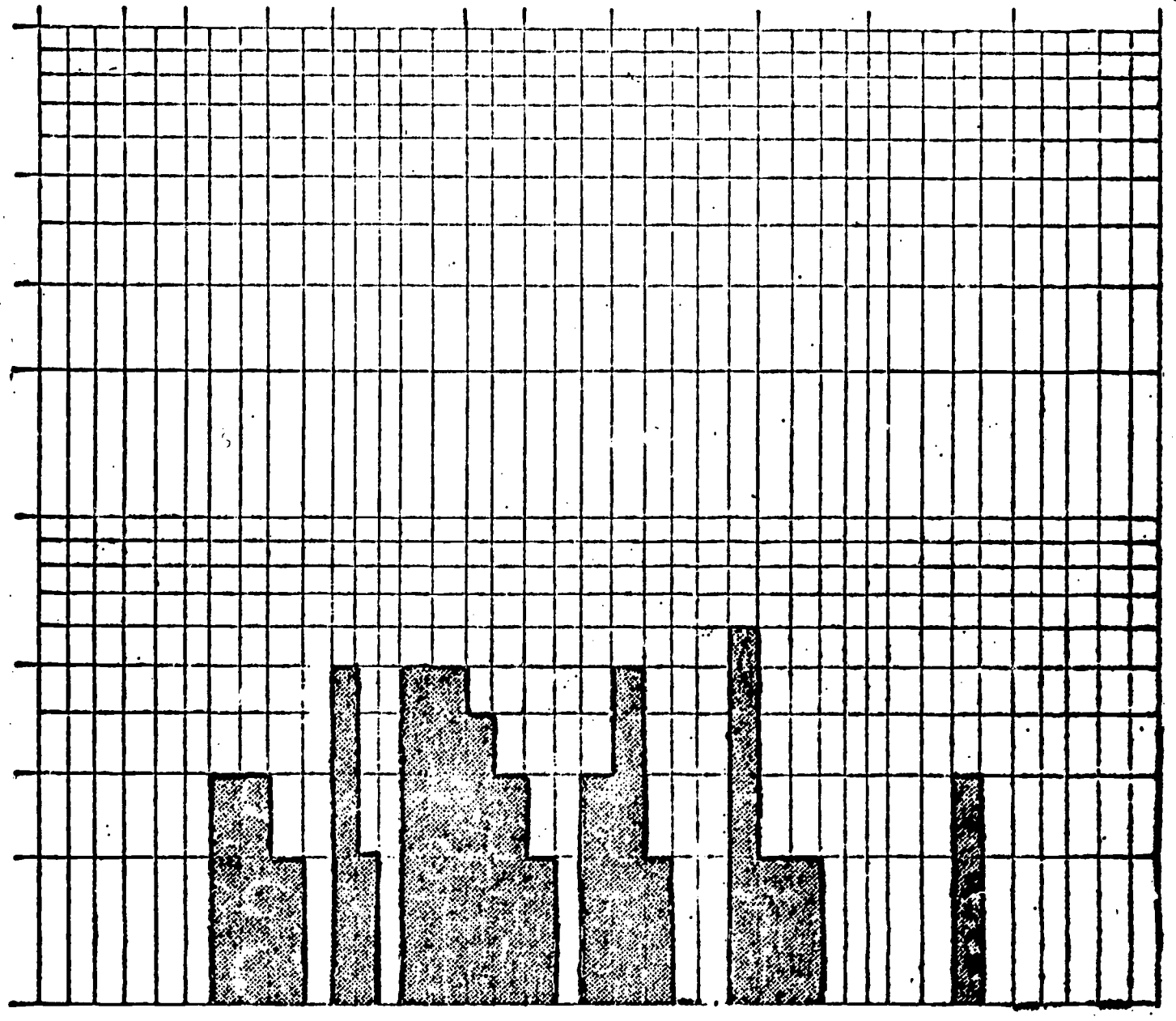
APPENDIX 26 Room Size Distribution in two Departments.

No. of rooms

Department of English

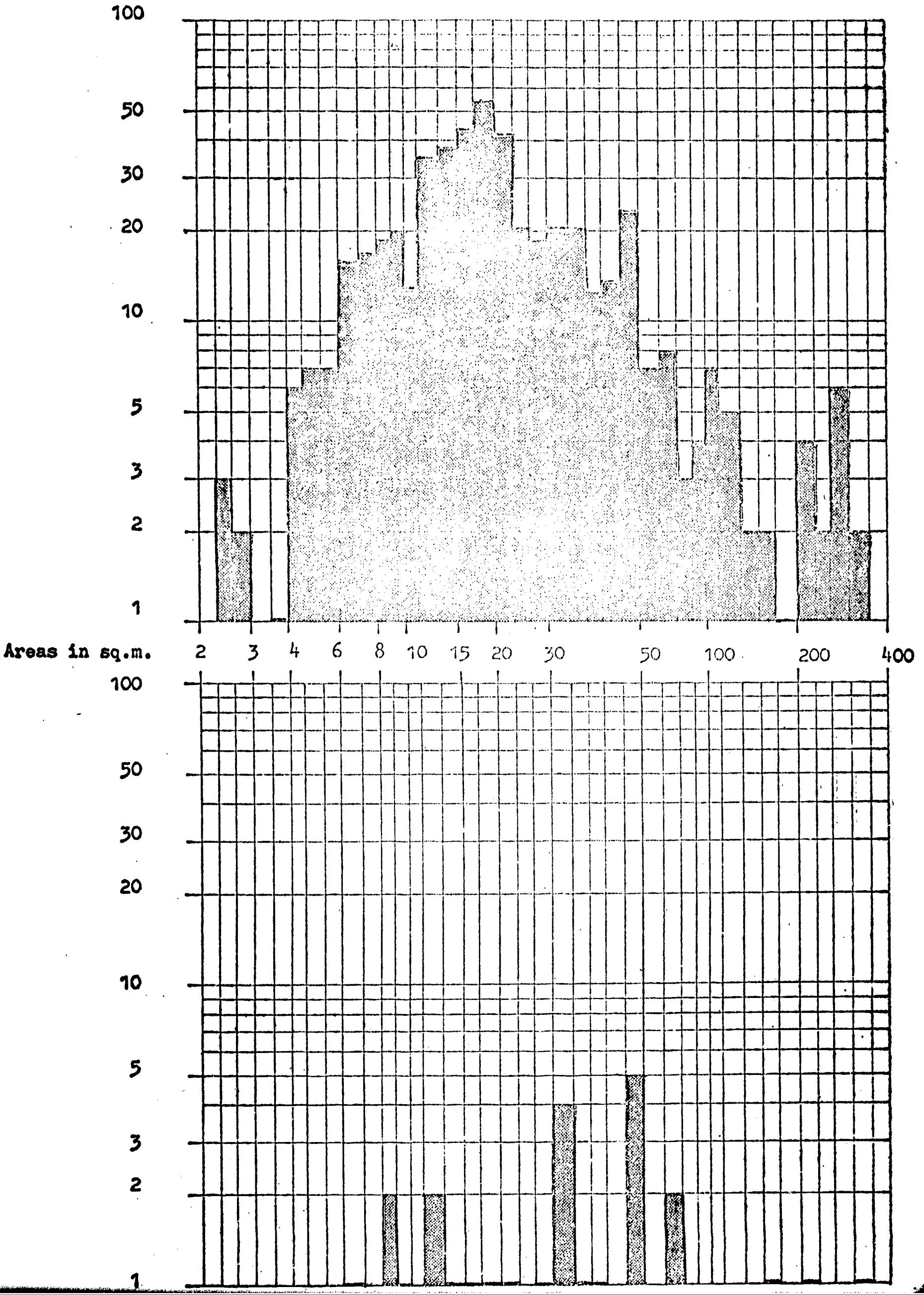


Department of Chemical Engineering



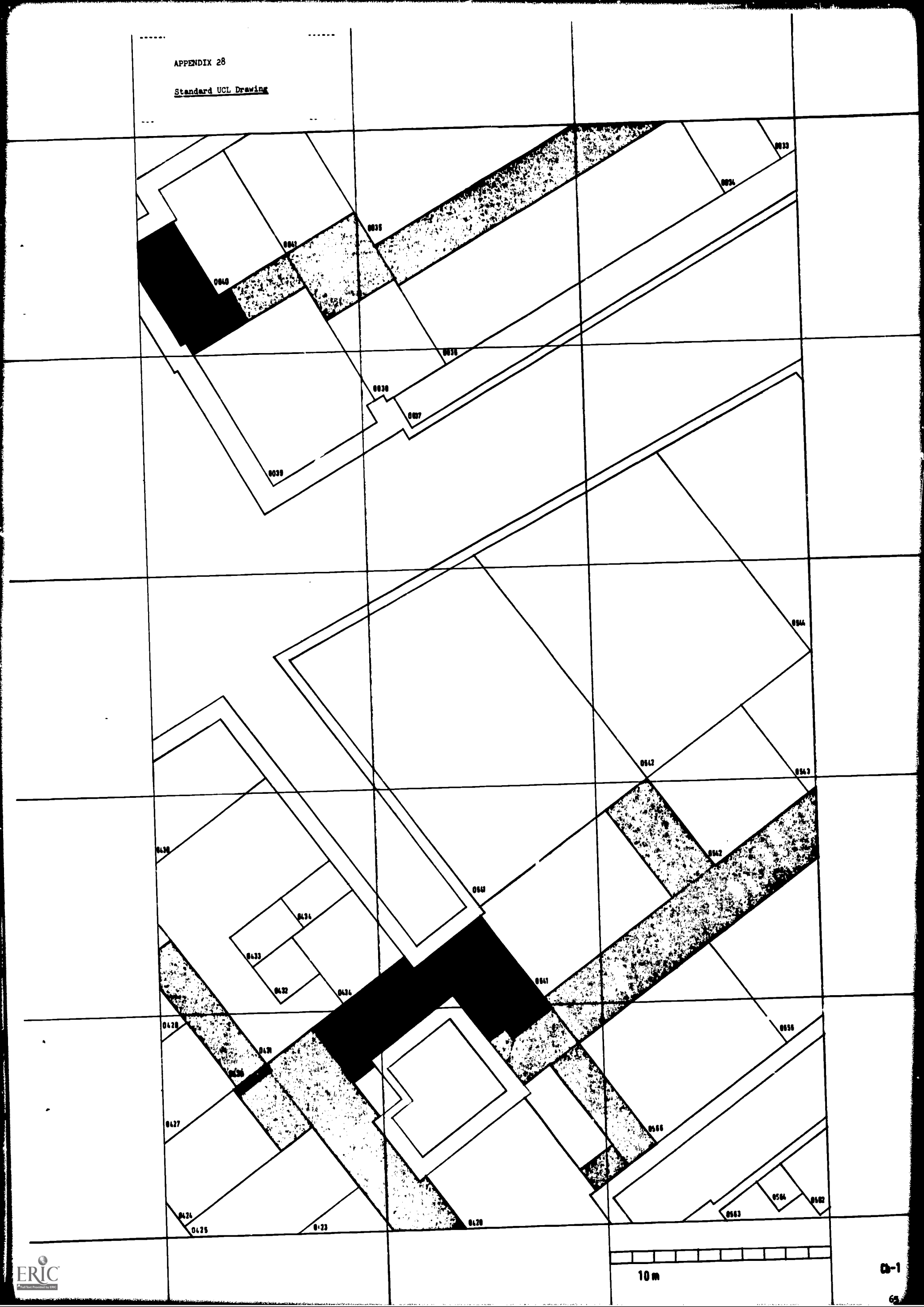
APPENDIX 27 Distribution of Laboratory Sizes

UCL as a whole



APPENDIX 28

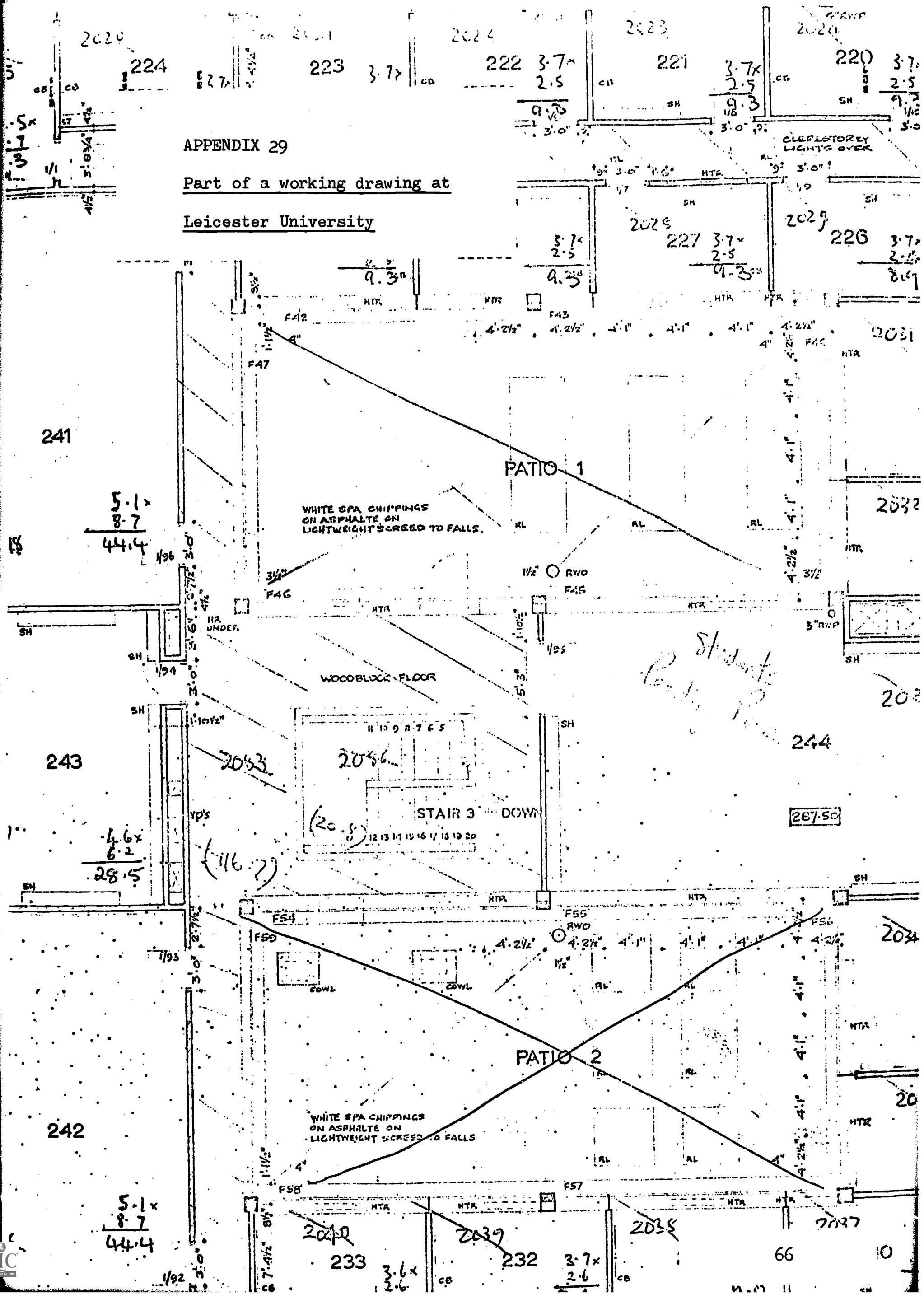
Standard UCL Drawing



APPENDIX 29

Part of a working drawing at

Leicester University



APPENDIX 30

Drawing Summary Sheet

University 3

Zone 22

Floor 0

Name of Building Engineering

Scale of Drawing 1:96

Person to Contact Mr. Freer

Where located 3011

Used Room Code Numbers 2810 - 2850 2853

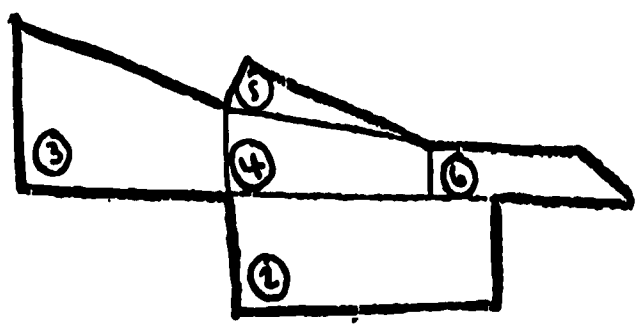
Spare Room Code Numbers 2851 // 2852 // 2853 // 2854
2855 // 2856 // //
// // //
// // //
// // //

Total Area of Floor 2297.0 square metres

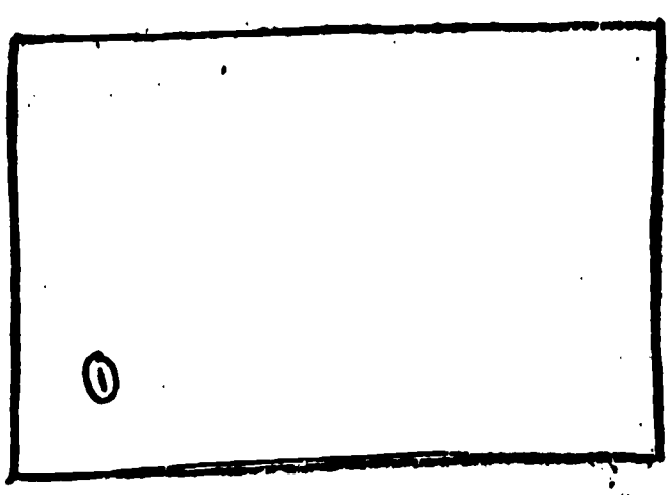
Notes

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....

Area Calculation



① 33.3 × 60.6 = 2018
② 5.3 × 15 = 8
③ ½(11+10) × 6 = 7
④ ½(10+3) × 12 = 7
⑤ ½(14×2) = 1
⑥ ½(12+9) × 3 = 3
2297



APPENDIX 31

Progress Chart of Space Survey at Leicester University

Month		January	February																	
Day		29	30	31	01	02	05	06	07	08	09	12	13	14	15	16	19	20	21	22	23
Zone	**Building**																				
	Training	11	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
11	Chemistry Teaching	00	11	10	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
10	Chemistry Research	00	00	11	10	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
15	Physics Building	00	11	11	11	10	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
24	R Block	00	00	01	10	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
14	Bennett Building	00	00	00	11	11	11	10	10	00	00	00	00	00	00	00	00	00	00	00	00
22	Engineering	00	00	00	11	11	11	10	00	00	00	00	00	00	00	00	00	00	00	00	00
23	"	00	00	00	11	11	11	10	00	00	00	00	00	00	00	00	00	00	00	00	00
13	Adrian Link	00	00	00	00	00	01	11	10	00	00	00	00	00	00	00	00	00	00	00	00
12	Adrian	00	00	00	00	00	01	11	11	11	11	10	00	00	00	00	00	00	00	00	00
20	Charles Wilson	00	00	00	00	00	00	11	11	11	11	00	00	00	00	00	00	00	00	00	00
21	" "	00	00	00	00	00	00	01	01	11	00	00	00	00	00	00	00	00	00	00	00
27	Astley Clarke	00	00	00	00	00	00	00	00	11	10	00	00	00	00	00	00	00	00	00	00
28	Percy Gee	00	00	00	00	00	00	00	00	00	11	11	11	11	00	00	00	00	00	00	00
25	H Block and College House	00	00	00	00	00	00	00	00	00	01	11	11	00	00	00	00	00	00	00	00
26	Fielding Johnson	00	00	00	00	00	00	00	00	00	01	11	11	11	00	01	11	11	10	00	00
16	Rattray	00	00	00	00	00	00	00	00	00	00	01	00	00	00	00	00	00	00	00	00
30	School of Education	00	00	00	00	00	00	00	00	00	00	00	01	11	00	00	00	00	00	00	00
31	School of Social Work	00	00	00	00	00	00	00	00	00	00	00	00	01	11	00	00	00	00	00	00
32	104 Regent Road	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	00	00	00	00	00
33	7a Salisbury Road	00	00	00	00	00	00	00	00	00	00	00	00	00	10	00	00	00	00	00	00
34	Museum Studies	00	00	00	00	00	00	00	00	00	00	00	00	00	10	00	00	00	00	00	00
35	Health Centre	00	00	00	00	00	00	00	00	00	00	00	00	00	10	00	00	00	00	00	00
36	Vaughan College	00	00	00	00	00	00	00	00	00	00	00	00	00	11	10	00	00	00	00	00
	Concluding	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	01			

1 = working on building
0 = not working on building
-/- morning/afternoon

APPENDIX 32

UCL Timetabling and Records

Timetabling at UCL is carried out by departments (with the exception mentioned in Section 2, page 23). Most departments have sent copies of their master timetables.

The Accounts Department has provided a complete list of staff at all levels giving name, department, sex and designation.

There are three sources of student lists; individual student records (probably the most convenient for our purposes), a typed list produced from these records (but not available until the end of the session) and a computer print-out arranged alphabetically by Faculty, not by Department.

Individual student records are arranged by faculty, department, year and finally alphabetically. A card for each student records name, course details, year of entry, type of residence etc.

Records for postgraduates are kept in the same way and filed by faculty, department and alphabetically.

APPENDIX 33

Leicester Timetabling and Records

Inter-departmental timetabling is centralised. The timetable structure is built around the Combined Studies courses which are taken by about 40% of the students. Students must pass eight course-years in four or five subjects to obtain their degree. Combination of courses is restricted by the timetable and each course has certain designated cognate subjects. When the timetable is completed a clash list is produced, and copies of the timetable are sent to the departments who arrange their own timetables round it. They then send these to the central administrator and rooms are allocated accordingly.

There are three sources for staff and student information, the calendar, wages sheets and student lists. The calendar and student lists have been supplied and the accounts department is preparing a list of staff not given in the calendar. Students are registered according to subject. Those taking Combined Studies are registered according to what will probably be their main subject.

APPENDIX 34

Information Handling

On hearing of a document that may be relevant a library card is made out giving, as far as possible, the author, title and details of publication. This is used in tracing the document in a library, buying it, ordering a photocopy or making inquiries to ascertain its relevance. When a document comes to the office it is given the next accession number and placed next on the shelves. It might be a book, periodical article, press cutting, notes or correspondence. Flexible shelving with moveable dividers facilitates storage of all forms of documents in accession order. Finally, the library card is completed and that too is stored in accession number order.

As soon as possible, the document is scanned and allotted 'keywords' from a prepared list. The keywords indicate the contents of each document, and enable users to find all the relevant information on a number of subjects or to find a particular document of which only some details can be remembered. Keywords for each document are noted on the back of its library card.

The present keyword list is given in Appendix 35 page 75. Having discussed the principles, it was

compiled mainly by examining the information collected and experimenting with a developing word list. The people and organisations who advised the team in setting up the system are given in Appendix 36 page 78.

The final step is to transfer the keywords from library cards to Visipost cards. Each keyword has a Visipost Card similar to that used in the space survey (Appendix 17 page 47). For each keyword of each document, a hole is punched in the appropriate Visipost Card in the numbered square representing the accession number of that document. The library cards list the keywords for each document and the Visipost Cards now 'list' (by a series of holes) the documents for each keyword.

Retrieval

To retrieve information on a given subject, definitive keywords are chosen from the list and the Visipost Cards are picked out and examined on top of each other on a light box. The light will shine through any coinciding holes, thus denoting the numbers of relevant documents. If the document has been returned to a library or is out on loan, a note is left in its position on the shelves saying where it is.

For a comprehensive system, most operators have found in practice that 500-800 keywords will cover everything. Many systems operate with far fewer and, at present, this specialised system has only 80.

Four refinements have been added to the basic word system. First, all periodical articles and books are 'keyworded' as such to speed retrieval. The second refinement is an 'author index'. Two sets of keyword cards from A-Z denote the first and second letters of authors' surnames. When searching for a document by a particular author, a card from each set can be combined to indicate all documents by authors whose names begin with the same two letters. Thirdly, superseded information can be identified by using the 'CANCEL' card with the others selected. Coinciding holes are noted, the CANCEL card removed and all numbers now coinciding except those noted represent up-to-date pieces of information. Fourthly, where information, especially correspondence, can be followed up at a later date, one of its keywords is 'FOLLOW-UP'.

This 'mechanical' system is not as easy to 'short-circuit' as more traditional library systems which physically store documents according to one range of classifications. The only aid to memory is accession order. However, the fact that it is necessary to

search systematically should make both thought and action more efficient, and produce better results. When searching for information, the system will show when an enquiry is too general or too specific by indicating too many or too few documents to examine. As the Cards are not completely opaque, 'near misses' are also indicated.

Development

As the research develops, certain aspects will require more detailed investigation. More specific keywords can be added by making out new cards and noting that they are operational only beyond a certain number or, if necessary, by re-examining all the documents covered by a more general keyword and allotting them the more specific keywords. Keywords can be withdrawn by simply removing the Visipost Cards. However, for efficient operation, it is necessary for both operators and users to work consistently and changes make this more difficult, and should therefore be kept to a minimum.

At a later date, it will be a comparatively simple matter to computerize the process if necessary and obtain print-outs of bibliographies on any subjects. It may be possible at a later stage to develop the keyword system for student use in an open access library.

APPENDIX 35

Keyword List - 5 January 1968

ACOUSTICS

ACTIVITY PATTERNS

ADMINISTRATION

AFRICA

AMERICAN CONTINENT - except USA

ANTHROPOMETRICS

AREA

ASIA

AUSTRALIA - and New Zealand

BIBLIOGRAPHY

BOOK

BUILDINGS

CANCEL - superseded information

CATERING

CHANGE

CIRCULATION

CITY OF LONDON UNIVERSITY

CLASSIFICATION

COMPUTING

CONSTRUCTION

CONVERSION

COST

CORRESPONDENCE

DATA HANDLING

DESIGN METHODS

EDUCATION THEORY

EUROPE - excluding Great Britain

FIRE

FOLLOW-UP - more specific information available on request

FOREIGN LANGUAGE

FURNISHINGS AND FITTINGS

FUTURE DEVELOPMENT

GROWTH

HEATING

HISTORICAL DEVELOPMENT

HOSPITALS

ILLUSTRATION

LABORATORIES

LECTURE

LEICESTER UNIVERSITY

LIBRARIES

LIGHTING

MAINTENANCE

OFFICES

OPERATIONAL RESEARCH

PERIODICAL ARTICLE

RESEARCH

RESIDENTIAL

ROOMS

SCHOOLS

SEMINARS

SERVICES

SHEFFIELD UNIVERSITY

SOCIAL

STANDARDS

STATISTICS - the subject, not the data

STRUCTURAL ELEMENTS

SURVEY DATA

SURVEY METHODS

SUSSEX UNIVERSITY

TEACHING METHODS

TIMETABLING

TOWN PLANNING

TUTORIALS

UNITED STATES OF AMERICA

UNIVERSITY COLLEGE LONDON

UNIVERSITY PLANNING

USE OF SPACE AND FACILITIES IN UNIVERSITIES

UTILIZATION

VEHICLES

A-Z Author Index, first letter of surname

A-Z Author Index, second letter of surname.

APPENDIX 36

Keyword System Advisers

The following people and organisations advised the team in setting up the keyword system of information retrieval:

Mr Marsden	Distillers Limited
Miss V. German	Wates Limited, Builders
Mr D. Dean	Deputy Librarian, RIBA
Miss E. V. Marshall	Cement and Concrete Association
Mr Gilchrist	ASLIB
Mr J. Konstruck	Alex Gordon & Partners, Architects
Mr B. C. Brookes	Reader in Information Studies, University College London
Mr R. Snel	Information Officer, Shell International Petroleum Company Limited.