1 **OVERVIEW**

Photography has been the principal medium for the recording of archaeological sites and artefacts since the middle of the nineteenth century. It is of primary importance to all field archaeologists and, consequently, an understanding of the techniques involved in photography are essential tools for any scientific project within archaeological sciences.

The aims of this course are to provide a thorough grounding in the basics of silver-based conventional photography. A selection of film formats will be covered from 35mm up to 6cm by 6cm roll film. We will cover the processing and printing of black and white negative material and colour processing. A new development in this course is the uses and technology involved in digital imaging. We will look at digital cameras, scanned conventional silver-based photographic material and the manipulation and output of digital files. In line with this development, the newly created Imaging Centre within the Photographic Department uses the most modern and up to date programmes and computer hardware.

This course will cover the photography of standing remains and object photography using a variety of camera types and lighting methods.

**TEACHING SCHEDULE**

Lectures will be held on Tuesdays in term one or on Fridays in term two between 14.00 and 16.00, in room 405.
Outside visits will be scheduled later in the term to undertake photography of standing remains or more likely the college building.

Lecture List
1st class  Introduction to photography within Archaeology SL
2nd class  The use of 35mm cameras and lenses and basic lighting SL
3rd class  Photography of materials with medium format using flash SL
4th class  Photography of materials using 'moving light', uses of filters SL
5th class  Developing and printing (or shift lenses dependant on weather) SL

READING WEEK (NO TEACHING)
6th class  The use of shift lenses including digital (Outside work so dress warmly) SL
7th class  Photography of materials using digital cameras SL
8th class  Digital inputting and basic image manipulation using Photoshop SL
9th class  Advanced digital imaging using Photoshop and Illustrator SL
10th class Reflection Transformational Imaging KP

Lecturer SL is Stuart Laidlaw
KP is Dr Kathryn Piquette

Basic texts
Recommended reading and topics covered

Introduction to 35mm
Basic principles and practice. Forming an Image, perspective & distortion, focusing and exposure, depth of field. Practical on using 35mm.

Object lighting
'Standard Lighting' and moving light and other techniques

Cameras and equipment
Cameras and lenses, shutters, light meters, scales and light filters. Practical on using medium and 35mm format cameras including camera movements

Electronic flash
Use of small units, hammerheads, ring flash, and studio flash

Processing
Development of 35mm and roll film processing and black and white printing
**Architecture**
Rectified photography using perspective control lenses on 35mm and medium format cameras. Site photography.

**Computers and imaging**
Digital images and their manipulation. Scanning vrs digital cameras
Ang, Tom 2008 Digital Photographer's Handbook, Dorling Kindersley
AIC Guide to Digital Photography and Conservation Documentation, 2nd Edition*

**ARCL 2035 Submission 2016/17**
**Methods of Assessment**
Archaeological photography is examinable by portfolio and essay.

The portfolio consists of 2 parts - this portfolio will count for 70% of the total course marks

(a) Black and white print

1 black and white print of a small object printed at an exact scale for example half size.

The print should be clear and sharp on unmarked or damaged paper. There should be no fixer staining and marks will be reduced for inaccurate sizing of the print. This may be output by digital means as a sized black and white output with no RGB values
submission date Friday 16th December 2016

(b) Digital files with metadata attached

1 digital file of a building with corrected verticals
1 digital file of a panorama or object using extended depth of field.
1 digital file of an object on a white background with scale showing the original photograph and the manipulated version.
1 digital file of a light coloured object on black background.
1 digital file of an object at same size as a black and white output at 300dpi.

The marks will be reduced if there is poor or inaccurate metadata. Obvious or discernable evidence of manipulation will lose marks. Scales should be clear, in focus and straight. Files can be in any file type.
Submission date Friday 20th January 2017

**AND**

An essay of about 1425 -2100 words

1. Discuss the advantages and disadvantages of conventional 35mm single lens reflex cameras to other film formats and type of image capturing systems.

2. How should you photograph a 30cm pottery vessel using two 500 watt tungsten floodlights and also
how would you photograph the same pot only using one single 150 watt tungsten light. What adjustments would you make on a digital camera and what problems will you have if using colour film.

3. Discuss the advantages and disadvantages of using a totally digital approach to photographing an archaeological site in a remote region. How will you archive this data and what system of metadata and keywording will you employ?

This essay will count for 30% of the total assessed mark.
Submission date Friday 20th January 2017
Course code ARCL 2035 Turnitin class ID 3228736 Password IoA1617

Word-length
Strict new regulations with regard to word-length were introduced UCL-wide and if your work is found to be between 10% and 20% longer than the official limit you mark will be reduced by 10%, subject to a minimum mark of a minimum pass, assuming that the work merited a pass. If your work is more than 20% over-length, a mark of zero will be recorded.

The following should not be included in the word-count: bibliography, appendices, and tables, graphs and illustrations and their captions. Penalties will only be imposed if you exceed the upper figure in the range. There is no penalty for using fewer words than the lower figure in the range: the lower figure is simply for your guidance to indicate the sort of length that is expected.
In the 2016-17 session penalties for overlength work will be as follows:

- For work that exceeds the specified maximum length by less than 10% the mark will be reduced by five percentage marks, but the penalised mark will not be reduced below the pass mark, assuming the work merited a Pass.
- For work that exceeds the specified maximum length by 10% or more the mark will be reduced by ten percentage marks, but the penalised mark will not be reduced below the pass mark, assuming the work merited a Pass.

Submission procedures (coversheets and Turnitin, including Class ID and password)

- All coursework must normally be submitted both as hard copy and electronically. (The only exceptions are bulky portfolios and lab books which are normally submitted as hard copy only and the digital submission which does not need turnitin and no hard copy.)
- You should staple the appropriate colour-coded IoA coversheet (available in the IoA library and outside room 411a) to the front of each piece of work (not digital submission) and submit it to the red box at the Reception Desk (or room 411a in the case of Year 1 undergraduate work)

All coursework should be uploaded to Turnitin by midnight on the day of the deadline. This will date-stamp your work. It is essential to upload all parts of your work as this is sometimes the version that will be marked

Students are required to submit hard copy of all coursework to the course co-ordinators pigeon hole via the Red Essay Box at Reception by the appropriate deadline. The coursework must be stapled to a completed coversheet (available from the web, from outside Room 411A or from the library)

Please note that new, stringent penalties for late submission were introduced UCL-wide. Late submission will be penalized in accordance with these regulations unless permission has been granted and an Extension Request Form (ERF) completed.
Date-stamping will be via ‘Turnitin’ (see below), so in addition to submitting hard copy, students must also submit their work to Turnitin by the midnight on the day of the deadline.

Students who encounter technical problems submitting their work to Turnitin should email the nature of the problem to ioa-turnitin@ucl.ac.uk in advance of the deadline in order that the Turnitin Advisers can notify the Course Co-ordinator that it may be appropriate to waive the late submission penalty.

If there is any other unexpected crisis on the submission day, students should telephone or (preferably) e-mail the Course Co-ordinator, and follow this up with a completed ERF

Please see the Coursework Guidelines on the IoA website (or your Degree Handbook) for further details of penalties.
http://www.ucl.ac.uk/archaeology/administration/students/handbook/submission

Hard copy will no longer be date-stamped.

Further information is given on the IoA website.
http://www.ucl.ac.uk/archaeology/administration/students/handbook/turnitin

Turnitin advisers will be available to help you via email: ioa-turnitin@ucl.ac.uk if needed.

Clearly there is no need for this with either the prints or digital files.

HOW TO UPLOAD YOUR WORK TO TURNITIN

Note that Turnitin uses the term ‘class’ for what we normally call a ‘course’.

1. Ensure that your essay or other item of coursework has been saved properly, and that you have the Class ID for the course which is 3228736 (available from the course handbook or here:
http://www.ucl.ac.uk/archaeology/studying/undergraduate/courses
http://www.ucl.ac.uk/archaeology/studying/masters/courses
and enrolment password (this is IoA1617 for all courses this session - note that this is capital letter I, lower case letter o, upper case A, number 1, six, number 1, number 7)
2. Click on
http://www.submit.ac.uk/static_jisc/ac_uk_index.html
http://www.submit.ac.uk/static_jisc/ac_uk_index.html
http://www.submit.ac.uk/static_jisc/ac_uk_index.html (NB Not www.turnitin.com, which is the US site) or copy this URL into your favourite web browser
3. Click on ‘New user’
4. Click on ‘Enrol as a student’
5. Create an account using your UCL or other email address. Note that you will be asked to specify a new password for your account - do not use your UCL password or the enrolment password, but invent one of your own (Turnitin will permanently associate this with your account, so you will not have to change it every 3 months unlike your UCL password). Once you have created an account you can just log in at
http://www.submit.ac.uk/static_jisc/ac_uk_index.html.submit.ac.uk and enrol for your other classes without going through the new user process again.
6. You will then be prompted for the Class ID and enrolment password
7. Click on the course to which you wish to submit your work.
8. Click on the correct assignment.
9. Double-check that you are in the correct course and assignment and then click ‘Submit’
10. Attach document

If you have problems, please email the Turnitin Advisers on ioa-turnitin@ucl.ac.uk, explaining the nature of the problem and the exact course and assignment involved.

One of the Turnitin Advisers will normally respond within 24 hours, Monday-Friday during term. Please be sure to email the Turnitin Advisers if technical problems prevent you from uploading work in time to meet a submission deadline - even if you do not obtain an immediate response from one of the Advisers they will be able to notify the relevant Course Coordinator that you had attempted to submit the work before the deadline.
UCL-WIDE PENALTIES FOR LATE SUBMISSION OF COURSEWORK
· The full allocated mark should be reduced by 5 percentage points for the first working day after the deadline for the submission of the coursework or dissertation.
· The mark will be reduced by a further 10 percentage points if the coursework or dissertation is submitted during the following six calendar days.
· Providing the coursework is submitted before the end of the first week of term 3 for undergraduate courses or by a date during term 3 defined in advance by the relevant Master’s Board of Examiners for postgraduate taught programmes, but had not been submitted within seven days of the deadline for the submission of the coursework, it will be recorded as zero but the assessment would be considered to be complete.
· Where there are extenuating circumstances that have been recognised by the Board of Examiners or its representative, these penalties will not apply until the agreed extension period has been exceeded.

Timescale for return of marked coursework to students.
You can expect to receive your marked work within four calendar weeks of the official submission deadline. If you do not receive your work within this period, or a written explanation from the marker, you should notify the IoA’s Academic Administrator, Judy Medrington.

Keeping copies
Please note that it is an Institute requirement that you retain a copy (this can be electronic) of all coursework submitted. When your marked essay is returned to you, you should return it to the marker within two weeks.

Citing of sources
Coursework should be expressed in a student’s own words giving the exact source of any ideas, information, diagrams etc. that are taken from the work of others. Any direct quotations from the work of others must be indicated as such by being placed between inverted commas. Plagiarism is regarded as a very serious irregularity which can carry very heavy penalties. It is your responsibility to read and abide by the requirements for presentation, referencing and avoidance of plagiarism to be found in the IoA ‘Coursework Guidelines’ on the IoA website

http://www.ucl.ac.uk/archaeology/administration/students/handbook

2 AIMS, OBJECTIVES AND ASSESSMENT

On successful completion of this course a student should:
· Have an overview of the particular techniques needed to fully record and document archaeological sites and materials.
· Understand the photographer's choice in selecting the focal length of lenses, type of film, camera settings and the variety of effects that can be produced by competent use of available light and artificial lighting set-ups.
· Recognise good practice in photography
· Be able to fully record and document archaeological sites and materials.
Be familiar with a variety of camera types and sizes.

Some photographs will be taken on 35mm film SLR equipment and some on digital cameras and these will replicate the majority of work required from archaeological photographers working within the field and in studio set-ups. We will look at the photographer's choice in selecting the focal length of lenses, type of film, camera settings and the variety of effects that can be produced by competent use of available light and artificial lighting set-ups. Digital photographs will be taken on compact digital cameras and DSLRs.

This is an intensive and varied course concentrating on the particular techniques needed to fully record and document archaeological sites and materials. Accurate photographs and the practical use of cameras of all types are also a useful transferable skill.

Course Information
This handbook contains the basic information about the content and administration of the course. Additional subject-specific reading lists and individual session handouts will be given out at appropriate points in the course. If students have queries about the objectives, structure, content, assessment or organisation of the course, they should consult the Course Co-ordinator.

Teaching methods
The course is taught through lectures and practicals. Practical will be arranged to give students greater familiarity with the materials and techniques covered in the course.

Prerequisite
This course does not have a prerequisite.

Workload
There will be 20 hours of lectures and 40 hours of practical laboratory/studio sessions for this course. Students will be expected to undertake around 40 hours of reading for the course, plus 40 hours preparing for and producing the assessed essay. Portfolio project work will take about 40 hours. This adds up to a total workload of some 180 hours for the course.

COURSEWORK

Originality. All work submitted as part of the requirements for any examination (which includes all assessed work) of the University of London must be expressed in the student's own words and incorporate their own ideas and judgements. Plagiarism is defined as the presentation of another person's thoughts or words as though they are one's own. Plagiarism constitutes an examination offence under the University Regulations and students found to have committed plagiarism may be excluded from all further examinations of the University and/or College. ANY QUOTATION FROM THE PUBLISHED OR UNPUBLISHED WORKS OF OTHER PERSONS MUST BE IDENTIFIED AS SUCH BY PLACING THE QUOTE IN QUOTATION MARKS, AND THE SOURCE OF THE QUOTATION MUST BE REFERENCED APPROPRIATELY. The concept of plagiarism also includes self-plagiarism, which is the extensive use of the same sources and materials in more than one piece of assessed coursework, submitted for the same or for other courses taken as part of the degree. To avoid charges of plagiarism or collusion, students must always ensure that their submitted work is their own. They should not lend essays or essay drafts to other students because they might be penalised if the other student copies the work and submits it as their own. If students are unclear about the definition of plagiarism, they should review the notes on plagiarism and examples of good and bad practice with respect to sources, included in the BA, BSc Handbook (also available on the Institute web-site: <www.ucl.ac.uk/archaeology/hbook/BAindex.htm>), and consult their Degree Co-ordinator or Personal Tutor.
Although each course is assessed independently of other courses, students should take care to ensure that the same or very similar work is not submitted for assessment more than once during their study for this degree. Failure to do so could result in a reduction of their overall mark. If students are in any doubt, they should seek advice from the Degree Co-ordinator, or the relevant Course Co-ordinator.

It is important that students reference their sources of information as accurately and as fully as possible. If a student summarises another person's ideas or judgements, or reproduces their figures or diagrams, a reference must be made in the text (using the Harvard convention) and all works referred to must be documented in full in a bibliography. Referencing styles are outlined in the BA, BSc Handbook (<www.ucl.ac.uk/archaeology/hbook/common/IoAPlag.htm>),

Presentation. Essays and other assessed work must be word-processed (unless otherwise specified) and should be printed on one side of the paper, using double-line spacing. Adequate margins should be left for written comments by the examiner. Students are encouraged to use diagrams and/or tables where appropriate. These should be clearly referred to at the appropriate point in the text, and if derived from another source, this must be clearly acknowledged. Students should adhere to word limits on essays; they are intended to help ensure equality of workloads between courses as well as to encourage the useful transferable skills of clearly structured argumentation and succinct writing.

Submission. Assessed work must be handed in to the Reception Desk or to the Course Co-ordinator before 5:00 pm on the submission date specified or agreed with the Course Co-ordinator. A blue coversheet must be stapled to each essay. These are available in the Institute Library, in the rack outside room 411a, and from the Reception Desk. The name of the Course Co-ordinator should be included on the cover sheet. Late work will incur a penalty unless an extension has been granted in advance. If students are ill or have serious personal or family difficulties, they must complete an Extension Request Form (ERF) (copies available from room 411A) and obtain the approval and signature of the Course Co-ordinator. ERFs should normally be accompanied by a medical certificate or other documentation justifying the circumstances (e.g. a note from their Personal Tutor or Degree Co-ordinator). If students do not submit either the coursework or an ERF ON OR BEFORE the submission deadline, the maximum mark that can be awarded is a minimum pass (50%). If there is an unexpected crisis on the submission day, students should telephone or (preferably) e-mail the Course Co-ordinator, and follow this up with a completed ERF.

Grading. The grading system for coursework is set out in the BA, BSc Handbook (<www.ucl.ac.uk/archaeology/hbook/criteria.htm>). In brief, the grades used are A, B, C and F, with finer distinctions indicated by a plus (+) or a minus (-). Allowing for vacations, every effort will be made to return assessed work within two/three weeks of the submission date. The mark given by the initial examiner (prior to return) is a provisional assessment for the student's guidance, and may be modified after assessment by the second internal examiner or by the Visiting Examiner.

Re-submission of Coursework. Students are not permitted to re-write and re-submit coursework in order to try to improve their mark. However, they may, if they wish, submit an additional piece of coursework (on a new topic) to substitute for the first piece of written coursework for that course. Students intending to do so should discuss this with the Course Co-ordinator.

Return of Coursework. All marked coursework must be returned to the Course Co-ordinator within a fortnight of its return to students, so that it can be second-marked, and is available to the Board of Examiners. Because assessed work forms part of the student's permanent academic record, it needs to be retained until well after the completion of the degree. If work is not returned to the Course Co-ordinator, the student will be deemed not to have completed the course. Students are strongly advised always to keep a copy of all work, and to make a copy for retention of all work after it has been assessed and commented upon by the first examiner, if they wish to make future reference to the comments on the work.
COMMUNICATION

The primary channel of communication within the Institute of Archaeology is e-mail. If you wish to be contacted on your personal or work e-mail address, please arrange for e-mail sent to your UCL address to be forwarded to your other address, since staff and other students will expect to be able to reach you through your College e-mail - which they can find on the UCL web-site. Students must consult their e-mail regularly, as well as the student pigeon-holes in the Basement Common Room for written communications. Please also ensure that the Institute has an up-to-date telephone number for you, in case you need to be contacted.

ATTENDANCE

It is a College regulation that attendance at lectures, seminars and practicals be monitored, and a register will be taken. A 70% minimum attendance at all scheduled sessions is required (excluding absences due to illness or other adverse circumstances, provided that these are supported by medical certificates or other documentation, as appropriate). Attendance is reported to College, becomes part of the student's academic record, and will be reported to their funding agency if this information is requested. Students should also be aware that potential employers seeking references often ask about attendance and other indications of reliability.

LIBRARIES AND OTHER RESOURCES

In addition to the Library of the Institute of Archaeology, most libraries in London will have general books on photography but seldom on archaeological aspects of the subject but for general photographic matters may be of use in this course.

Attendance

A register will be taken at each class. If you are unable to attend a class, please notify the lecturer by email. Departments are required to report each student’s attendance to UCL Registry at frequent intervals throughout each term.

Information for intercollegiate and interdepartmental students

Students enrolled in Departments outside the Institute should collect hard copy of the Institute’s coursework guidelines from Judy Medrington’s office.

Dyslexia

If you have dyslexia or any other disability, please make your lecturers aware of this. Please discuss with your lecturers whether there is any way in which they can help you. Students with dyslexia are reminded to indicate this on each piece of coursework.

Feedback

In trying to make this course as effective as possible, we welcome feedback from students during the course of the year. All students are asked to give their views on the course in an anonymous questionnaire which will be circulated at one of the last sessions of the course. These questionnaires are taken seriously and help the Course Co-ordinator to develop the course. The summarised responses are considered by the Institute's Staff-Student Consultative Committee, Teaching Committee, and by the Faculty Teaching Committee.

If students are concerned about any aspect of this course we hope they will feel able to talk to the Course Co-ordinator, but if they feel this is not appropriate, they should consult their Personal Tutor, the Academic Administrator (Judy Medrington), or the Chair of Teaching Committee (Dr. Mark Lake).
HEALTH AND SAFETY

The Institute has a Health and Safety policy and code of practice which provides guidance on laboratory work, etc. This is revised annually and the new edition will be issued in due course. All work undertaken in the Institute is governed by these guidelines and students have a duty to be aware of them and to adhere to them at all times. This is particularly important in the context of the studio work which will be undertaken as part of this course.
Glossary of Types of Assessment with Learning Outcomes

Introduction

The following guidelines indicate the full extent of undergraduate assessment procedures and their learning outcomes within our department. These various types of assessment have been created in order to allow students to both draw upon and develop a diverse range of skills and individual talents. We believe that this range provides a balance between unseen and continuous evaluation strategies, allowing the discernment of real learning while not overly biasing towards students who are better in one type of assessment than another.

Glossary of Types of Assessment:
(NB: Roman numerals refer to learning outcomes, see end of document)

Standard Essay – An essay based upon a specific question and researched via a range of reading (books, journals, online). Alternatively, the readings may be from a given reading list, or researched in addition to a given reading list (Ia, II [perhaps only in years 2 and 3, depending upon degree of independence involved in library research])

Practical Essay – A piece of written work relating to the analysis of specific, given datasets; this may include individual artefacts, lab data, epigraphic texts, questionnaire data, etc… (III)

Book Reviews – A short critical assessment of a book that also indicates wider knowledge and contextual situation of the source (Ib)

QATI – Critical commentary of about 600-700 words contrasting two articles, based around a structured format with headings: Central Quotation (a sentence or series of phrases that indicate the central argument of the text; Argument (summary of the argument in 5-7 sentences); Textual connection (discussion and comparison of the principal text with a second one); Implications (implications of the argument for the interpretation of the archaeological record). Commentaries are used as a basis of group discussion for a topic (Ia, IX)

Field and Lab Notebooks – Notes, observations (written and illustrative) on all aspects of fieldwork site visits and laboratory work, followed by reflective writing on the field/lab experience. (VI)

Portfolios – Assemblages of original illustrative or written work (may be sketches, technical drawings, computer websites, posters, exhibit plans, photographs, examples of field notebook entries, newspaper articles, museum/school oriented writing etc…). (IV, VII)

Powerpoint Presentation – Creation of a Powerpoint presentation file on a specified subject, integrating texts and graphics. (IVa)

Project Paper – A lengthy piece of original work on a particular topic featuring elements of independent research (original research may include a wide range of activities: library research, site planning, translations, practical study of assemblages, microscopic work, model building, certain placements [e.g. in museums, schools] etc…). Normally, project papers include an oral presentation of the project to the rest of the class (Ia, II, III, IVb)
**Dissertation** – A lengthy piece of original research on a topic determined by the student, in consultation with a supervisor. Topics may include fieldwork, labwork, or synthetic analyses of existing data. This project will normally be undertaken over the length of the academic year and will include an oral presentation component, normally with Powerpoint. (Ia, II, III, IVa, IVb)

**Standard Unseen Exam** – An essay based exam on a set of written questions and/or images which may include short answer questions, traditional longer answers, or a mixture of both. Completed within a set time limit (Va)

**Practical Unseen Exams /Worksheets** – Quiz or Practical work on pre-formatted sheets (including multiple-choice or yes/no questions and short answers [i.e. no more than one paragraph]) which may be undertaken while in class or lab (can include epigraphic and computer work for example). Only standard references permitted by the examiner may be used. This might also be set up on Moodle or similar online format (Va [depending on subject, may also include III])

**Open Book Exam** - essay- and/or quiz-based exam held in a specified location and for which students may bring a set number of sources of their own choice to use during the exam (Ia, Vb)

**Take Home Open Book Exam** - essay- and/or short answer question-based exam to be completed within a set period and for which students may use published sources of their choice. (Ia, Vb)

**Group Work** - collaborative project (poster, oral and/or visual presentation) organised and undertaken by a group of students. A group mark is given for the final project, individual members are assessed through a short written piece relating to the topic of the project, and through individual reflection on group dynamics in preparing, undertaking and completing the project. The group mark should form the lowest percentage of the final mark (VII, VIII).

**Glossary of Learning Outcomes**

Ia – Reasoned and Critical Assessment of Multiple Sources
Ib – Reasoned and Critical Assessment of a Single Source
II – Independent Research Use of Library/ Archival facilities
III – Independent Problem-solving based on Real Data Sets
IVa – Experience in the Production of Presentation Graphics at a Professional level
IVb – Experience in the Oral Presentation of Original Research Results
Va – Time Limited and Invigilated Assessment, Testing Comprehension and Critical Use of Taught Knowledge
Vb – Time Limited Assessment, permitting use of sources, testing the employment of information learned in class, as well as appropriate choice of sources, and independent research skills.
VI – Critical Self-reflection and Evaluation of Field Experiences
VII – Demonstration of the ability to Manage and Integrate Different Research Tasks.
VIII – Demonstration of Ability to Work as part of a team towards the Production of an Original Project
IX – Experience in an alternative forms of note taking and essay structure
INTRODUCTION TO 35mm CAMERAS

The simplest classification of camera is by their size of negative, or ‘format’. By far, the commonest and most popular format for still cameras is 35mm, i.e. giving a negative 36mm x 24mm. Such cameras have great advantages in ease of handling and cheapness of film. There is a very wide range of accessories available for them, and the cameras come in a great variety of makes, models and prices. But even the simplest 35mm camera is a complicated mechanism, easy to damage and usually expensive to repair. Moreover, all suffer from a basic disadvantage: the image is recorded on a very small area of sensitised film which has to be considerably enlarged to yield a usable positive print, and any scratches, dust, or processing faults which may be on the film will be enlarged to the same degree. It is essential to avoid opening the camera in dusty conditions, to handle the film with great care - and as little as possible - and never to drop or knock the camera, nor force any of its mechanisms.

Fortunately, all 35mm cameras have very similar controls and, once they are understood, it is simple enough to use any make or model. However, it is of great advantage to become so familiar with one’s own camera that its use becomes almost automatic and your attention can then be fixed not on the camera mechanism, but on the subject of the photograph.

**Loading and unloading**

35mm film, whether colour or black and white, is always loaded into the camera in metal or plastic containers known as cassettes. These are light-proof, cylindrical canisters with a central spindle and a fabric-lined slit through which the leading end of the film protrudes. In fact, no cassettes are completely light-tight and they should be handled only in subdued lighting. Film is sold in ready-loaded cassettes of twenty-four or thirty-six exposures, or it can be bought, very much more cheaply in bulk lengths and loaded into cassettes by the user.

The camera-back is opened by means of some sort of spring-loaded catch or by pulling up the rewind knob. The shaped end, or tongue, of the film is engaged in the slit or clip on the take-up spool and then the film cassette is gently placed in the film-chamber with the lighter-coloured, emulsion, face of the film
towards the lens. The film is then advanced by means of the wind-on lever until the sprocket-holes along both edges of the film are fully engaged with the teeth on the sprocket spindle. The film is held under tension by half-advancing the lever, and the back closed. Two blank exposures are taken in order to get past the three or four inches of exposed film. Loading and unloading must be carried out in shaded, dust-free conditions.

After the whole length of film has been exposed, it can be wound back into its cassette by means of the rewind crank. To do this the sprocket-spindle must be disengaged by depressing the rewind button, which is usually on the base plate of the camera. If depressing the rewind button is not done, the edges of the film will certainly tear and it will be impossible to rewind into the cassette. It is also important not to rewind the film too quickly or static electricity may build up which can discharge and fog the emulsion. When the film has been re-wound it will disengage itself from the take-up spool (this can be felt as a slackening of tension on the rewind crank) and the back of the camera can then be opened and the cassette removed.

On top of the camera, and usually in line with the take-up spool, is an exposure counter. On most cameras, this starts at ‘O’ minus 2, to allow for the first blank exposures) and runs to ‘36’. On most cameras, the counter zeroes itself automatically when the back is opened.

The shutter.

A camera shutter is a device, which controls the length of time for which light is allowed to reach the film. There are two types of shutter in common use: the focal-plane shutter (usually in 35mm cameras) which consists of two fabric or metal blinds immediately in front of the film which cross the film frame with a gap between them at fast speeds, or with an interval between them at slow speeds and the lens shutter in which a diaphragm within the lens opens and closes (each lens has its own shutter). When the film is advanced one frame by means of the wind-on lever, the shutter is automatically cocked ready for the next exposure. (This dual role prevents the possibility of a double exposure, i.e. of taking two photographs on the same frame).

The length of the exposure is regulated by means of a setting or ‘speed’ ring, usually on top of the camera, which rotates against a mark, or by means of a visual display, giving speeds from 1 second or longer to 1/500th or 1000/th of a second. The usual series runs 1, 2, 4, 8, 15, 30, 60, 125, 250, 500, 1000. This is more or less a halving series: i.e., adjusting the ring from one position to the next will halve or double the length of the exposure. There is a further position on the ring marked ‘B’; when this is set the shutter will remain open for as long as the release button is held depressed. This is used for exposures longer than one second. The release button itself is always positioned near the top, front edge of the body, so placed as to fall easily beneath the forefinger of the right or left hand when the camera is held correctly.

Probably the commonest fault in 35mm photography is a slightly blurred or double image due to camera movement. With care, a hand-held camera with standard lens can be used at exposures of 1/60 or even 1/30 sec: longer exposures than this should always be taken with the camera on a tripod or similar support and using a cable release, i.e. a flexible extension which screws into a tapped socket in the release button. However, even at faster speeds it is all too easy to shake the camera during the exposure, and it is therefore vital to practice holding the camera securely, and to become accustomed to its weight and proportions.
Used horizontally, the camera should rest on the heels of the hands. The forearms should be pulled in, and the hands cradle the camera body in such a way that the focusing and aperture rings can be rotated with the thumb and first finger of the left hand, the wind-on lever worked with the right thumb, and the release button with the right forefinger. At the moment of exposure, the hands should be clamped and the breath held. Ideally, the button should be operated by squeezing the whole hand together.

Held vertically the camera body should rest on the heel of one hand. (Most people find the left hand more convenient), the left forearm vertical and the other hand around the top of the camera, again with the right forefinger on the release button. The only exception is when a long or heavy lens is being used, when the left hand should cradle the lens at the point of balance.

Situations may arise, particularly in museums and galleries, when the amount of light calls for a long exposure, but tripods are forbidden. Any improvisation to steady the camera is worth trying: resting it on a show-case or a chairback, against a wall or even across someone’s shoulder, or bracing oneself against a solid object may help. In any case, always take several similar exposures in such circumstances and select the sharpest after processing the film.

The lens.

Most 35mm SLR cameras have removable lenses in bayonet mounts so that a range of different lenses may be used. All incorporate two control rings: a focusing ring, usually at the front of the lens, and an aperture control (diaphragm) ring.

The focusing ring is used to adjust the distance between the lens and the film-plane, thus bringing objects nearer or farther away from the camera into sharp focus. The nearest point, which can be focused sharply with a standard lens lies about 45 cm in front of the camera.

The aperture ring adjusts a diaphragm within the lens which controls the amount of light reaching the film. The ring is marked in ‘f-numbers’; a series running from f1.4 or f2 (the largest); f2.8, f4, f5.6, f8, f11, f16, f22 and sometimes f32 (the smallest). This also is a halving series - to open or close the ring by one mark is to double or halve the amount of light coming through the lens.
There are thus two controls over the exposure: the speed-ring controlling its length, and the aperture controlling its amount. Any exposure is a combination of these two factors which, within limits, are directly reciprocal, i.e. a long exposure with a small aperture will have the same effect on the film as a short exposure with a large aperture. With all except automatic cameras, the choice of the combination lies with the photographer. An exposure meter, whether built into the camera or a separate unit, measures the light reflected from the object and presents a series of exposure times matched against apertures, any pair of which should provide an adequate dosage of light. The choice of which to use depends on a number of factors, of which two are of prime importance.

1. If the camera is hand-held, or if the subject of the photograph is moving, as was mentioned earlier, a short exposure must be used in order to obtain a sharp, un-doubled image.

2. The other consideration, which is usually more important in archaeological photography, concerns the depth of field.

When a point in front of the lens is focused sharply, a zone in front of and behind that point will also come into acceptably sharp focus. This zone, known as the ‘depth of field’, varies with a number of factors, one of which is the size of the aperture. Other things being equal, the smaller the aperture, the greater is the depth of field. In site photography, in particular, it is usually desirable to record the whole depth of the scene, from the nearest point to the most distant, in the sharpest possible focus. It is therefore necessary to use a small aperture combined with a long exposure. The length of the exposure often necessitates the use of a tripod.

**Focal length.**

Lenses are usually described, however, not directly in terms of their angle of view, but by their ‘focal length’ - the factor which governs that angle. This is the distance between a point on the lens and the film-plane when the lens is focused at infinity. Thus a standard lens for a 35mm camera is described as a 50 mm lens, and this figure will always be found on the front of the lens. This presents to the film an angle of view of about 45° which is roughly the same as that of a normal, relaxed, human eye, disregarding peripheral vision.

It is often useful, especially in site photography, to use a lens with a wider angle of view than standard usually in order to take in more of a structure or of a section where space is restricted. The widest lens available for the 35mm format is of 6mm focal length - the so-called ‘fish-eye’ lens - which takes in an angle of more than 180°, but with such extreme wide-angle lenses there is, unavoidably, extreme distortion of straight lines at the edges of the field. The most useful wide-angle lenses for archaeology are of 24mm or 28mm focal length, giving angles of 85° and 75° respectively. These still give some distortion at the edges but not enough to be obtrusive. Wide-angle lens also have the advantage of great inherent depth of field.
In the other direction, it is sometimes of value to use a lens with a narrower-than-standard angle of view in order to obtain a reasonably-sized image of a small or distant object. The longest obtainable for 35mm cameras are of 1200mm focal length, giving an angle of only 2°, but for archaeology a long lens of 135 or 200mm, giving 18° or 12°, is quite sufficient. Compared with a wide-angle or a standard lens the depth of field is shallow and the apparent perspective effect can give a ‘stacked-up’ appearance to distant objects.

As well as lenses of fixed focal length, there are many ‘zoom’ lenses available. These are lenses in which the focal length, and thus the angle of view can be altered. Their advantages are obvious: images can be tightly framed, and only one or two lenses need be carried to cover the whole range of desirable focal lengths. Resolution of the image is not quite as good with a zoom as with a lens of fixed focal length. This is particularly the case at the ends of their range of movement. Zoom lenses can be bought that will cover the whole span from 28 to 200mm, but most will only cover a shorter range: 28-50mm, 28-70mm or 70-200mm.

The optical glass from which lenses are ground is considerably softer than window glass, and quite easily scratched. Moreover, the surfaces of lens elements are usually coated with a thin chemical deposit in order to reduce internal reflections. It is always necessary therefore to protect the lens surfaces. When the camera is not in use the front of the lens should always be protected with a lens cap, as should the rear element when the lens is out of the camera. If dusty conditions are likely, it is advisable to keep a clear glass (UV) filter over the lens at all times. If, despite all precautions, the lens surface becomes dusty, it should be brushed lightly with a lens brush which should be reserved for that purpose alone. Smears or fingerprints should be wiped off, gently, with a lens tissue after first brushing off any dust.

In sunny weather or when using bright artificial lighting, there is always a possibility of chance light-rays reflecting from the front lens surface and causing diffusion and degradation of the image. It is often advisable to use a lens-hood: a conical or cylindrical extension screwed on to the front of the lens. The hood should be one designed for use with the particular focal length of lens, otherwise, if too short it may not adequately shield the glass or, if too long, it may cut off the corners of the image.

The focusing mechanism.

The commonest focusing device is the pentaprism or through-the-lens (TTL) viewfinder. In this an angled mirror behind the lens reflects the image into a five-sided prism on top of the camera and thence through an eyepiece. The image thus transmitted is focused by means of the focusing ring. It appears in the eyepiece the right way up and the right way round and is, within about 5%, exactly the same as will be thrown on the film. At the moment of exposure, the mirror swings out of the path of the light-beam, allowing the image to fall on the film-frame.

Obviously, if the lens were set to a small aperture before exposure this would also cut down the amount of light through the eyepiece and make focusing difficult. For this reason, most lenses incorporate a device known as an ‘automatic aperture’, by which means the lens stays fully open, no matter what ‘f’ number is set on the ring, until the moment of exposure.

It is useful to be able to view the image with the lens stopped down in order to examine the adequacy of the depth of field. Annoyingly, a small stop, f16 or f22, will usually so restrict the light that it becomes difficult to see the image, let alone examine the depth of field. As a rough check many lenses also incorporate a depth of field scale which shows the approximate depth with any ‘f’ number.

**Light meters** are devices based on photo-electric cells which measure the light reflected from an object or scene and display the information in terms of exposure.
The most accurate meters are separate units which can be used with any camera, but all modern 35mm cameras now have built-in meters which measure the light actually falling on the film-plane (through-the-lens or TTL meters) and give readings through the eyepiece.

Film emulsions differ widely in their sensitivity to light and this sensitivity, or ‘film-speed;’ must obviously be allowed for in any calculation of exposure. The speed is expressed by a number, which is always shown on the cassette, or on its packing. ISO (International Standards Organisation) is by far the most common system and it is the same as values shown as the old ASA (American Standard Association). DIN (Deutsche Industrie Norm) was marked and used on the continent. The ISO system is a simple arithmetical scale: i.e. a film of ISO 100 will be twice as fast as one of ISO 50, and half as fast as ISO 200. Somewhere on the meter, or on the camera-body there is a dial on which the appropriate film-speed must be set; this setting should always be checked with each change of film.

Many cameras now incorporate a device known as ‘DX coding’ whereby a sensor in the camera body reads a bar-code on the cassette and sets the film-speed automatically. This is a useful device so long as the camera also has an over-ride mechanism. Some film cassettes are not marked with the necessary bar-code, and if the film is loaded from bulk into re-used cassettes the code might well be missing or wrong. With most DX coded cameras the film speed is automatically set to ISO 100 if the code is missing.

Automatic cameras. The majority of cameras now being sold have fully or partly automatic light-measurement and exposure, and many have automatic focusing. So far as exposure is concerned, the different options (known as ‘modes’ or ‘programmes’) are

‘Aperture-priority’ in which the operator decides on the aperture and the camera automatically sets the appropriate shutter-speed,

‘Shutter-priority’ where the operator sets the shutter-speed and the camera sets a suitable aperture, and

‘Programme’, in which the camera sets both, allowing for light-level and film-speed.

On some cameras all three modes can be used, together with a manual over-ride which allows the operator to set both shutter and aperture. For the purposes of archaeology, only ‘aperture priority’ is useful (since depth of field, controlled by the aperture, is often the over-riding consideration) and a manual control is essential.

Automatic focusing has no great advantage in field or survey work, and may be a positive drawback in object and close-up photography; so, again, if a camera has this facility it is essential that there is also a manual over-ride.

Measuring exposure.

With the simpler types of manual TTL metering, the meter is first switched on, then either the exposure time is set and a needle visible through the viewfinder eyepiece is centred between two marks by opening or closing the aperture ring, or the aperture is set and the needle centred by changing the shutter speed setting.

Most TTL meters are centre-weighted; they have several small cells which take readings from different parts of the frame and the results are integrated with a bias towards the reading from the centre of the frame. This system is designed primarily for portraiture, where the centre of the photograph - the face - is the most important part of it. In both site and artifact photography, however, the most important detail may be anywhere in the frame. It may be necessary therefore to ensure a more accurate reading by moving the camera forwards until the important part of the object, fills the whole frame, taking a reading from that position, and then moving back to the original viewpoint.

A more reliable, though rather time-consuming, method is to take two readings: one from close to the darkest important detail, the other from the lightest. An exposure is made which is mid-way between the
two: e.g. if a sun-lit part of a building gives a reading of 1/125th at f16, and a shadowed part 1/125th at f8, a likely exposure would be 1/125th at f11. Alternatively, if the range of tonal contrast is very great and if the most important detail is in the shadows, then expose for these alone and allow the lightest parts of the scene to record as blank white or if the lightest detail is more important, take the reading in this area alone and let the shadowed areas disappear into blackness. In strong sunlight, this choice often has to be made - the film emulsion covers a much shorter tonal range than does the human eye.

Whatever method is used, it is essential to measure the light reflected from the artifact, or the important part of the scene, and not from the background. For instance, a dark-toned artifact may well be photographed against a illuminated background so the best way get a suitable exposure is to turn the backlight off and take the reading without it and to keep that exposure set.

Finally, if there is any doubt about the correct exposure it is wise to ‘bracket’ it, i.e. to take a series of photographs at different exposures ranging around the central value given by the meter. If, for example, on colour slide film the meter reading was 1/125th at f11, five exposures at 1/125th at f8, f8/11, f11, f11/16 and f16 should ensure against the effects of a slight miscalculation, or even of gross error. On black and white negative film three exposures would be sufficient 1/125 at f8, f11, and f16. It is always cheaper to take a few unnecessary frames then to return to a site or to re-arrange an artifact.

Colour temperature

| Photograph taken with tungsten light on daylight film | Photograph taken in daylight light on tungsten film | Photograph taken with correct light and film combination |

In general, a better colour balance is obtained, and less light is lost, if a Tungsten film is used in daylight with the proper filter, than if a filtered Daylight film is used under tungsten lighting.

The colour temperature of a light source is measured in degrees Kelvin. A candle is about 1930K and a household bulb between 2400K and 2800K. Early morning and late evening light starts from about 4000K and can rise with clear blue skies to as much as 18000K. Daylight films are designed to give the most faithful colour results at between 5200K and 5800K. Flash lighting has a colour temperature equivalent to bright sunlight and so requires daylight balanced film. Conversion filters are used only on colour film to match the colour of the light to that for which the film is balanced. Daylight balanced colour film, both positive and negative, can usually be used in tungsten light by means of a blue conversion filter (Wratten 80A), and quadrupling the exposure, either by quadrupling the length of the exposure or by opening the aperture by two stop. The few films balanced for tungsten light, for example Fujichrome 64T Prof. and Kodak Ektachrome 64T Prof., need no filter for use in this light, but can be used in daylight with a yellow/amber conversion filter (Wratten 85B), coupled with an increase in exposure by about 2/3. Photographs taken when the sun is low in the sky, (i.e. at dawn or dusk), may show a reddish overall cast. This can be counteracted by using a bluish filter (Wratten 82A), and increasing the exposure by about 1/3, whilst a warmer filter (Wratten 81A), also with an exposure increase of 1/3, will correct the rather cold bluish appearance of a photograph taken under a bright but rather cloudy sky. Filters are also made (FL-D...
filters) to counteract the rather unpleasant blue-green effect of fluorescent lamps but we try to avoid using this non-continuous lighting source.

Film
Of the three general types of film: black-and-white; colour negative (print film) and colour positive (reversal film), each has its own particular uses. Colour negative film is primarily designed to give colour prints, but it can also be used to produce black-and-white prints reasonably well. Additionally, colour prints can be re-photographed to give colour transparencies for projection. Similarly, colour positive film is intended to give transparencies by reversal processing, but these can then be used to make colour prints by reversal printing. Transparencies can then be copied on to black-and-white film, thus producing black-and-white prints. Black-and-white negatives, however, can yield only black-and-white prints or black-and-white transparencies.

In general, the slower films give higher resolution, that is, they record finer detail, but they also give images with greater contrast between black and white. For most recording work films of 100-200 ISO would be suitable - although if the length of the exposure is unimportant and if there is fine detail, especially in close-up work, 25- 50 ISO might be better. If, on the other hand, the light is dim or if the camera has to be hand-held, films of 400 ISO would be more useful. At greater speeds than this there would probably be some loss of detail and contrast. The main uses of each type of film are given below:

Black-and-white negative film, and the resultant black-and-white prints have in the past been the commonest and most reliable means of recording structures and objects. Advantages include the wide exposure latitude, the fact that different types of light-source can be used and mixed without greatly affecting the quality of the result, the simplicity of processing, and the relatively low cost of reproducing black and white plates in publications. The other main consideration is that a black-and-white negative remains the most stable and long-lasting archival document assuming that it has been properly processed and correctly stored. The most obvious disadvantage is that black-and-white film records colours only as shades of grey, with the consequence that much information can thus be lost. Whether or not this is important depends on the type of artifact being recorded. For example, colour would probably be unimportant when photographing a collection of coins, while polychrome pottery could hardly be recorded without it. A further slight disadvantage might be that in some places it is not easy to find a commercial laboratory willing to process black-and-white film. All the major manufacturers market slow to medium speed black-and-white films, and although there are differences between them, particularly in terms of resolution and exposure latitude, all are capable of yielding good, detailed record photographs.

A few films in this class deserve special mention. In order to record black and white documents or drawings with maximum clarity, a film of extremely high contrast is necessary with very sharp division between the tones. The greatest contrast, and the finest detail can be recorded by using a ‘lithographic’ film, such as Kodalith (this was available in 35mm lengths and sheet film sizes) and now produced by other manufacturers. For the best results, however, this has to be developed by inspection under a red safe light in a special developer; a skilled process which could prove impossible to arrange. A slightly lower degree of contrast and fineness of detail can be achieved with a line film like Agfaortho 25 Prof. or Kodak Technical Pan 2415 (developed in D-19 developer). Kodak BW400CN and Ilford XP2 super are especially useful for black-and-white photography where a black-and-white processing service is not available since they are processed in the same way as colour negative film. Although a relatively fast film - 400 ISO they have fine grain structure and very great exposure latitude.

Colour negative film
This has become the most widely used type of film and is consequently the easiest to obtain and to have processed. Quite apart from simple convenience, this wide availability is important. Because of the film’s popularity, there is usually a rapid turnover of stocks in shops and dealers, and the chance of finding only out-of-date or badly stored material is reduced. Processing and printing are relatively cheap, but care must
be taken when choosing processing services. Specialist laboratories catering for professionals are best of all, but the costs are always very much higher than in retail processors.

Colour negative film is convenient and reasonably suitable for straightforward record photographs, and is especially useful when prints are needed quickly. Compared with colour positive film it has a wider exposure latitude, and there is less need for a correct balance in the colour of the light. Slight departures from a correct colour balance in the negative can be compensated for in the printing process, although this may not be possible in mini-lab processing. The negatives have similar archival properties to colour transparencies when properly developed.

There are more than twenty makes and types of colour negative films on the market with speeds of between 50 and 1600 ISO. All claim some special quality of accuracy or colour rendition, exposure latitude or storage characteristics. It might be possible to recommend and to choose one particular film among them all which would give the most accurate and consistent results under ideal conditions but, in fact, nearly all of them would yield an acceptable record, although differences would certainly be apparent if results were compared. However, the appearance of the print is also dependent on the lighting and on processing. By far the most reliable way of choosing a film for a programme of recording is to test-expose several types, have them processed by a reliable laboratory and to compare the results with each other and the original.

Many manufacturers market two ranges of colour film, both negative and positive: 'Professional' films and 'General purpose' films. The Professional films - which are usually more expensive - are rather more accurate and reliable in their speed and colour balance. Storage conditions are also more exacting if Professional films are to maintain their balance and consistency. Both types of film should produce good results given reasonable conditions, with differences not usually important enough to be worth considering in record work.

Colour positive film

Colour positive film yields transparencies, primarily for projection, although the film has other advantages. The recording of colours is more accurate and possesses greater depth than does colour negative film. It is therefore often preferred for publication and scanning. Colour prints can be taken from it either by copying on to negative film (interneg), or by printing on to reversal paper, although this process is more expensive and needs more skill than does printing from colour negative film.

Positive film has inherently less latitude than colour negative film, and because there is no intermediate step between film and transparency, there is a greater need for neutral lighting conditions. If transparencies are used for projection very frequently, or for long periods, they may fade. Kept in good conditions it has been calculated that the least stable color, yellow, suffers a 20% loss in 180 years. This is mostly attributable to the fact that Kodachromes have no unused color couplers remaining after processing, unlike other colour slides.

Although they can be copied without difficulty, since this always involves some loss of quality, it is preferable to take several original exposures if the slides will be so used. The film is not processed with the same chemicals as negative film so it may not be possible to have the work done as cheaply and easily.

Most of the thirty or so types and brands of positive film on the market are designed to be used in daylight or with electronic flash (these are usually marked 'D' or 'Daylight'). There are a few films that are balanced for use in tungsten lighting. Tungsten balanced films include Fujichrome 64T Prof, Kodak Ektachrome 64T Prof, 160T Prof, and 320T. Both the Fujichrome and Ektachrome 64T professional films are formulated to give consistent results with little or no colour bias at long exposures.
Stands and Tripods

The basic arrangements for photographing objects are:

Horizontal with the object standing on its base and the camera recording something close to a profile.

Vertical with the camera pointing down at the object.

Pottery, figurines, and similar free-standing artifacts lend themselves to the first method, and coins, beads, tablets and sherds to the second. Occasionally some other arrangement is preferable: a pendant on a chain, for example, is best shown against an inclined board so that the links of the chain are correctly spread. Horizontal and vertical set-ups are, however, probably suitable for more than 90% of objects.

Camera-shake is probably the commonest reason for poorly-defined photographs. The result of bad camera-shake, like movement of the object during the exposure, is obvious: the picture is doubled or appears quite blurred. Slight camera-shake, however, can give a result that is not so obvious: the image is just slightly soft or shows a slight loss of sharp definition which may not be so easy to spot. Most people can hand-hold a camera steadily for about 1/60 sec or less. At 1/30 or 1/15 sec there is a good chance of camera-shake; at any slower speeds camera shake is almost certain. If possible, it is always better to mount the camera on a tripod or copying stand. However, if these are unavailable there are various other devices and techniques that can be introduced to reduce camera-shake.

If the camera has to be hand-held without any of the above aids, it is important to hold it correctly. Enclose the ends of the camera with the hands, pull the elbows in and brace the camera back and, at the moment of exposure, hold your breath. It also helps to lean against a wall or a show-case, or to rest the camera over the back of a chair or something similar. If there is any doubt about the steadiness of the camera, it is advisable to take several exposures and later to select the sharpest negative or transparency.

One device that can reduce shake is a monopod—a simple adjustable leg on which the camera stands. These eliminate shake, although the camera can still sway. Another is a shoulder-stock, a device like a rifle butt, which enables the camera to be held tightly to the shoulder. These are designed primarily for use with very long lenses - which are particularly subject to shake - but they work equally well with shorter lenses.

The heavier and more stable the tripod the better, but even a light tripod is better than none. The most useful are the centre-column type with independently adjustable legs and a pan-and-tilt head rather than a ball-and-socket. Built in spirit levels—which can be used to level the camera—are also desirable. An overall height of 1.5 or 2m is often valuable, and if they are to be used for such things as recording wall-paintings or architectural details, a greater height still is desirable. It is often also of value to be able to
remove the head and position it on the bottom of the centre-column, or to be able to reverse the column, so that the camera can be used close to the ground or pointing downward. If the tripod has a removable bolt, or quick release head, for holding the camera, it is vital to keep one or two spares - such things get lost only too easily. Vertical photographs with a 35mm or medium-format camera can also be managed with a heavy tripod and a counterweighted cross-arm, although this is not a very convenient arrangement.

Stands

For small and medium format cameras being used in a studio a copying stand is preferable to a tripod. Stands are best mounted on a solidly built low bench, 50 - 60 cm high, which can be moved about so that lights can be positioned around the stand.

The simplest horizontal stand is a shelf or table 40-50cm deep and 1m or so wide, standing against a wall, with a single sheet of background paper or cloth running down the wall and across the horizontal surface without a break. In many cases however, a clearer picture results if the object stands on a sheet of glass or Perspex supported on blocks above the shelf, so that the base of the object is not lost in its own shadow. Stands of this sort can be cheaply and quickly erected anywhere--in a site hut on a dig, or in a museum basement. If object photography is going to be undertaken regularly, however, it is worth buying or constructing a framework on castors, holding a sheet of opal Perspex curved up from a horizontal bench-top to a vertical back. Such stands can be built easily enough from 4 X 2cm hardwood strip or from slotted angle-metal. With a stand like this, lights can be positioned below and behind the Perspex, to give an opaque shadowless background. It is important that it is built in such a way that there are no cross-struts to throw shadows on the Perspex.

Cable releases

These are used for firing the shutter when the camera is on a tripod or stand. The most useful length is about 20cm, and the type with a locking device is valuable for long exposures. Without a cable release, a shake-free exposure can be achieved by using the self-timing device, if the camera has one.

Scales and information labels

All record photographs, whether of sites, architectural detail or movable objects, should include a scale. For sites and large structures the standard scale is either a human figure or a 2m red and white surveying pole. Such scales - whether figures or poles - must be positioned with care, ensuring that they do not obscure important detail. If the picture has any depth, for instance if the view is along the length of a building, there should be scales near both the front and back of the picture.

Photographs of all smaller movable or potentially movable objects should also include a scale, preferably of a size similar to the artifact: a one centimetre scale next to a 40 cm high vase, for instance, would not be very informative. The scale should be placed either horizontally or upright close to, but not overlapping, the object. It is important to make sure that the scale is in the same plane as the object, preferably about halfway back in its visible depth. In this position, not only will it give the most accurate indication of the size of the object, but if the scale is focused sharply it will ensure that the object is centered in the depth of field. All scales should include the unit of measurement (e.g., cm, in) and the length of one segment printed on it, since a simple black-and-white stick of unknown length is of little value.

As well as a scale, other information should be included in the photograph if at all possible. In order that an object can be readily identified from the photograph, it should include some sort of label giving its location, ownership or holding body the date of the photograph, and any available accession or collection number. In addition, the photograph should if possible include a guide for printing or scanning the print or transparency. Such guides include both a scale of standard grey tones which can be used in printing to
ensure that the contrast range of the print matches that of the object (the printer matches the grey scale in the negative with a similar scale in the darkroom), and a series of colour patches of known values. By using these, the printer or scanner can, within limits, counteract any colour cast or bias in the negative or transparency, and reproduce an image with colours very close to the original. Such grey and colour-patch scales can be obtained from Kodak (the Kodak Colour Separation Guide), or Letraset (the Pantone Colour Chart), and another suitable scale is the IFRAO Standard Scale (http://www.cesmap.it/ifrao/scale.html), devised and produced by the International Federation of Rock Art Organizations.

Background

For standard record photographs in black-and-white, the most effective background is either black or white. Any other tone will result in grey on grey, inevitably detracting from the object’s clarity. It would obviously be pointless to photograph something very light in tone—an alabaster head or a silver brooch—against white; or something very dark a basalt axe or a jet necklace—against black. However, the majority of artifacts are, after all, of a fairly middle tone, and if there is a choice then, for two reasons, a white background is preferable to black. First, unless the lighting is very skilfully arranged, the edges and thus the shape of objects are apt to get swallowed up by a black background; secondly, plate-making processes rarely produce smooth areas of solid black which would detract from object photographs which may, at a future date, be published.

White background material can be the opal Perspex mentioned earlier, ordinary cheap cartridge paper or flexible matte-surfaced white plastic. For use on a dig, and for uncleaned objects, plastic is much preferred, being washable and less likely to tear.

Black cotton velvet (not nylon) or black flock paper are about the only materials giving a solid unreflective black for ordinary black-and-white photography of objects. Unfortunately, velvet is all too easily marked and apparently innocuous materials like plasticine can leave a virtually indelible patch.

If the photography is for colour slides, white backgrounds can glare on the screen. They do, however, act as a useful check on the colour balance of the film - if the white is reproduced as truly white, then it is reasonably certain that the colours are correctly recorded. A black background is often effective, and since the contrast of the picture involves colours as well as tones, a lower degree of subject contrast between the object and its background is often acceptable. Usually, however, a coloured background will give a more pleasing, if not a more informative picture. Certain care must, however, be taken in the selection of the colour. Very intense saturated colours distract the eye from the object itself and, especially if there is a large area of such a colour, produce a carry-over effect to the eye; reflection from the background can consequently tinge the artifact with its colour. For aesthetic reasons, if for no other, it is preferable to avoid eye-catching colours like jade-green or mauve. A few sheets or rolls of unobtrusive coloured paper are usually sufficient; chrome-yellow, rusty brown and olive green and blue would cover most situations.

When photographing ceramics in black-and-white, the objects are best positioned against either black or white backgrounds, although white is usually better. Fabric, cartridge paper or plastic sheeting is suitable for making backgrounds for ceramic objects. If possible, stand the object on a glass or rigid plastic raised above the horizontal surface. White, black or coloured backgrounds will serve for colour photography, making sure that light reflected from a coloured background does not give a colour cast to the object.

The majority of metal objects fall into one of two groups: smooth shiny objects of gold, silver, brass, polished steel, plate, pewter, and the like; and darker rough-surfaced metal objects of cast or wrought iron, bronze, and sometimes copper. There are, of course, many intermediate cases. For black-and-white photography, the first group are best shown against black - preferably black cotton velvet, and the second against white. Such things as rivet holes, hinge-lines, and opened cracks will be visible only against white or, better, against an illuminated background. Colour photographs can be taken against either, or against a coloured background, but even more than with ceramics, strongly-coloured close backgrounds should be avoided.
Coins and similar small objects with surface relief can be photographed against black, white or coloured backgrounds. The simplest white background is either a light-box or a sheet of glass held above a white illuminated surface. Care must be taken not to have too bright a background; otherwise it can produce a halo effect with light creeping round the object’s edges. Black cotton velvet gives the most solid black, but the surface of the material may catch the light, giving a textured field. If possible the object should be raised above the surface on a column of plasticene or modelling clay, a centimetre or so high, so that the background is out of focus. (Care must be taken, however, not to place any fragile object on plasticene or similar materials which might stain or lift off its surface). With objects such as pierced brooches it is essential to be able to see the piercings clearly; this is more easily achieved with an illuminated background. Colour photographs can often be taken successfully against black. For a white background, however, light-boxes may give an unpleasant blue-green colour and have a colour temperature of about 4000K. Coloured backgrounds can be used, but if the object is placed on a glass sheet above a coloured background, particularly a dark colour, there may be strong reflections in the glass. For very small objects, which can not be raised above a black fabric surface, ordinary black carbon paper gives a good matte black.

2nd photography class

Light meters are devices based on photo-electric cells which measure the light reflected from an object or scene and display the information in terms of exposure.

The most accurate meters are separate units which can be used with any camera, but all modern 35mm cameras now have built-in meters which measure the light actually falling on the film-plane (through-the-lens or TTL meters) and give readings through the eyepiece.

Film emulsions differ widely in their sensitivity to light and this sensitivity, or ‘film-speed,’ must obviously be allowed for in any calculation of exposure. The speed is expressed by a number, which is always shown on the cassette, or on its packing. ISO (International Standards Organisation) is by far the most common system and it is the same as values shown as the old ASA (American Standard Association). DIN (Deutsche Industrie Norm) is still marked and used on the continent. The ISO system is a simple arithmetical scale: i.e. a film of ISO 100 will be twice as fast as one of ISO 50, and half as fast as ISO 200. Somewhere on the meter, or on the camera-body there is a dial on which the appropriate film-speed must be set; this setting should always be checked with each change of film.

Many cameras now incorporate a device known as ‘DX coding’ whereby a sensor in the camera body reads a bar-code on the cassette and sets the film-speed automatically. This is a useful device so long as the camera also has an over-ride mechanism. Some film cassettes are not marked with the necessary bar-code, and if the film is loaded from bulk into re-used cassettes the code might well be missing or wrong. With most DX coded cameras the film speed is automatically set to ISO 100 if the code is missing.

Automatic cameras. The majority of cameras now being sold have fully or partly automatic light-measurement and exposure, and many have automatic focusing. So far as exposure is concerned, the different options (known as ‘modes’ or ‘programmes’) are ‘Aperture-priority’ in which the operator decides on the aperture and the camera automatically sets the appropriate shutter-speed, ‘Shutter-priority’ where the operator sets the shutter-speed and the camera sets a suitable aperture, and ‘Programme’, in which the camera sets both, allowing for light-level and film-speed.

On some cameras all three modes can be used, together with a manual over-ride which allows the operator to set both shutter and aperture. For the purposes of archaeology, only ‘aperture priority’ is useful (since depth of field, controlled by the aperture, is often the over-riding consideration) and a manual control is essential.

Automatic focusing has no great advantage in field or survey work, and may be a positive drawback in object and close-up photography; so, again, if a camera has this facility it is essential that there is also a manual over-ride.
Measuring exposure.

With the simpler types of manual TTL metering, the meter is first switched on, then either the exposure time is set and a needle visible through the viewfinder eyepiece is centred between two marks by opening or closing the aperture ring, or the aperture is set and the needle centred by changing the shutter speed setting.

Most TTL meters are centre-weighted; they have several small cells which take readings from different parts of the frame and the results are integrated with a bias towards the reading from the centre of the frame. This system is designed primarily for portraiture, where the centre of the photograph - the face - is the most important part of it. In both site and artifact photography, however, the most important detail may be anywhere in the frame. It may be necessary therefore to ensure a more accurate reading by moving the camera forwards until the important part of the object, fills the whole frame, taking a reading from that position, and then moving back to the original viewpoint.

A more reliable, though rather time-consuming, method is to take two readings: one from close to the darkest important detail, the other from the lightest. An exposure is made which is mid-way between the two: e.g. if a sun-lit part of a building gives a reading of 1/125th at f16, and a shadowed part 1/125th at f8, a likely exposure would be 1/125th at f11. Alternatively, if the range of tonal contrast is very great and if the most important detail is in the shadows, then expose for these alone and allow the lightest parts of the scene to record as blank white or if the lightest detail is more important, take the reading in this area alone and let the shadowed areas disappear into blackness. In strong sunlight, this choice often has to be made - the film emulsion covers a much shorter tonal range than does the human eye.

Whatever method is used, it is essential to measure the light reflected from the artifact, or the important part of the scene, and not from the background. For instance, a dark-toned artifact may well be photographed against an illuminated background so the best way get a suitable exposure is to turn the backlight off and take the reading without it and to keep that exposure set.

Finally, if there is any doubt about the correct exposure it is wise to ‘bracket’ it, i.e. to take a series of photographs at different exposures ranging around the central value given by the meter. If, for example, on colour slide film the meter reading was 1/125th at f1, five exposures at 1/125th at f8, f8/11, f1, f1/16 and f16 should ensure against the effects of a slight miscalculation, or even of gross error. On black and white negative film three exposures would be sufficient 1/125 at f8, f11, and f16. It is always cheaper to take a few unnecessary frames then to return to a site or to re-arrange an artifact.

**Tungsten lighting**

There are two types of tungsten lighting commonly used in photography; tungsten bulbs and tungsten-halogen units. Tungsten bulbs are suitable for most sorts of record photography, but low-wattage bulbs, up to about 200W, have too low a colour temperature, that is, they are too yellow for use with colour film. However, for such things as photographing coins in black and white, they are perfectly adequate. 275W bulbs with a colour temperature of more than 3000K are more useful and give out enough light to allow reasonably short exposures. They also, however, give out a considerable amount of heat, and with many organic materials, (wood, paper, fabrics, etc.), great care has to be taken not to leave the lights playing on the object over-long. All tungsten bulbs give out less light and become more yellow in colour with age. Over-run or photo-flood bulbs are occasionally useful. These are domestic-size bulbs with thin filaments which give a far higher light output than their wattage suggests, at the expense of a short life. They are designed to maintain their colour temperature of 3400K throughout their life.

Various types of light-housings are available. The most convenient are column-stands, adjustable uprights on wheeled tripod bases with tilting lampholders and shades large enough to shield the whole bulb. A useful group would be three or four stands and a boom-light: a column with a counterweighted arm
allowing the light to be positioned above the object. For work outside the studio, clamp-lights are ideal, some of which have jaws wide enough to attach to scaffolding. Lightweight collapsible light stands with tripod bases are almost as convenient, although they are rather less stable and take up more floor space.

**Tungsten-halogen units**

These have a high output of light which remains almost constant in colour throughout their life, which is longer than that of tungsten bulbs. They are relatively expensive although their length of life may offset this, and they can be housed only in specially-designed holders. They are rather fragile while alight and immediately afterwards, and they run at high temperatures, so most housings incorporate a fan-cooling device. Most projectors and spotlights are now built for tungsten-halogen lamps. Particularly useful is a 'broad-light' which gives out a wide beam of light which is even from side to side. A small spotlight - about 500-600W - may be useful to show the texture of an object or to give a 'rim-light'; a bright halo outlining an object against its background. Spots are often best used with snoots, tubular front - extensions which restrict the width of the beam and both spots and floods with 'barn-doors', flaps that can be used to cut off part of the beam.

On any lights used out of doors the fittings should be weatherproof, and ordinary care must be taken to ensure that all electrical equipment is properly earthed and isolated, and that circuits are not overloaded.
There are a number of types of electronic flash gun on the market. The cheapest are designed to clip onto the accessory shoe of the camera (which in the case of 35mm SLRs is usually above the pentaprism). The problem with this position is that the light emitted by the flash reflects straight back into the lens, resulting in patches of glare appearing on photographs of objects with shiny surfaces (e.g., varnished paintings, glass surfaces and objects, porcelain). However, attaching the flash to a separate flash bracket can reduce the amount of reflection. If the flashgun has an adjustable head, the brightness of the light can be softened by bouncing the light off an angled piece of white card positioned above the flash. More expensive guns tend to be larger, more powerful, and have their own built-in brackets. In addition, a number of more specialist types of flashgun are available, such as the ring flash: a circular flash lighting unit that fits around the outside of the front of the lens. This type of gun is most often used in close-up photography of small objects (e.g., coins) to produce localized, shadow-free lighting.

Most commercial studios and many museum departments now use electronic flash as the only form of lighting. The flash is usually fired into a diffuser or reflector (umbrella) to soften the harshness of the light source. The advantages are that light-output is very high, and smaller apertures, with consequent larger depth of field, can be used. Additionally, low-speed film can be used, heat production is negligible, and most important, the light is of a colour-temperature that does not change and which matches Daylight-type colour film. One of the disadvantages includes the difficulty in seeing the effect of slight changes in the direction and distance of different lights before the exposure. However, most large flash units incorporate small tungsten bulbs - 'modelling lights' - to help overcome this problem.

Calculating the flash exposure
In photography with constant light, the total exposure consists of two elements: the timing of the shutter and the size of the aperture (the f-number). When flash is used, however, one of these variables is lost, since the length of the exposure no longer depends on how long the shutter is open for, but on the length of the flash of light. The overall exposure has therefore to be determined in some other way. There are three ways of doing this: guide numbers, where the strength of a flash unit, or a flash bulb, is expressed by a guide number. This number is a multiple of the aperture (in f numbers) times the distance between the flash and the object (in metres), with a film speed of 100 ISO. A small unit might have a guide number of between 15 and 20 and a large studio flash of 40 to 50 or more. Using a unit with a guide number of, for instance, 50 at a distance of 5 metres, the aperture should be set at 50/5 = f 10: or if, for instance, a smaller aperture of f16 was preferable, the equation could be used the other way round: 50/16 = 3.1 m, and the...
flash should be placed at this distance. It is important to note that this is no more than a guide - nothing is being actually measured, and if the object were very dark, and if there were no nearby surfaces to reflect light, it might well be necessary to shorten the distance away of the flash, or to open the aperture by one or two stops. Alternatively, if the object were very light, or if there were white, reflective surfaces nearby, the converse might be true. Nearly all flash units, no matter how small, incorporate some sort of table or dial which will indicate the appropriate f-number or distance without calculation.

**Automatic flash**

Many larger units do now incorporate an automatic control, a self-regulating device which adjusts the length of the flash according to an automatic reading taken by a light sensor built into the flash unit. The sensor measures the light reflected from the subject during the flash, and cuts off the flash accordingly. Most such units have to be set for distance or f-number, and all have to be adjusted for different film speeds. The most reliable models now available are through-the-lens dedicated units. These are designed for specific cameras and use the camera's circuitry to achieve the correct exposure, adjusting flash duration appropriate to the aperture set.

**Flash meters**

The most reliable method, and that normally used with large flash units or multiple flash exposures, is by means of a flash meter. These are similar to ordinary light meters except that they measure not the level of light but the overall dosage. The meter, (set to the appropriate film speed) is linked to the unit or units by the flash cable, the flash is triggered off, and a reading is taken on or from the object. The reading on the meter is in f-numbers, and this reading is transferred to the camera aperture ring.

**Class Four Moving light and filters**

How to photograph a skull by using the moving light technique

- Place the skull on to a black cotton velvet background
- Set the camera up on a tripod
- Place a 20cm scale to the every edge of the frame
- Turn on a 150 watt tungsten bulb at a distance of about ten feet and place on a stand or have it held by an assistant
- Take a meter reading with a hand held meter or though the camera (you may need to set a wide aperture to make the in-built meter work)
  
  translate the reading into a long exposure (So, that f4 at 1/4sec becomes f22 at 8 seconds)
- set the camera to B (brief time setting)
- turn out any other lights and pull the curtains or wait until there is very low ambient lighting
- using a cable release start the exposure
- moving the light give an exposure of about two thirds of the exposure on the left and the rest on the right side 'painting the object with light'
- On colour print film remember to use an 80A colour conversion filter and allow 2 stops extra exposure
- For colour slides use tungsten light balanced film and give a range of exposures varying the time or the distance of the light to the object

Clearly, the object could be something different to a skull!

Dorrell, P.G. 1989, Photography in Archaeology and Conservation, Cambridge*
Light Filters

Filters are discs or squares of glass or gelatine which are placed over the camera lens, or sometimes over the light-source, in order to change the colour or quality of the light reaching the film.

There are many different types and colours of filter, and manufacturers tend to use their own codes of letters or numbers to describe their products. So it is not always easy to compare one make of filter with another. However, all filters fall into a few general classes, although the same filter may serve several different purposes. The most comprehensive system of filter types is the ‘Wratten’ range used by Kodak, who also make the greatest number of filters, and this system is used in these notes. Where possible, the equivalent in other popular makes is given.

Nearly all lens-filters absorb light as well as changing its colour or quality. It is usually necessary to compensate for this loss by lengthening the exposure or by increasing the size of the aperture. With cameras which incorporate a through-the-lens meter, and with the lighter yellow, yellow-green, and blue filters, this can be done by simply taking a light-reading with the filter on the lens. When darker filters are being used, particularly dark red and dark green, this method is no longer accurate because the colour-sensitivity of the film may not be the same as that of the exposure meter. In this case, or when a separate meter is being used, the meter-exposure must be multiplied by a factor, known as the ‘filter-factor’, specific to that filter. This factor is usually given on a leaflet supplied with that filter; for example, a pale yellow filter may have a factor of x1.5 or x2, whilst a deep red may be as high as x25.

Filters for black-and-white photography

Haze Filters

Distant views often appear to be veiled in photographs. This effect is caused by the scattering of light by water vapour in the atmosphere. The shorter wave-lengths, ultraviolet and blue, are those chiefly affected, and since b/w film is particularly sensitive to this part of the spectrum, the effect is often worse on a photograph than it is in reality. A filter which excludes the UV (Wratten 2A or 2B, Ilford 102, Hoya UV (O), Nikon L39) will give a degree of haze-penetration, while any filter which blocks the shorter wave-lengths - yellow, orange or red - will have a similar or stronger effect. A few very expensive lenses such as the Leica incorporate UV excluding glass, and the use of a haze-filter is unnecessary (this feature will make these lenses unusable for technical photography with UV fluorescence).

Correction filters

As a result of the sensitivity of panchromatic emulsions to UV and blue, blue skies may be rendered as white on the print, and greens, to which such emulsions are not so sensitive, rather dark. A light yellow filter (Wratten 6 or 8, Ilford 104 or 105, Hoya K2, Nikon Y44, Cokin A1) or light yellow-green (Wratten 11, Ilford 401 or 402) will darken blues and lighten greens, usually an advantage in photographs with sky, trees and grass.

Some fast panchromatic films also have increased sensitivity in the red deliberately heightened in order to increase their speed in tungsten light. If a correct rendering of red tones is essential, as it might be for instance when photographing an oil painting, this tendency may be corrected by using a light blue filter (Wratten 38, Ilford 301 or 403).

Contrast filters
Black and white emulsions record colours as shades of grey. It quite often happens that different colours will record as similar grey tones and thus the contrast between different parts of the scene or object will be lost. Contrast filters accentuate the difference in the rendering of colours as tones, the general rule being that a filter lightens its own colour and darkens colours complimentary with it in the spectrum.

It is sometimes useful to lose a colour altogether against its background; for instance, if a yellow-stained print is to be re-photographed, by using a yellow filter all trace of the stain may be lost. When photographing a site or an artefact however it is rarely possible, or desirable, to suppress a colour altogether. All that is necessary is to accentuate an existing difference. For instance, the difference between the green of corroded bronze and the red-brown of corroded iron on the same tool may be accentuated by using either a green filter which would lighten the green and darken the red-brown or a red which would have the opposite effect. It is important to remember that such a modification involves, necessarily, the distortion of tonal values, and such distortion should always be kept to a minimum.

Filters for colour photography

Obviously, neither correction nor contrast filters can be used with colour film as they can with black-and-white. A red filter, for instance, would simply render the whole picture red. Some manufacturers, specially Cokin, do supply a whole range of more or less strongly coloured filters, called ‘Creative’ filters (also known as ‘effect’ or ‘pop’ filters) by the use of which colours are deliberately distorted for aesthetic effect. In the same class are graduated filters, which grade from one colour to another, multiple image filters, ‘starburst’ filters, split image and soft focus filters and similar gadgets. Their value is minimal, as far as archaeological recording is concerned.

The scattering of light which may veil distant views can be apparent in colour as in black-and-white photography; moreover, the scattered blue light can give an overall bluish cast, especially in the shadows. This effect may be overcome by using a ‘Skylight’ filter - a very pale pink or salmon-coloured filter which absorbs the UV and corrects the blue cast. (Wratten 1A, Ilford 805, Hoya 1B, Nikon L1B, Cokin 230). It is useful to have one of these filters in place all the time unless using another due to the protection to the lens element in the event of an accident - it’s cheaper to replace a filter then a lens element!

A number of filters are used with colour film in order to change the quality of the light to match that for which the film sensitivity is balanced. There is a series of ‘Conversion’ filters made especially for matching light to film:
Filter Selection & Exposure adjustments
for Artificial Light Source Variability Compensation

<table>
<thead>
<tr>
<th>Films</th>
<th>Recommended Meter setting (ISO) and Illumination Balance</th>
<th>Daylight</th>
<th>Tungsten Lamps (3200K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fujichrome Velvia RVP</td>
<td>50 ISO Daylight</td>
<td>No Adjustment</td>
<td>No. 80A + 2 stops</td>
</tr>
<tr>
<td>Fujichrome 64 Professional RTPII</td>
<td>64 ISO Tungsten 3100K</td>
<td>No.85B</td>
<td>No Adjustment + 2/3 stop</td>
</tr>
<tr>
<td>Fujichrome Provia 1600 Pro</td>
<td>1600 ISO Daylight</td>
<td>No Adjustment</td>
<td>No. 80A + 1 2/3 stops</td>
</tr>
</tbody>
</table>

If a colour photograph is taken under mixed lighting, for example a room lit at one end by daylight and at the other by tungsten bulbs, a colour cast is inevitable no matter what filter is used. This can be overcome either by replacing one of the forms of lighting, for instance by switching off the tungsten lights and illuminating the area by electronic flash, which is balanced for Daylight film; or by covering the lights with filters changing their spectral quality to that of daylight. Glass or gelatine filters of a large enough size would be expensive and of a higher optical standard than necessary, so a number of manufacturers supply sheets of acetate of the appropriate colour characteristics.

In general, a better colour balance is obtained, and less light is lost, if a Tungsten film is used in daylight with the proper filter, than if a filtered Daylight film is used under tungsten lighting.

In addition, there are filters designed to compensate for the too-red effect of early-morning and evening sunlight on Daylight film (Wratten 82A, Hoya 82A, Nikon B2, Cokin A24), or the bluish cast produced when using Daylight film on a cloudy day or in shadows, (Wratten 81A, Hoya 81A, Nikon B2, Cokin A26). Hoya also makes a filter (FL-D) for use with Daylight film under fluorescent lights.

Kodak make a series of primary and complementary colour filters in graded steps for the fine adjustment of colour balance. These can be used over the light-source or the lens. They are designated by the initials ‘CC’ followed by a number indicating their density, and the initial letter of their colour, for instance CC50Y is the densest of the yellow series.

It should be emphasised that the balancing of colour film and light sources is a complicated business if exact results are required; it is usually necessary to make a series of tests. These notes provide only a rough outline; more information can be found in ‘Kodak filters for scientific and technical uses’, (Eastman Kodak Co. 1970).
**Miscellaneous filters**

**Neutral Density Filters**

These are neutral-grey filters, supplied in a graded series. They reduce the light coming through the lens without affecting its colour and may therefore be used with both black-and-white and colour film. Their chief use is to control the exposure when it is necessary to combine a large aperture with a relatively long exposure-time, in order to minimise the depth of field. They are little used in archaeology.

**Polarizing filters**

Normally the wave-front of the light vibrates in all possible planes at right-angles to the direction of the light-ray. However, when light is reflected from the surface of many non-metallic materials, it becomes polarized, i.e. it vibrates in one plane only. Such surfaces are glass, plastic, water, glaze, enamel, polished wood etc. Polarizing filters (which are misnamed - they do not themselves polarize light) will in part suppress reflections from such surfaces. They are grid-like plates of parallel crystals which pass polarized light lying in the same plane as themselves, and block polarized light at any other angle. Since they necessarily block out a portion of the total light, they have a fairly high filter factor, X2.5 - X5.

With a single-lens reflex camera, or a camera with a focusing screen, the best angle can be found by mounting the filter on the lens and turning it while watching the image in the eye-piece or screen until the reflection is extinguished. With other types of camera, it is necessary to look through the filter itself from the camera position, turn it until the reflection disappears and then mount the filter on the lens at exactly that angle.

There are, however, a number of factors which limit the value of these filters. First, they will only completely eliminate reflections at a fairly acute angle to the surface - less than about 40°, so they are ineffective for eliminating for example, the reflection from a camera-mounted flash-gun in the glass of a showcase viewed square-on. Secondly, such a showcase may well be reflecting several lights from several different directions, and, very often, as the filter is turned to extinguish one reflection, another emerges. And, thirdly, they are very much more effective with a long focal-length lens, accepting light only from a narrow angle, than with a wide-angle lens, the angle of acceptance of which is likely to be wider than the filter can cover. They are also ineffective in suppressing reflections from metallic surfaces since this light does not become polarized. To eliminate these reflections, it is necessary to use polarizing sheets over the light-sources as well as over the lens.

Polarizing filters may be used for both black-and-white and colour. In colour photography they have an additional function. Some of the light from a clear blue sky is polarized, and, as was mentioned earlier, it is light from this end of the spectrum which is most likely to be scattered and to degrade the clarity of shadows and distant views. A polarizing filter will both darken the blue of the sky and give greater clarity and sharpness to a distant scene.

One final type of filter is worth mentioning, the so called 'Pan-vision' filters (Wratten 90, Ilford 811). These are dark grey - amber filters which when looked though, give roughly the same tone-relationships of different colours when photographed on panchromatic black and white film in daylight. They are not intended for use over the camera lens.

Most filters cab be bought either as glass or as gelatine. Glass filters, which are the most expensive, are normally supplied to fit individual lenses, or are used with some sort of adapter which will fit several. Optically, the most satisfactory are the so-called ‘ghostless’ filters which are curved to fit the front-element of the lens, but these are so expensive as to be justified only if they are to be in constant use and I must admit I’ve never seen one in use in twenty years of photography! Glass filters should be treated as lenses - kept dust and scratch-free, and cleaned only with great care.
Site Photography
During the course of an excavation photographs are taken for a number of purposes. The prime purposes of course must be to preserve a record of the site and to provide illustrations for the published report, showing the appearance and relationship of walls, floors and buildings, and the details of constructions and in situ artefacts. Ideally photographs, plans and sections should complement each other so that the position and measurements of an edifice can be immediately matched to its visual appearance. Moreover viewpoints should be chosen, and the feature excavated and cleared in such a way that all the evidence is revealed on which are based theories of construction and chronology. This is a counsel of perfection, and such a display of archaeological logic will probably never be achieved, but at least a serious attempt should be made to avoid the situation, all too common, where vital evidence has not been recorded, and where, following the destruction of the excavation, assumptions and theories must go unsupported.

Site photography has also a number of other functions of almost equal importance which should not be overlooked. Where time and staff permit, all photographs should be of publishable quality. Unfortunately time and staff never do, and many excavators find it of value to take series of quick, roughly prepared photographs, snapshots in fact, during the course of excavation to act as visual notes for future reference. This practice can be most useful, so long as it is not thought of as a substitute for properly thought-out and properly prepared site photographs.

One field in which photography is unrivalled is the placing of the site in the landscape. Unless the dig is fortunate enough to have a member of its staff with the rare talent of accurate landscape drawing, the photographer must be responsible for the recording of such things as the siting and aspect of settlements in relationship to communications, water and other sites, local topography, geology and flora.

Most excavations and some surveys will become the subjects of illustrated lectures. For this purpose at least the important black-and-white photographs are normally matched by 35 mm colour transparencies. These slides may serve very well for academic purposes, but prove rather indigestible fare for public lectures. A leavening of slides showing excavators at work, dig life, and local conditions are always a welcome addition. It needs some discretion to produce a set of slides, which display all the features, which the lecturer will want to talk about but which are not a procession of walls, buildings and objects only. Similar photographs in black-and-white and colour may prove to be of value for printed publicity.

Clear, informative dig photographs, whatever the equipment used and whatever the site, depend on viewpoint and lighting.

Viewpoint Obviously the viewpoint chosen for a particular photograph should show as much as possible of the subject. Very often a difference of only a few inches will reveal or mask some feature; will show, for instance, an object silhouetted against a plain background rather than against an obtrusive one; will show the levels connecting two structures or leave them unconnected; or will show the floor-levels associated with a building rather than leave the building apparently floating in midair. Viewpoint is also important in isolating in the photograph structures from others with which they have no connection. Most trenches will have structures of different periods exposed at the same time - however undesirable this may be in theory - and few things are more confusing in a site photography than the juxtaposition of walls and floors unrelated by their construction or chronology, but merely by the progress of excavation. Related to this is the absolute necessity of photographing artifacts in situ on the surface on which they occurred (or in the case of graves and pits, from which they were cut) and not on some other surface. Even in published reports it is still sometimes possible to find photographs of such things as pillar-bases or pots apparently standing on columns of soil, their proper surfaces having been cut through; or of artifacts apparently emerging from holes in the ground, their proper surfaces having not been reached.
It is desirable, where circumstances permit, to show ground level when photographing down into a trench. Photographs which show only the walls of a trench and the structures at the bottom produce a tunnel-like effect which make it difficult for the eye to recognize sizes and scales.

Most structures of any size become more comprehensible if they can be photographed from a high viewpoint as well as from ground level. Many devices have been used to obtain such photographs (apart from low-level aerial photography). They fall into two classes - those designed to give a strictly vertical viewpoint and those from which high oblique photographs can be taken. Both types of photograph can, given strict control and recording of angles and distances, be used as the basis of plan drawing. Vertical viewpoint devices are two, three and four-legged structures or fishing-rod-like affairs which straddle a given area and from the apex of which a camera can be suspended to image the square beneath without linear distortion. Mechanically such devices are not difficult to build, but their construction needs a good deal of forethought. They must be rigid enough to support the camera without vibration, especially when there is any wind, but light enough to be easily assembled and moved from place to place. A 35mm camera with a normal (50mm) lens has to be raised about 9 m. to cover a square of 5 m. sides. If the supporting legs are too thick they may cast shadows across the area, as will any cross-struts. The cradle holding the camera at the apex must be so designed that the camera can be lowered for rewinding and cocking (if needed as most modern cameras have built-in autowinders), and set in gimbals (a kind of balanced bracket) so that the lens is always pointing straight down. The camera must also be fitted with a long cable release or uses an infra-red remote control. Digital cameras can be used so that the image can be viewed and any necessary adjustments can be made from the ground.

Vertical photography works very well on a comparatively flat site with low structures. If the site is stepped up a hillside manipulation becomes more difficult and if a drawing is to be made, the mathematics involved in compensating for the changing angles more complicated. Digital adjustments may be made to the image if scales are placed at suitable points in the photograph. Moreover the vertical distance between the lowest and highest points in the photograph may be beyond the depth of field of the lens, even at its smallest aperture, as may also happen if the structures on the ground have considerable height. In this case the only solution is to proceed in much smaller steps. If it is desired ultimately to construct a mosaic of vertical photographs covering all or part of a site, two other precautions are necessary; the camera must always be focussed on the same plane and must be at a more or less constant height, and each area photographed should include corner markers in it so that prints can be fitted together and any small inaccuracies in squareness compensated for during enlargement. This is easiest by scanning the photographs and fitting them together as a mosaic.

High-angle oblique photographs are easier to arrange and merely involve some way of raising the viewpoint. Often an increase in height of only one or two metres will be found to be of great value in disclosing the plans of a structure. This can usually be achieved by standing on a car-roof or a step-ladder or, if rather greater heights are needed by using a builders scaffold tower. Fire escapes and the sort of elevator used for servicing street-lamps can be hired or borrowed; these have the great advantage of being laterally manoeuvrable with the photographer in position so that slightly different viewpoints can be considered. Possibly trees and neighbouring buildings should also be tried.

**Lighting** The great majority of site photographs are taken by unassisted daylight, so lighting is largely a matter of choosing the right time of day. If it is at all possible photographs should not be taken in direct sunlight. The heavy shadows thrown by walls and by the sides of trenches will not only obscure details, but their pattern will confuse the layout of the structure, and the contrast between light and shade may be too great for the contrast range of the film.

On the other hand photographs taken completely in shadow may appear dull and lifeless. Morning or evening light is often preferable or, if the weather is suitable, hazy sunlight. If direct sunlight is unavoidable it may be possible to choose a viewpoint such that the sun is behind the camera and shadows
Thus case directly behind the subject, although the photographer's shadow may be a nuisance in this case. Occasionally it may prove valuable to photograph with the sun at its zenith and shadows therefore at a minimum, but in these circumstances even a small stone projecting from a wall would cast a very long shadow indeed. Potential subjects for photography should wherever possible be previously studied at different times of day; light which at one angle may reveal all the detail of a wall or floor, may, a short time later, be so flat as to show no detail at all.

It is sometimes of value to supplement daylight by reflectors or electronic flash. White paper, a sheet, or silver foil can be used to direct light into dark areas of to highlight detail, and electronic flash, used with discretion, can raise the contrast of dully-lit structures or fill in the shadows of strongly sun-lit ones. Electronic flash can also, of course, be used as the main light-source, but in this case it should be well off the line of the lens axis and may need its own fill-in reflectors or subsidiary electronic flash.

Cleaning and preparation. Cleaning a site for photography is inevitably a tedious and time-consuming job. All surfaces should be cleared of rubble and dust, rocks and hard faces scraped, brushed and sometimes even washed, sections and baulks straightened and their angles sharpened, and dumps cleared back from the edge of trenches. Soft sections and mud-brick must be treated with discretion. Over-enthusiastic cleaning, or worse the deliberate outlining of obscure features may result in an unnatural looking picture which raises suspicions that the excavator has been creating the stratigraphy. Finally the subject should be carefully examined for footprints, trailing vegetation, half-hidden dumps of soil and extraneous objects like bags or trowels - only too easy to overlook. There are no short-cuts in this process except always to clean from the top down, and to view the object through the camera first so as to avoid clearing areas not in the picture.

Scales Any site photograph should include one scale at least, not so much in order to measure exact distances within the picture, as to give the eye a standard whereby sizes and relationships can be judged. Where size allows, the standard scale is a clean, red and white, 2 metres survey pole. If any other scale is used it should always have the length of its graduations marked on one of the divisions. Too often site photographs include scales whose length is impossible to estimate. Scales should either be parallel to one side of the photograph, or lie parallel to the plane of some important feature in the picture, particularly if the feature is running obliquely back. In any case the scale should always lie approximately in the plane of greatest interest. With an area of any size - a building or a whole trench - by far the most informative scale is a human figure, provided it can be placed fairly unobtrusively, and provided that the figure is not more attractive than the archaeology! If the scene is of any depth scales, whether human or survey poles, should be placed both in the foreground and in the background so that perspective can be appreciated. The practice of using trowels, brushes, picks or other implements as scales should be avoided if possible, as they differ in size and tend to confuse the picture.

Graves and tombs. The chief problem in recording burials lies not in the photography, but in the length of time needed to clean a skeleton properly. To clean and delineate every bone of a skeleton, human or animal, is a matter of days rather than hours, and may prove an unrewarding business as the bones first cleaned may well become dry and dusty before the last are revealed. Their appearance can often be improved by spraying lightly with water and a little glycerine just before photographing. Where there are a large number of skeletons it might be sufficient to clean and photograph properly only a sample, photographing the rest with just the extremities cleared to show size and posture, unless they seem likely to be of particular archaeological or osteological interest.

Skeletons in graves are normally photographed from above, from a sufficiently high viewpoint to show the whole of the skeleton and grave goods, and to include the surface from which the grave was dug. Depending on the practice of the excavation, such photographs may include scales (many excavators think these unnecessary with normal adult skeletons), north points, and cards with registration details. There is often a danger of the grave being so cluttered with such things that the burial becomes obscured.
Tombs often present considerable problems of space and lighting, and if there has been any preservation of organic materials the time available for working may be very short. Restrictions of space are best dealt with by using a 35mm. camera with a wide-angle lens, either taking a viewpoint to cover all or most of the interior, or taking a series of overlapping vertical photographs and joining the prints to form a mosaic.

In either case lighting will probably have to be by electronic flash unless a generator is available. It is better in a restricted space to bounce the electronic flash from the roof or from a white surface, otherwise the effect will be intolerably harsh and contrasting.

**Registration**

The details of a negative should always be recorded in a notebook, when the photograph is taken. The sort of information recorded and the form of registration varies from dig to dig, but in general it should include:

- A running number by which the negative can be identified
- Date of exposure
- Site
- Square, trench and level or object number
- Compass direction

It is also useful to record details of film, exposure, aperture and filter for future reference. Digital cameras should be set to give a continuous series of non repeating frame numbers and should have the date and time correctly set at the beginning of the excavation season. The frame number may then be safely put in the site record. If using multiple digital cameras it may be worth adjusting the setting to ensure non-repetitive numbers.

**Equipment.** When we must have the very best results a large format camera with camera movements is preferable for use on a dig, which includes architecture. The foreshortening inevitable if a camera is pointed up or down can be compensated for, and depth of field and focus manipulated. Also, grain and dustmarks, obtrusive when a 35 mm. negative is enlarged, are much less obvious on a larger format. The weight and expense of a large camera, and the difficulties of processing the film lead most digs to rely on small format cameras. In any case a 35 mm. camera will almost always be necessary for the production of colour transparencies, and if black-and-white is exposed on 35 mm., two camera bodies with a common range of lenses will suffice. Digital cameras will have a variety of uses on most sites.

A standard and good wide-angle lens will certainly be necessary, and a long focus lens is useful surprisingly often. A rigid tripod, preferably one on which the column is reversible, or usable as a cross head, is essential for close-up photography and must have individually adjustable legs for use on uneven ground.

Cameras and other vulnerable equipment should be kept and carried in a dustproof case (the type with clamp edges is better proofed than zipped or flapped cases). If conditions are particularly dusty, cameras and lenses should be further protected in plastic bags, and a bag used as a hood while the camera in position on the tripod. They should be protected as far as possible from excessive heat, strong sunlight, rain, and sea spray, and cleaned as often as necessary with a soft brush. Lenses should be fitted with caps back and front when off the camera, and a colourless skylight filter should be kept permanently on the lens to protect it from scratches. Films should be individually bagged with a unique number sheet enclosed and used as the first exposure.
Seventh Class

Digital Imaging in Archaeology

The digital revolution that has changed the printing industry now has implications within archaeological photography. The use of digital cameras on archaeological sites and the scanning of conventionally taken silver images are now used regularly for published reports. However, to best understand the advantages and disadvantages of conventional photography over digital photography, we need to have an understanding of how the image is recorded in the two different ways.

Traditional silver-based cameras operate in a similar fashion to the eye in that light passes through a lens which inverts and focuses the image onto a light sensitive area - the retina in our eyes and a piece of film in a camera. The intensity of the light hitting the film is adjusted by an aperture control within the lens and by the amount of time that the film is exposed to the light. The resolution or resolving power within silver-based mediums depends on the sensitivity of the film material in that less light-sensitive films are thinner and will resolve finer detail than faster films. In addition, the lenses produced on conventional 35mm cameras will resolve detail that can be as small as 20 microns. The outcome is that on the best 35mm transparency the image information would equate to a 20 million pixel digital camera.

Digital photography had traditional camera optics and mechanisms and replaced film with an electronic light sensor. The nature of Digital Single Lens Reflex (DSLR) cameras now are that the camera bodies and lenses have been designed specifically for digital recording. The two current formats are DX (about the size of APS film at 16mm by 24mm) and FX the size of 35mm film (24mm by 36mm). These sensors are either built into removable film backs for use with normal medium format and 5 x 4" cameras or housed in modified 35mm camera bodies which take advantage of automatic focusing and subject-related exposure programmes. Digital camera sensors, CCDs (Charge Coupled Devices), record a fixed number of image details quoted as a number of pixels. Currently a basic cheap amateur use array for a compact would be of the order of 2312 by 1700 pixels giving a total of 4,000,000 pixels. These are generally referred to as megapixel cameras and give a good image quality. Each of the pixels has to record the light falling upon it as unique value.

In order to create a digital image the CCD digitises the light falling on it and digitises it into a computer readable form. The arrays come as either Area (also known as Matrix) or linear. The Area array is large enough to produce an image in one exposure or three consecutive exposures though red, green and blue filters giving a full 24 bit image. Electronic flash is usable on Area array CCDs if they are one pass systems (i.e. if the image is captured in one exposure), but would have to be used three times on three shot single area cameras. All low and medium cost digital cameras are Area array and often have flash built in.
It is worth noting that the Area array may well be a lot smaller in area than a normal 35mm film and the optics of the lens should be of a very high resolution so that the circle of confusion of the lens is as small as the gap between the individual CCDs elements (which can be as little as 7 microns).

Linear arrays scan the image one line at a time and can produce high resolution files with long exposure times of about one minute and so are only usable for object photography without the possibility of camera movement. These can only be used with no camera or object movement and with continuous source lighting like daylight, HMI lights or high frequency fluorescence tube arrays. This is the technology that is used in flat bed scanners and so has a proven track record but has been superseded by area arrays.

The dynamic range of negative film and CCDs is very high with a contrast range of 700:1 being recordable (this would be similar to photographing a scene in very bright sunlight that contained a white alabaster pot, in full light, and an black obsidian flint, in full shadow). This range makes negative film far less sensitive to slight over or under exposure recording something with a lower contrast range. Slide film has a lower dynamic range about 80:1 that is compensated for by the film having a higher visual contrast. Printing paper has a range of about 70:1 so all the media have to condense the information to fit the prints range. In tests carried out in America on a large group of people, most of them were able to resolve differences of between 150 and 350 different tones on a black to white tone wedge. The number of grey levels supported by most image-handling applications on a computer is 256 which is normally sufficient to fool the brain into thinking that a black to white tone wedge is smooth. Eight binary digits bits (one byte) are needed to enumerate these 256 grey levels. Most analogue to digital converters, built into digital cameras, have a greater bit depth than this as they chop the analogue information into 1,024 (10 bit) or 4,096 (12 bit) grey levels. This supersampling can improve image quality even though the outputted grey levels will be reduced to 256. In a colour image the information requires an 8 bit number for red, green and blue which results in a choice of over 16,000,000 colours. This resulting file occupies three times the storage space of a black and white file.

Portable digital cameras have memory cards inserted that allow a number of photographs to be stored within its memory. The number of the images will be directly related to the resolution and any compression of the images. Additional memory cards are often available to increase the number of images stored but are coming down in price regularly. The downloading of these images frees the cameras memory again. The department has a Canon G2 digital camera with a 256mb memory card. The camera has a 4 megapixel chip and will store at the least compression and highest quality (2272 by1704) 123 images. The camera using the highest compression and smallest pixel count (640 by 480) will store on the same card 2712 images. With the cost of memory chips falling rapidly we have several 1GB and 2GB card which will record a proportionally larger number of high-resolution pictures.

The resolution of a digital image is the number of pixels in the horizontal and vertical directions that have been captured by a scanner or digital camera. A single area CCD with 2,048 by 2,048 elements (like a digital back for a 6cm square medium format camera) would capture an image about 7 inches square with an output resolution of 300ppi (pixels per inch). This would be suitable for high quality printing in art books. Each pixel would contain a unique image detail. If the image was only wanted for Web page design, coarse newspaper printing or on screen use only the resolution needs to be only 72ppi so that a very basic web camera with a 400 by 600 pixel capture would only display at 4.5 by 6.5 inch sharply.
A guide to megapixels is

**5 MP = 2592 x 1944 pixels**
High Quality: 10 x 13 inches
Acceptable Quality: 13 x 19 inches

**4 MP = 2272 x 1704 pixels**
High Quality: 8 x 10 inches
Acceptable Quality: 11 x 14 inches

**3 MP = 2048 x 1536 pixels**
High Quality: 5 x 7 inches
Acceptable Quality: 8 x 10 inches

**2 MP = 1600 x 1200 pixels**
High Quality: 4 x 6 inches
Acceptable Quality: 5 x 7 inches

Greater than 5 megapixels
Digital camera manufacturers would like all customers to believe that higher megapixels is always better, but as you can see from the chart above, unless you have a large format ink jet printer, anything over 3 megapixels is more than most people will ever need.

However, there are times when higher megapixels can come in handy. Higher megapixels can give amateur photographers the freedom to crop more aggressively when they can't get as close to a subject as they would like. But the trade-off to higher megapixels is larger files that will require more space in your camera memory and more disk storage space on your computer. I feel the cost of additional storage is more than worthwhile, especially for those times when you capture that priceless photo and may want to print it in a large format for framing. Remember, you can always use an online printing service if your printer can't handle large format.

The cost of digital camera has come down with the wider acceptance of the use and utility of this medium from a typical £100 per megapixel to about £10 to £20. Canon has a sub £400 8 megapixel SLR including a wide angle zoom optic of a focal length similar to a 28-80mm lens on a 35mm camera.

The storage of digital files, which for A4 full resolution colour images can be in the order of 30Mb, creates problems. American creative design companies at present make three copies of their files and aim to recopy them on a seven year cycle as they agree that all storage solutions have a finite life. A typical Compact Disc will record 650 to 740 Mbs of digital information so would give 20 to 30 full resolution images. The photo CDs that are available will take up to 100 full resolution images by a loss free compression system that condenses the information from a scan and then re expands the image and compares the two and notes the differences so that when the file is next re expanded the corrections make the condensed image the same as the original. Currently extra hard drives with a capacity of 500 to 2000 Gbs are available using a USB2 connection as well as firewire which are practicable methods of connecting to storage with the proviso that changing the operating system of the computer can cause the drive to become recognisable. DVD super drives are also now built in giving in the order of 4.4 Gbs of storage on recordable DVD discs. Double size DVDs give nearly 8.5gbs and Blu-ray discs 25 –50 Gbs. I would predict that alternative storage media will be developed in the near future that will continue to bring down the cost of storage of data and should be aimed at producing more stable and archival media.

The rule of thumb that I use for all computer systems for determining if it has enough memory is to look at the requirements of the software you intend to run. Pick up the boxes for each of the applications and the OS that you intend to run and look at both the "minimum" and "recommended" requirements. Typically
you want to have more RAM than the highest minimum and ideally at least as much as the highest listed recommended requirement. The following chart provides a better breakdown of what is acceptable for different computer tasks:

Tasks / Functionality / Amount of RAM

Enough to Boot / Absolute Minimum / 256 MB

Word Processing / Barely Functional
256 MB - 512 MB

General Computing/Web Surfing / Functional
512 MB - 1000 MB

Gaming/Music /Optimal
512 MB - 2000 MB

Heavy Graphics image manipulation of large files
Should be smooth sailing
2000 MB and up

The ranges provided are a generalization based upon most general computing tasks. It is best to check the requirements of the intended software to make the final decisions. The lower part of the scale is the minimum while the higher number is better. This is not accurate for all computer tasks because some operating systems use more memory than others.

Memory Restrictions

Laptop computers generally have two slots available for memory modules compared to three or four in desktop systems. This means that they are more limited in the amount of memory that have available. With current memory module technologies, this restriction generally comes to either 1 or 2 Gigabytes of RAM in a laptop system based on either 512 MB or 1024 MB modules. Some ultraportable systems are even fixed with one size of memory that cannot be changed at all. So what is important to know when you look at a laptop?

First, find out what the maximum amount of memory is. This is generally listed by most of the manufacturers. This will let you know what upgrade potential the system has. Second, determine how the memory configuration is when you buy the system. For example, a laptop that has 512 MB of memory can be configured as either a single 512 MB module or two 256 MB modules. The single memory module allows for better upgrade potential because by adding another module you are gaining more memory without sacrificing any current memory. Upgrading the two module situation with a 1000 MB upgrade would result in the loss of one 256 MB module and a resulting memory total of 1256 MB.

Most laptop systems today have a small door on the underside of the system with access to the memory module slots. If it does, then it is possible to just purchase a memory upgrade and install it yourself without much trouble. A system without an external door or panel for memory access will require installation by a service technician. This generally will add additional expense to the memory upgrade in the future or possibly even the requirement that the system is sent in to a service centre that means the lack of a computer until the upgrade is completed. Typical upgrades to ram cost about £40 a gigabyte.

The permanence of output from computer files is under scrutiny from many sources and depends on the particular printer, ink and paper combination. Most output in the commercial world is not aimed for
permanence so that the deterioration of images in bright conditions is not a major problem as the file may be easily reprinted. A guide is that silver based colour prints will have a storage life of between 12 to 17 years (Fuji archival paper should be good for 60 years) and that Inkjet output a life of between 1 and 17 years. Better results are given with Laser printers (10 Years) and Electrostatic printers (42 years). I have printed from 10 by 8 inch glass plate negatives from 1897 that have hardly deteriorated and show superb quality and resolution. The 150 year development of silver based photography has made the storage permanence of film and papers more predictable.

Further reading:
Evening, Martin 2007, Adobe Photoshop CS2 for photographers, Focal Press, London
Evening, Martin 2009, Adobe Photoshop CS4 for photographers, Focal Press, London
Evening, Martin 2011, Adobe Photoshop CS5 for photographers, Focal Press, London
Evening, Martin 2013, Adobe Photoshop CS6 for photographers, Focal Press, London

Ang, Tom2006, Digital Photography Handbook, Dorling Kindersley
1. How to make a large picture from 2 overlapping photographs in early versions of Photoshop.

2. Take 2 or more photographs with about 40% overlap in as consistent a method as possible.

3. Input the photographs to a computer.

4. Open them in Photoshop.

5. Take the middle photograph and ensure that it is square and level (use the eyedropper palate ‘i’ straight line tool to draw along a straight line and the apply image/rotate/arbitrary and agree to the value shown by pressing the carriage return control).

6. Make the canvas size larger in the direction that you wish to enlarge the image by using Image/canvas size.

7. Open the next picture and select all (control+A) and v (move) to drag the selection to the first picture.

8. Open the layer palate and select an opacity of 60%.

9. Try to position the new layer on top by using the move tool (v) and the up and down single pixel move buttons on the keyboard.

10. The level can be resized and rotated by using the transform palate or Control+T.

11. Reset the opacity on the layer.

12. Re crop (c) and flatten control+E.

Save.
Photoshop toolbar shortcut keys and options
<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Marquee Tool</td>
<td>Make a selection box for objects</td>
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<tr>
<td>Move Tool</td>
<td>Move existing objects</td>
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<tr>
<td>Lasso Tool</td>
<td>Select objects with freehand, polygonal, or magnetic selection</td>
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<tr>
<td>Magic Wand Tool</td>
<td>Select similar objects</td>
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<td>Crop Tool</td>
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<td>Slice Selection Tool</td>
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<tr>
<td>Airbrush Tool</td>
<td>Paint soft-edged strokes</td>
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<tr>
<td>Paintbrush Tool</td>
<td>Paint brush strokes</td>
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<tr>
<td>Pencil Tool</td>
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<tr>
<td>Clone Stamp Tool</td>
<td>Clone a sample of an image</td>
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<tr>
<td>Pattern Stamp Tool</td>
<td>Paint with part of an image as a pattern</td>
</tr>
<tr>
<td>History Brush Tool</td>
<td>Paint a copy or snapshot into the current image window</td>
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<tr>
<td>Art History Brush Tool</td>
<td>Paint with styled strokes that emulate different paint styles</td>
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<tr>
<td>Eraser Tool</td>
<td>Erase pixels from an image or restore previously painted areas</td>
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<tr>
<td>Background Eraser Tool</td>
<td>Erase areas to transparency by dragging</td>
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<tr>
<td>Magic Eraser Tool</td>
<td>Erase solid-colored areas to transparency with a single click</td>
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<tr>
<td>Gradient Tool</td>
<td>Create gradient fills, radial, and diamond blends</td>
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<tr>
<td>Paint Bucket Tool</td>
<td>Fill similarly colored areas with the foreground color</td>
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<td>Blur Tool</td>
<td>Blur hard edges in an image</td>
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<td>Sharpen Tool</td>
<td>Sharpen soft edges in an image</td>
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<td>Smudge Tool</td>
<td>Smudge data in an image</td>
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<td>Dodge Tool</td>
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<td>Burn Tool</td>
<td>Darken areas in an image</td>
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<td>Sponge Tool</td>
<td>Change the color saturation of an area</td>
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<tr>
<td>Path Selection Tool</td>
<td>Make shapes or selections from layers or images</td>
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<tr>
<td>Type Tool</td>
<td>Create text type on an image</td>
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<tr>
<td>Pea Tool</td>
<td>Custom shapes selected from a custom shape list</td>
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<tr>
<td>Custom Shape Tool</td>
<td>Make custom shapes</td>
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<tr>
<td>Annotations Tool</td>
<td>Add text, arrows, and image annotations</td>
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<td>Eyedropper Tool</td>
<td>Sample colors in an image</td>
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<tr>
<td>Measure Tool</td>
<td>Measure distances, locations, and angles</td>
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<tr>
<td>Hand Tool</td>
<td>Move an image within the window</td>
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<tr>
<td>Zoom Tool</td>
<td>Magnify and reduce the view of an image</td>
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</tbody>
</table>

Archaeological Photography ARCL 2035
The typical file opens in the Red Green Blue colour mode which is used for most Desktop publishing packages. I first crop the image to minimise the size of the file. Then I look at the levels and adjust them so that the image appears to have full range of tonal values. It often is worth trying Auto levels control or variations with photographs to give good results.

When opening the desktop palettes it is useful having 3 or 4 open for speed of use. I open Navigator, Brushes and Layers. If I am working with version 6 or 7 I also open History. The number of palettes that it is convenient to have open will depend on the size of screen and the resolution used. It is possible to stack the palettes and bring the required one to front when needed.

The Actions palette allows you to programme a series of commands and apply them to a folder of files to alter the enclosed files in the same way and save them in a new folder. When selecting an area using the Magic wand or Lasso tool it is useful to smooth the selection. This will incorporate adjacent areas to the selected one and make edges selected within the class.

The filters window has two filters I use a lot. The Dust and Scratches filter averages out surrounding pixel values and covers dust marks etc. This filter blurs the whole picture and so at first it seems to have limited value; however, if you apply this filter after selecting an area and then using the History palette you can draw on the blurred state and then use the History palette to paint on the original state and reveal the area selected. The Unsharp Mask filter blurs the area selected and the edges appear sharp.

APPENDIX A: POLICIES AND PROCEDURES 2016-17 (PLEASE READ CAREFULLY)
This appendix provides a short précis of policies and procedures relating to courses. It is not a substitute for the full documentation, with which all students should become familiar. For full information on Institute policies and procedures, see the following website: http://wiki.ucl.ac.uk/display/archadmin

For UCL policies and procedures, see the Academic Regulations and the UCL Academic Manual: http://www.ucl.ac.uk/srs/academic-regulations; http://www.ucl.ac.uk/academic-manual/

GENERAL MATTERS
ATTENDANCE: A minimum attendance of 70% is required. A register will be taken at each class. If you are unable to attend a class, please notify the lecturer by email.

Archaeological Photography ARCL 2035
DYSLEXIA: If you have dyslexia or any other disability, please discuss with your lecturers whether there is any way in which they can help you. Students with dyslexia should indicate it on each coursework cover sheet.

COURSEWORK LATE SUBMISSION: Late submission will be penalized in accordance with current UCL regulations, unless formal permission for late submission has been granted. Please note that these regulations have changed for the 2016-17 session.
The UCL penalties are as follows:
- The marks for coursework received up to two working days after the published date and time will incur a 10 percentage point deduction in marks (but no lower than the pass mark).
- The marks for coursework received more than two working days and up to five working days after the published date and time will receive no more than the pass mark (40% for UG modules, 50% for PGT modules).
- Work submitted more than five working days after the published date and time, but before the second week of the third term will receive a mark of zero but will be considered complete.

GRANTING OF EXTENSIONS: Please note that there are strict UCL-wide regulations with regard to the granting of extensions for coursework. You are reminded that Course Coordinators are not permitted to grant extensions. All requests for extensions must be submitted on a the appropriate UCL form, together with supporting documentation, via Judy Medrington’s office and will then be referred on for consideration. Please be aware that the grounds that are acceptable are limited. Those with long-term difficulties should contact UCL Student Disability Services to make special arrangements. Please see the IoA website for further information. Additional information is given here: http://www.ucl.ac.uk/learning-support-services/academic-guidance/extension-forms/

RETURN OF COURSEWORK AND RESUBMISSION: You should receive your marked coursework within one month of the submission deadline. If you do not receive your work within this period, or a written explanation, notify the Academic Administrator. When your marked essay is returned to you, return it to the Course Co-ordinator within two weeks. You must retain a copy of all coursework submitted.

CITING OF SOURCES and AVOIDING PLAGIARISM: Coursework must be expressed in your own words, citing the exact source (author, date and page number; website address if applicable) of any ideas, information, diagrams, etc., that are taken from the work of others. This applies to all media (books, articles, websites, images, figures, etc.). Any direct quotations from the work of others must be indicated as such by being placed between quotation marks. Plagiarism is a very serious irregularity, which can carry heavy penalties. It is your responsibility to abide by requirements for presentation, referencing and avoidance of plagiarism. Make sure you understand definitions of plagiarism and the procedures and penalties as detailed in UCL regulations: http://www.ucl.ac.uk/current-students/guidelines/plagiarism

RESOURCES MOODLE: Please ensure you are signed up to the course on Moodle. For help with Moodle, please contact Tina Paphitis, Room 411a (t.paphitis).
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APPENDIX TO BE INCLUDED AT THE END OF EVERY COURSE HANDBOOK, EXCEPT THOSE FOR CORE COURSES, WHICH SHOULD INCLUDE THE PAGE ABOVE INSTEAD

INSTITUTE OF ARCHAEOLOGY COURSEWORK PROCEDURES
General policies and procedures concerning courses and coursework, including submission procedures, assessment criteria, and general resources, are available on the IoA website. It is essential that you read and comply with these. Note that some of the policies and procedures will be different depending on your status (e.g. undergraduate, postgraduate taught, affiliate, graduate diploma, intercollegiate, interdepartmental). If in doubt, please consult your course co-ordinator.

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