The Higher Education Academy
Interdisciplinary Teaching and Learning Group

Supporting academics teaching on Cognitive Science courses

The nature and curricula of Cognitive Science courses in UK higher education

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1. Introduction

This report concerns a project on the provision of support for staff involved with teaching on Cognitive Science courses in UK higher education (HE). The project was funded by the Higher Education Academy Interdisciplinary Teaching and Learning Group, and was managed by the Higher Education Academy Psychology Network in collaboration with the Higher Education Academy Subject Centre for Philosophical and Religious Studies (PRS). The project had two related aims: the development of support for staff involved with the teaching of Cognitive Science in UK HE; and the investigation of ways in which Higher Education Academy subject centres can provide support for academics teaching on "emerging and 'uncovered' courses". Work on the project was to be undertaken in three parts:

> (1) a working group consisting of members of the Cognitive Science community were to develop an online repository of existing and bespoke materials to support Cognitive Science teaching (course outlines, reading lists, sample essays, etc.), the details of which would be determined by the working group;
> (2) a report would be compiled by the group on the nature and curricula of existing Cognitive Science courses, and on existing and desirable mechanisms for the support of those involved with such courses; and
> (3) a report would be compiled on the process of undertaking the project in order to provide the Higher Education Academy with potential guidelines concerning the implementation of appropriate processes to support academics on other on emerging and uncovered courses.

This report represents the outcome from part two of the project.[1, 2]

2. What is Cognitive Science?

Research in the field of what is now known as Cognitive Science has a very long and complex history. This history is often claimed to begin with Descartes, and to include most of the subsequent developments in the fields of Philosophy, Psychology, Physiology, Neurology, Anthropology, evolutionary theory, Linguistics, computing, and artificial intelligence (and others). This history will not be discussed in this report. Interested readers are instead directed to Barbara Von Eckardt's *What Is Cognitive Science?* (1995) and Margaret Boden's *Mind as Machine: A History of Cognitive Science* (2006). Rather, the focus in this report will be Cognitive Science as it is currently presented to and by those engaged with the teaching and learning of Cognitive Science within UK HE. To that end, here are some useful definitions:

> Cognitive science studies how the mind works…What makes cognitive science different from psychology is that cognitive science is a highly interdisciplinary enterprise which also draws on methods and insights from artificial intelligence, linguistics, neuroscience, and philosophy. (University of Edinburgh 2008)

> Cognitive Science is an interdisciplinary study that brings together the fields of psychology, artificial intelligence, philosophy, linguistics, neuroscience and anthropology in an integrated attempt to unravel the mystery of the mind. (University of Westminster 2008)

These definitions are taken from webpages promoting undergraduate Cognitive Science courses to potential undergraduate students at the Universities of Edinburgh and Westminster. As such, these definitions not only provide a useful summary of what Cognitive Science now is, but may well also provide prospective students with their first expectations concerning what a Cognitive Science course will provide, and thus the kind of teaching and learning experience they may receive should they undertake such a course. Such definitions clearly indicate that Cognitive Science courses involve a thoroughly interdisciplinary programme of study, and thus that students on Cognitive Science courses can expect an interdisciplinary teaching and learning experience.

3. The nature of existing Cognitive Science courses

In the academic year 2007-08 there were nine undergraduate-level Cognitive Science courses offered at five higher education institutions (HEIs) in the UK. Details can be found in Table 1. Entry requirements for these courses are generally high: BBB or above at A-level (or equivalent), often with a mathematics or science requirement. The one exception is the course offered by the University of Westminster: CC or above at A-level.[3] In contrast, student numbers are generally very low, again with the exception of the course offered by the University of Westminster. Roughly half of all courses had places available through clearing for entry into the 2007-08 academic year. Overall, therefore, the student cohort for Cognitive Science consists of a small number of high quality students, often with some background in mathematics or science, many of whom may not have originally intended or expected to study Cognitive Science at university prior to entry via the clearing process.

The small size of the Cognitive Science undergraduate cohort is somewhat of a surprise given both the long history of the discipline and the size and robustness of the community who currently describe themselves as cognitive scientists. There is a thriving bimonthly peer-reviewed journal, *Cognitive Science*, first published in 1976, and there are several other Cognitive Science-specific journals, including the *Canadian Undergraduate Journal of Cognitive Science* and *The Journal of Cognitive Science*. There are also a number of other peer-reviewed journals that regularly publish Cognitive Science research, including *Minds and Machines* and *Philosophical Psychology*. The Cognitive Science Society was incorporated as a non-profit professional organization in 1979, and now has over 1,000 members. The first annual Cognitive Science conference took place in 1979, and the 30th such conference, *CogSci2008*, took place in Washington, DC on 23-26 July 2008. Moreover, there has been a European Conference on Cognitive Science since 1995, and there are Cognitive Science societies in at least seven European countries.[4] In addition, many small and large events in the UK advertise themselves as being organised by and for the benefit of cognitive scientists. The Cognitive Science research community therefore seems to be large and robust, both internationally and within the UK. That the *undergraduate* Cognitive Science community does not reflect this research status is therefore somewhat surprising. Possible reasons for this are discussed in the following sections of this report.

4. Course content

The content of existing undergraduate Cognitive Science courses varies widely from institution to institution. Details for each course can be found in Appendix 1. There is, of course, a high degree of commonality at an overall level: all courses include modules on Computer Programming, Linguistics, the history and nature of Cognitive Science, and both introductory and specific modules on current and historical aspects of Psychology and Philosophy. However, the details of such modules vary widely, and are determined largely by the interests of staff within the department running the course. In addition, the percentage of compulsory modules on Cognitive Science courses differs significantly from institution to institution, and there exists similar variation concerning the requirements for a project or dissertation in the final year of the course. Consequently, while there is some degree of high-level commonality across existing Cognitive Science courses with regard to the modules and topics *available* to undergraduates during their degree programme, there also exists extremely wide variation with regard to what any given Cognitive Science undergraduate may *actually study* during their time as a student. As one might expect, this degree of variability has a significant impact on the teaching and learning experience of all those involved with Cognitive Science courses.

Some of this impact is extremely positive. Students on Cognitive Science courses are able to explore a wide range of subject areas, and many students discover during their course that "*what they are really interested in is not what they thought they would be interested in when they started university*": each year several of the students who enter the Cognitive Science programme at the University of Westminster do so believing that their interests lie in traditional computing, but discover during the programme that they are much more interested in Neuroscience. Students on Cognitive Science courses also develop a wide variety of specific and transferable skills, and eventually graduate with degree-level research, analytic, literacy, numeracy, and computing skills. Graduates from Cognitive Science courses are therefore usually "*well rounded and versatile individuals*", and career pathways for Cognitive Science graduates are thus extremely varied. Course leaders also report that the percentage of Cognitive Science graduates who go on to further academic study is higher than in many other disciplines, including the sub-disciplines from which many Cognitive Science modules are drawn. The variability within undergraduate Cognitive Science courses therefore provides many benefits to students on such courses, both during and after their undergraduate study. However, this variability also leads to a number of more problematic teaching and learning issues.

5. Teaching and learning issues

5.1 Generic issues

The nature of and variation in module content within a given Cognitive Science course generates a number of significant issues for the learning and teaching experience of students and staff involved in such courses. As one might expect, many of these issues are common to interdisciplinary study in general (as opposed to the study of Cognitive Science specifically). For students, such generic issues include:

- incompatible lecture and seminar scheduling
- short intervals between lectures and seminars that are held in different physical locations (i.e. departments)
- the lack of a home department or other common space for interdisciplinary study
- difficulties with administrative staff when dealing with cross-departmental registration
- textbooks and other materials that are specific to sub-disciplines of Cognitive Science rather than to Cognitive Science as its own discipline.

For staff, such generic issues include:

- lecture and seminar scheduling being a "*logistics nightmare*"
- the lack of a home department or other common space for interdisciplinary discussion
- bureaucratic and financial constraints within the host institution
- a lack of certainty concerning which material individual students will have previously studied, and how much knowledge it can be presumed that such students possess
- interdisciplinary teaching appearing to be less highly valued in terms of, for example, career progression, research funding, and the Research Assessment Exercise (RAE)
- a lack of awareness or understanding in one's colleagues concerning the nature and benefits of interdisciplinary study
- discouragement or disapproval from colleagues for not being part of a "proper" discipline.

These issues are all significant, and their impact on the teaching and learning of Cognitive Science in UK HE should not be downplayed. However, such issues are also perhaps of lesser interest here given the Cognitive Science-specific focus of the current report. For further discussion of these generic issues readers are directed to the Organisation for Economic Co-Operation and Development (OECD)'s report on *Interdisciplinarity: Problems of Teaching and Research in Universities* (1972), the *Report of the Subcommittee on Interdisciplinary Teaching at Emory University* (1997) and Chettiparamb *Interdisciplinarity: a literature review* (2007), especially section 4.

5.2 Cognitive Science-specific issues

The previous section briefly outlined some of the issues that impact upon the teaching and learning experience of those involved in Cognitive Science courses as a result of the interdisciplinary nature of such courses. This section examines in more detail some of the issues that impact upon the teaching and learning experience of those involved in

Cognitive Science courses as a result of the specific subject matter that such courses involve.

Students on Cognitive Science courses come from a variety of subject backgrounds, and carry with them a correspondingly large range of preferences and prejudices concerning their learning experience. For example, significant differences exist concerning the intellectual interest and explanatory value attributed by individual students to, on the one hand, "thought experiments" – procedures in which imaginary situations and hypothetical questions are used to try to develop our understanding of the actual world – and, on the other hand, "real experiments" – procedures in which aspects of the actual world are tested according to specific hypotheses under known conditions. As one lecturer put it:

> *"Philosophically minded" students are often wary of "psychologically minded" students' seemingly extensive knowledge and experience of experimental techniques and actual data. Similarly, psychologically minded students are often extremely wary of philosophically minded students' ability and enthusiasm for debate, and for exploring options that go far beyond what could "really" be the case.*

To some extent these differences mirror differences that exist within the Cognitive Science research community more generally. Such differences are also precisely the kind of thing that interdisciplinary education is intended to involve (see Haynes 2002, Chettiparamb 2007). However, such differences can be especially disorienting for undergraduate Cognitive Science students because these differences are experienced *in addition to* the intellectual confusion often experienced by single honours undergraduate students during their degree programme. Students studying Psychology single honours, for example, experience during their degree programme "an epistemological shift in their understanding of the nature of psychology – their beliefs change from psychology as a subject concerned with the essence of human nature to a subject that is essentially a 'body of knowledge"' (Wallwork *et al.* 2008, p. 4). Moreover, students' understanding of what constitutes "psychological knowledge" also changes, from knowledge as "collecting all the facts" to knowledge as "a subjective decision about what is and is not relevant…or useful" (Wallwork *et al.* 2008, p. 35). Because Cognitive Science students experience these kinds of changes not only with respect to Psychology but with respect to *each of* the sub-disciplines from which their Cognitive Science course is drawn, their resultant intellectual confusion is correspondingly amplified.

Cognitive Science students also often express concern about giving "*the wrong kind of answer*" in an exam or other assessment activity. That is, these students are worried that they may provide an answer in a Psychology exam that is written in a style that would be appropriate for a Philosophy exam but is inappropriate for Psychology. Or that they may produce a report on a computer practical that conforms to the reporting conventions of Psychology but not those for Computing. Again, this concern reflects to some extent differences that are inherent in the very nature of interdisciplinary study and its assessment (Klein 1996). However, for undergraduate Cognitive Science students it is once again extremely disorienting to be faced with differing assessment criteria for "Cognitive Science essays" depending on whether the essay is being written for a Philosophy module or a Psychology module – especially as such confusion occurs in addition to being faced with what are often novel modes of assessment for the

constituent sub-disciplines of the overall degree programme (e.g. project reports, lab classes, programming assignments, etc.).

Of course, discomfort concerning the nature of the subject matter or the method of assessment is not unique to Cognitive Science students or to Cognitive Science courses. Nor does such discomfort necessarily arise from properties of the course as opposed to properties of the students on such courses. However, it is worth recalling here that, as we saw in section 3, the undergraduate cohort for Cognitive Science typically consists of high quality students, most of whom have some background in mathematics or science. Such students are therefore typically both highly able and highly motivated. As a result, for some Cognitive Science students a more accurate way to express the points made in the previous paragraph is that for these students, the worry is that they may submit an assignment for a Psychology module that is written in a style that would be *first class* for a Philosophy module but is inappropriate for Psychology (or vice versa). Moreover, for the majority of Cognitive Science students the worry is that an assignment in a style that would be graded as an upper second in, say, Computing, will be graded a lower second in, say, Psychology (or vice versa) – where an upper second represents the default preferred grade for the majority of undergraduates.

Again, such concerns are not exclusive to Cognitive Science undergraduates. For a variety of reasons students on all degree programmes "*are becoming increasingly pragmatically oriented*", with their primary motivation being to do what is required in order to achieve their preferred degree class. In the light of such general pragmatism, however, it is easy to see why Cognitive Science undergraduates may be especially concerned that the disorienting nature of their Cognitive Science course could have an undesirable impact upon their final degree class, even if such disorientation is nonetheless an accurate reflection of the state of Cognitive Science more broadly, or of the nature of interdisciplinary study in general.

This kind of student pragmatism is evidenced most explicitly in students' decisions about how to proceed when they are on a Cognitive Science programme, and about whether to undertake a Cognitive Science degree in the first place. In some cases students begin their undergraduate studies enrolled on a Cognitive Science course and then change programme during their degree in order to maximise their chances of obtaining their preferred degree class by focussing on preferred sub-disciplines, or by dropping whichever sub-disciplines they find less interesting, less rewarding, or "too hard". At the University of Leeds, roughly 50% of students who begin the Cognitive Science degree programme fail to complete this course.[5]

Alternatively, prospective undergraduate students often prefer to enter a degree programme other than Cognitive Science in order to "*keep their options open*" concerning future study. At the University of Dundee, students who might otherwise study Computing and Cognitive Science tend instead to choose Applied Computing and Psychology, as the latter course allows students the option to change to single honours Psychology or to Applied Computing after their second year.

Moreover, the desire to keep one's options open is especially acute with respect to the British Psychological Society's Graduate Basis for Registration.

5.2.1 British Psychological Society Graduate Basis for Registration

In order to work as a Chartered Psychologist in the UK, it is necessary to have achieved the British Psychological Society (BPS) Graduate Basis for Registration (GBR) and to have undertaken BPS-accredited postgraduate professional training.[6] The most straightforward way for a prospective undergraduate to achieve GBR is to graduate with a lower second or above from a BPS-accredited honours degree programme.[7] Prospective undergraduates who are interested in a possible career as a practising psychologist in the UK are therefore strongly inclined to opt for degree programmes that can enable them to achieve GBR, and virtually all HEIs in the UK offer BPS-accredited honours degree programmes.

However, in order for a student to achieve GBR via a BPS-accredited honours degree programme the student is required to have studied specific topic areas and methods within Psychology during their degree programme. The requirements for these areas and methods are specified in some detail by the BPS, and one unintended consequence of such specification is that many HEIs believe it difficult to provide dual, multi- or inter-disciplinary degree programmes that can meet the requirements for GBR. Moreover, those dual, multi- and inter-disciplinary degree programmes that do confer eligibility for GBR typically do so by requiring students to select Psychology modules largely to the exclusion of all other options.

The upshot of all this for Cognitive Science programmes in the UK is twofold. First, only the University of Westminster currently offers a Cognitive Science course that provides a route through which students can achieve GBR (see Appendix 1). This route is extremely popular: 80-90% of the Cognitive Science entry at the University of Westminster choose this route each year. However, in comparison with students who are not on the GBR route, students who choose this route "*do not get much choice*" about the modules they can study – though the choices open to these students nonetheless ensure that students on the GBR route will study a range of modules from across all of the sub-disciplines from which Cognitive Science draws. Further discussion of this route can be found in section 6 below.

However, the University of Westminster is not the only HEI to have offered a BPS-accredited Cognitive Science programme during the past decade or so. The Cognitive Science course offered by the University of Leeds was accredited from 1994 until a decision was taken to abandon such accreditation in 2003, and there were also accredited courses at the Universities of Exeter (accreditation abandoned in 1999), Hertfordshire (abandoned in 2003), Middlesex (abandoned in 2001), Royal Holloway (abandoned in 2001), Sheffield (abandoned in 1996) and University College London (abandoned in 2001). The main reason for the decision to abandon accreditation at the University of Leeds was the perceived difficulty in meeting BPS accreditation requirements while also providing a properly interdisciplinary Cognitive Science course. One suspects that similar reasons may also apply to the courses once offered at other HEIs (the actual reasons are unknown).[8]

The second consequence for UK Cognitive Science programmes of the requirements for GBR is that many "*psychologically-inclined*" prospective undergraduate students who might otherwise study Cognitive Science choose instead to keep their options open for becoming a practising psychologist by opting to enter a degree programme through

which they can achieve GBR. Moreover, admissions advisors and other staff report that they find it extremely difficult to recommend to such students that they opt for a Cognitive Science course rather than a BPS-accredited programme, given the perceived potential consequences of such a decision for students' careers. The overall effect therefore is that the number of students on Cognitive Science courses is much smaller than it would be otherwise, as psychologically-inclined students adopt the pragmatic solution to their own uncertainty about their future career. Namely, choose a BPS-accredited non-Cognitive Science programme, or study Cognitive Science at the University of Westminster.

The perceived need on the part of HEIs to provide BPS-accredited courses that confer eligibility for GBR, in combination with these HEIs' perception of the requirements placed by the BPS on such courses, therefore has a significant negative impact on both the number of Cognitive Science courses offered in UK HE and the number of students who choose to enter such courses. Moreover, one can see that these two factors may well combine to preclude the development of additional Cognitive Science courses in the future.

6. Existing solutions and support, and possible developments

The preceding sections have discussed some of the main issues facing staff and students involved with Cognitive Science courses in the UK. Some of these issues are common to interdisciplinary courses in general; others are specific to the content, structure and typical cohort of Cognitive Science degree programmes. It should also be remembered that these issues occur alongside the teaching and learning issues faced by students and staff involved with *any* degree programme, such as plagiarism, equipment failure, increased administrative duties, pressure on seminar rooms and lab space, the RAE, etc.

Support for students and staff that can help address many of these issues is currently available from a variety of sources. Resources and other materials relating to specific sub-disciplines are available at no charge from several Higher Education Academy subject centres, including the Subject Centres for Psychology; Philosophical and Religious Studies; Languages, Linguistics and Area Studies; and Information and Computer Sciences. Resources and materials to support interdisciplinary teaching and learning are available from the Subject Centre for Languages, Linguistics and Area Studies, and from several Centres for Excellence in Teaching and Learning (CETLs). A more limited number of resources specifically for those involved with Cognitive Science teaching and learning have been collated as part of the current project, and are now available via the Higher Education Academy Psychology Network website.[9]

Perhaps the most significant issue currently facing many of those involved with Cognitive Science teaching in the UK is the limited size of the Cognitive Science undergraduate cohort. As we saw above, this limitation appears in part to result from the way in which BPS requirements for GBR are perceived by most HEIs. Changes in either this perception or the requirements themselves may therefore offer the most significant benefit to those involved with teaching and learning on Cognitive Science courses.

As the University of Westminster demonstrates, it is possible to provide a Cognitive Science course that enables students to meet the requirements for GBR, and such courses are very popular with prospective undergraduate students. Developing and maintaining the course at the University of Westminster initially required "*working back from the learning outcomes [of the course] via the BPS requirements*" to determine which modules could or should be compulsory. This process also requires regular analysis of which Cognitive Science modules contain material that would enable students to meet the requirement for GBR *without* having to study a specific module for that requirement. For example, some of the GBR requirements for research methods are now met via the module on Connectionism and Cognition rather than a specific Research Methods module. Similarly, the recently enhanced GBR requirements for qualitative research methods are met within the Psychology of Language and Studies on Consciousness modules, rather than a specific qualitative research methods module. Once the requirements for GBR are met, optional modules are then grouped so as to ensure that students will be able to study all of the areas required for a properly interdisciplinary Cognitive Science degree.

A second positive development relating to the requirements for GBR would be the clarification, simplification and dissemination of mechanisms through which students who have successfully completed *some* elements of the GBR Qualifying Exam during their Cognitive Science degree would be able to complete the remaining elements

without having to complete a one-year M-level BPS-accredited conversion qualification. Such development would make it much easier for students to decide to study Cognitive Science – and for admissions tutors to recommend the study of Cognitive Science to prospective students – while at the same time allowing students to keep their options open for becoming chartered psychologists. Mechanisms of this kind already exist in principle, in the sense that the BPS does allow students to "*'top up' missing GBR core modules provided they are studied within a set period of their original degree studies and are studied with a department that is offering accredited degrees*". However, it is in practice extremely difficult for recent graduates to undertake such topping up because most HEIs do not allow graduate students to study only a single second or third year undergraduate module. Work with HEIs to make this kind of topping up easier for graduates to undertake would therefore be extremely useful, not only for students involved with Cognitive Science courses, but also for students involved with *any* dual, multi- or inter-disciplinary degree programmes for which Psychology is a constituent element.

A final development with regard to the requirements for GBR would be to emphasise to prospective students and to (prospective) course leaders that "*a BPS degree is a BPS degree*", and that a BPS-accredited Cognitive Science programme is therefore just as legitimate a route into postgraduate or professional Psychology as a single honours Psychology programme. Moreover, graduate destination data from the Cognitive Science programme at the University of Westminster suggests that graduates from their GBR route are at least as successful as graduates from Psychology programmes with regard to entry into postgraduate and professional Psychology career paths. Much more could therefore be done to market Cognitive Science courses to prospective undergraduates as possible and legitimate routes to postgraduate and professional Psychology.

A different mechanism for addressing the limited size of the Cognitive Science undergraduate cohort in the UK would be for HEIs to lower the entry requirements for Cognitive Science courses. As we saw in section 3, current entry requirements for Cognitive Science courses at HEIs other than the University of Westminster are high.[10] However, retention and progression rates at the University of Westminster are currently 85-90%, and graduate destination data is also extremely positive. So while there are no doubt many factors which contribute to retention and progression rates on existing Cognitive Science courses in the UK, data from the University of Westminster suggest that having lower entry requirements is not in itself detrimental to such rates. It may therefore be the case that the benefits of a significant increase in student numbers, and the associated increase in peer-to-peer interaction and peer support over the course of a degree programme, outweigh any initial costs incurred by HEIs as a result of lower course entry requirements.

An increase in student numbers and an associated increase in peer-to-peer interaction and peer support might also help to address some of the disorientation experienced by Cognitive Science undergraduates as a result of the nature of Cognitive Science programmes, at least in so far as such increases may afford students greater opportunity to work together to overcome their confusions about both the subject matter and methods of assessment that Cognitive Science courses involve. However, what is perhaps most crucial for addressing students' disorientation is that, wherever possible, modules within a Cognitive Science course are presented from "*a Cognitive Science*

perspective'', rather than from the perspective of the sub-discipline from which they may be drawn. Such a perspective is crucial to maintaining students' interest and involvement in their Cognitive Science course, and to enabling them to experience what one lecturer referred to as ''*the 'aha' moment in their third year*'', wherein students' understanding of the constituent parts of their degree programme suddenly integrates into a single coherent whole. Without such a perspective, students may well come to feel that their Cognitive Science course is no more than a collection of disparate constituent parts, and that they would be better off focussing on the parts that most interest them. The continued acceptance, promotion and development by HEIs of Cognitive Science as a subject *in its own right* is therefore another crucial factor in addressing the teaching and learning issues faced by staff and students involved with cognitive courses in the UK.

7. Conclusion

Cognitive science courses provide an excellent exemplar of interdisciplinary teaching and learning, and students on such courses graduate having obtained a wide range of knowledge and skills. However, very few Cognitive Science courses are currently offered in the UK, and student numbers for such courses are low. Students and staff involved with Cognitive Science courses face a variety of teaching and learning issues, some of which are specific to Cognitive Science, others of which are shared by all those who engage in interdisciplinary teaching and learning. This report has examined some of these issues, and has suggested some ways in which such issues can be addressed. However, the extent to which those involved with Cognitive Science courses will be able to successfully address these issues is unclear. Nonetheless, given the belief within the Cognitive Science teaching and learning community that "*it would be an absolute disaster if Cognitive Science dropped out of this country*", there is perhaps some reason to hope that Cognitive Science courses will continue – or even grow – within UK higher education.

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[1] I would like to thank the Cognitive Science course leaders and lecturers, the departmental and university administrators, and the British Psychological Society members who provided valuable information and insight during the compilation of this report. Comments in this report that are in italics and contained within " " are direct quotations from these sources.

[2] This report is neither as detailed nor as comprehensive as was originally intended. In particular, it focusses exclusively on undergraduate Cognitive Science courses in UK HE. Reasons for this are discussed in the process report compiled for part 3 of the project.

[3] However, the average number of points for students entering this course is around 220 (roughly AB at A-level), and many students have two or more A-levels at grade B or above.

[4] Namely: Austrian Society for Cognitive Science; Bulgarian Cognitive Science Society; Association pour la Recherche Cognitive (France); Gesellschaft fur Kognitionswissenschaft (Germany); Cognitive Science Society of Ireland; Associazione Italiana di Scienze Cognitive (Italy); and Slovenian Cognitive Science Society.

[5] Most students choose instead to complete a dual or single honours degree in their preferred sub-discipline(s). However, students on the Cognitive Science degree programme at Leeds also have the option to graduate after the first or second year of study with a Certificate in HE or a Diploma in HE, respectively.

[6] At present, it is not legally necessary to register as a Chartered Psychologist to work as a psychologist in the UK. However, employers often prefer to appoint a Chartered Psychologist because the title is seen as the public's guarantee that the person is properly trained and qualified, and is answerable to an independent professional body.

[7] GBR is also awarded to applicants who have not completed a BPS-accredited degree programme but have otherwise passed the BPS Qualifying Examination; or who have completed a BPS-accredited conversion qualification; or who are deemed to have "at least as broad a grasp of the general areas of psychology as required by the Qualifying Examination and to the same standard" (British Psychological Society 2008).

[8] It is also worth noting here that none of the six institutions that once offered a BPS-accredited Cognitive Science course currently offer a Cognitive Science programme. This opens up the possibility that there were at one time a (much) greater number of Cognitive Science courses, both accredited and non-accredited, in the UK. However, investigation of this history is beyond the scope of this report.

[9] http://www.psychology.heacademy.ac.uk/html/cognitive_science.asp

[10] BBB or above at A-level (or equivalent).

Higher education institution	Course name	Length and qualification	Home department	Entry requirements	Average number of students	Clearing in 2007
University of Dundee	Computing and Cognitive Science	3 year Hon BSc	School of Computing	300 points (= BBB) including B in Computer Science at A level or advanced higher	"*a handful*"	Yes
		4 year Hon BSc		240 points (= AA or CCC) including a science		
University of Edinburgh	Cognitive Science	4 year Hon MA	School of Informatics	Highers: BBBB including maths OR A-levels: BBB including maths (or A in maths at AS level and A in any science at A level)	6	No
University of Leeds	Cognitive Science	3 year Hon BSc	School of Computing	ABB	12	Yes
University of Sussex	Linguistics (50%) and Cognitive Science (50%)	3 year Hon BA	Centre for Research in Cognitive Science (COGS) - Departments of Informatics, Linguistics and Psychology	ABB/BBB	1	No
	Linguistics (75%) with Cognitive Science (25%)	3 year Hon BA		ABB/BBB	1	
	Philosophy (50%) and Cognitive Science (50%)	3 year Hon BA		AAB/ABB	5	
	Psychology (75%) with Cognitive Science (25%)	3 year Hon BSc		AAB/ABB	5	
University of Westminster	Cognitive Science	3 year Hon BSc	School of Computer Science	CC	30-35	Yes

Table 1: Details of undergraduate Cognitive Science courses offered in the UK in 2007-08

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Appendix 1: Cognitive science course content 2007-08

University of Dundee: Computing and Cognitive Science BSc

Level 1
Applied Computing
Software Development: Java programming and team project

Psychology
Introductory Psychology 1: fundamental topics in experimental psychology
Introductory Psychology 2: research skills

Philosophy
Foundations of Modern Philosophy
Reading and Thinking Philosophy

Level 2
Applied Computing
C++ and Data Structures
UNIX and Computer Systems

Psychology
Neuropsychology and Language
Perception and Development

Philosophy
Aesthetics and Kant
Hume and Recent European Philosophy (Problems of the Self)

Level 3
Applied Computing
Human-Computer Interaction and Usability Engineering
Object Oriented Analysis and Design
Software Engineering
GUI Programming

Psychology
Language and Cognition

Philosophy
One from:

- Question of Vision in Art and Philosophy
- How to be Good: an Introduction to Applied Ethics
- Mind: Action, Experience and Attitude
- Spinoza's Ethics and the Denial of Free Will

Level 4
Applied Computing
Individual computing project
Plus one from:

Internet Programming
Networks and Data Communications
Database Systems
Computer Architecture and Operating Systems
Industrial Team Project

Psychology
One from:
Working with Cognitive Psychology
Eye Movements and Visual Cognition
Cognitive Science and Psycholinguistics

Philosophy
One from:
Critique and Creativity: Deleuze's Essays
Critical and Clinical Science
Religion and Philosophy
The Bodily Self: Nietzsche and Foucault
Understanding, Dialogue and Interpretation
World and Meaning II: Quine, Kripke and the late Wittgenstein

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University of Edinburgh: Cognitive Science MA

Year 1 *
Informatics 1A
Informatics 1B
Psychology 1
One from:
Mathematics for Informatics 1
Linguistics 1A
Logic 1
One from:
Mathematics for Informatics 2
Formal Modelling in Cognitive Science 1
Human Communication 1
Linguistics 1B
Introduction to Philosophy 1B
Philosophy of Science 1

Year 2 *
Informatics 2A
Psychology 2
Either
Informatics 2B or
Informatics 2D
Either
Philosophy 2A or
Both Linguistics and Further courses or
Both Neuroscience and Further courses

Year 3 **

Introduction to Cognitive Science

Courses in any of:

- Cognitive Neuroscience
- Vision
- Perception and Action
- Knowledge Representation and Reasoning
- Language Processing
- Neuroinformatics
- Speech Processing or AI and Education‡

Courses †

- Further courses in any of:
- Cognitive Neuroscience
- Vision
- Perception and Action
- Knowledge Representation and Reasoning
- Language Processing, Neuroinformatics
- Speech Processing
- AI and Education or Schedule I ‡

Further course

Year 4

One from:

- Honours Project (Informatics)
- Dissertation in Philosophy
- Dissertation in Psychology
- Dissertation in Language Sciences

Courses in any of:

- Cognitive Neuroscience
- Vision
- Perception and Action
- Knowledge Representation and Reasoning
- Language Processing, Neuroinformatics
- Speech Processing or AI and Education ‡

Further courses †

Further course #

Further course

* Cognitive Science is one of two "Group Honours" degrees linking the four subject areas Informatics, Language Sciences, Philosophy, and Psychology. The central feature of these degrees is that they involve a "breadth requirement" (a minimum of 80 credit points at Level 8 in each of three subject areas) and a "depth requirement" (a minimum of 60 credit points at Level 9/10(/11) in two of those subjects). Although the specific Level 8 requirements for Cognitive Science are listed here under Years 1 and 2, note that up to 60 credits of required courses in Years 1 and 2 may be postponed to Years 2 or 3, in order to enable students to take other Level 7/8 courses from Schedules A-Q and to permit changes of degree programme.

** In addition to passing all compulsory courses, entry to Honours requires either the permission of the relevant Heads of School or a pass at 50% or above at the first attempt in one of the Informatics 2 courses, and one out of three of the following: a pass at 50% or above at the first attempt in Linguistics 2A; a pass at 50% or above at the first attempt in Philosophy 2A; a pass at 50% or above in Psychology 2. Honours courses must be selected from the subjects passed at these levels, unless with special permission of the relevant Heads of School.

‡ Documentation giving details, as well as restrictions on choice of courses in the School of Informatics, will be available for students entering the year to facilitate advance planning.

† Documentation giving details, as well as restrictions on choice of courses in the School of Philosophy, Psychology and Language Sciences, will be available for students entering the year to facilitate advance planning.

Students must take at least 40 points worth of courses in the school in which they did not take their project.

University of Leeds: Cognitive Science BSc

Year 1

Compulsory modules:

- Introduction to Cognitive Science
- Introduction to Human-Computer Interaction
- Introduction to Programming
- Reason and Argument
- Introduction to Theoretical Philosophy
- The Mind
- Elementary Logic
- The Senses and Communication
- Social and Cognitive Psychology
- Learning and Biological Psychology
- Developmental Psychology and Personality

Year 2

Compulsory modules:

- Fundamentals of Artificial Intelligence
- Introduction to the Philosophy of Language
- Formal Logic
- Cognition, Emotion and Motivation
- Biological and Abnormal Psychology
- Neuropsychology, Learning and Motivation
- Visual Perception and Language

Optional modules:

- Speech, Audio and Image Processing
- Bio-Inspired Computing
- Object-Oriented Software Engineering
- Practical Software Development

History of Psychology
Philosophy of Psychology
Theories and Observations in Science
Ethical Issues in Computing
Linguistics
Introduction to Grammar
Introduction to Epistemology
Realism and Antirealism
Developmental Psychology and Individual Differences
Social Psychology
or from the electives in the University Electives Handbook

Elective modules:

Candidates may study a maximum of 20 credits of elective modules. Alternatively, these credits may be chosen from the option lists above.

Year 3

Compulsory modules:

Philosophy of Mind

Optional modules (this module must be passed for the award of the Honours degree):

Computing Specialist Project
Philosophy Dissertation
Psychology Special Study (Long)

At least 20 credits from the following Computing modules:

Computer Vision
Natural Language Processing
Knowledge Representation and Reasoning
Personalisation and User Adaptive Systems

At least 20 credits from the following Psychology modules:

The Psychology of Hearing
Aging, Neuropsychology and Cognition
Reasoning and Decision Making
Current Themes in Cognitive Science

Options:

Speech, Audio and Image Processing
Bio-Inspired Computing
Object-Oriented Software Engineering
Practical Software Development
Ethical Issues in Computing
Introduction to Grammar
Syntactic Theory
Discourse Analysis
Introduction to Epistemology
Realism and Antirealism
Proctoring
Advanced Topics in Philosophical Logic
Advanced Topics in Mind and Knowledge
Developmental Psychology and Individual Differences
Social Psychology

It may be possible to substitute other appropriate modules: permission should be sought from the Cognitive Science Coordinator.

University of Sussex: Linguistics and Cognitive Science BA

Year 1

Linguistics

Approaches to Meaning
Approaches to Pronunciation
Approaches to Grammar
Language in Society

Cognitive Science

The Ghost in the Machine: an Introduction to Cognitive Science
Solving Real-World Problems
Philosophy of Science
Cognitive Modelling

Year 2

Linguistics

Grammar
Phonology
Semantics and Pragmatics
Options:

- Language, Variation and Change
- Sociology of Language
- Biology and Evolution of Language
- Language Acquisition

Cognitive Science

Four from the following:

- Biology and Evolution of Language
- Philosophical Foundations of Cognitive Science 1
- Philosophical Foundations of Cognitive Science 2
- Human-Computer Interaction
- Perception and Attention
- Grammar and Mind
- Language Acquisition
- Evolution and Human Behaviour

Year 3

Linguistics

Linguistic Typology
Historical Linguistics
Individual research project
Options from:

- Communication Analysis
- Language Processing in the Mind
- Meaning and Mind

Cognitive Science
Four from the following:
- Topics in Philosophy of Cognitive Science
- Language Processing in the Mind
- Programming for Cognitive Science 1
- Programming for Cognitive Science 2
- Current Issues in Cognitive Science
- Meaning and Mind

University of Sussex: Linguistics with Cognitive Science BA

Year 1
Linguistics
Approaches to Meaning
Approaches to Pronunciation
Approaches to Grammar
Language in Society

Cognitive Science
The Ghost in the Machine: an Introduction to Cognitive Science
One of:
- Solving Real-World Problems
- Philosophy of Science

Year 2
Linguistics
Grammar
Phonology
Semantics and Pragmatics
Options:
- Language, Variation and Change
- Sociology of Language
- Biology and Evolution of Language
- Language Acquisition

Cognitive Science
Two from the following:
- Biology and Evolution of Language
- Philosophical Foundations of Cognitive Science 1
- Philosophical Foundations of Cognitive Science 2
- Human-Computer Interaction
- Perception and Attention
- Grammar and Mind
- Language Acquisition
- Evolution and Human Behaviour

Year 3
Linguistics
Linguistic Typology

Historical Linguistics
Individual research project
Options from:
- Communication Analysis
- Language Processing in the Mind
- Meaning and Mind

Cognitive Science
Two of the following:
- Topics in Philosophy of Cognitive Science
- Language Processing in the Mind
- Programming for Cognitive Science 1
- Programming for Cognitive Science 2
- Current Issues in Cognitive Science
- Meaning and Mind

University of Sussex: Philosophy and Cognitive Science BA

Year 1
Philosophy
Introduction to Philosophy
Philosophical Reasoning
Elementary Logic
Issues in Philosophy

Cognitive Science
The Ghost in the Machine: an Introduction to Cognitive Science
Solving Real-World Problems
Philosophy of Science
Cognitive Modelling

Year 2
Philosophy
Kant
One from:
- Aesthetics
- Philosophy of Mind
- Plato

One from:
- Epistemology and Metaphysics
- Ethics
- Phenomenology

Cognitive Science
Four from the following:
- Biology and Evolution of Language
- Philosophical Foundations of Cognitive Science 1
- Philosophical Foundations of Cognitive Science 2
- Human-Computer Interaction
- Perception and Attention

Grammar and Mind
Language Acquisition
Evolution and Human Behaviour

Year 3
Philosophy
One from:
Aristotle
Hegel
Wittgenstein
One from:
History
Language and the Limits of Philosophy
Philosophy of Language
Social and Political Philosophy

Cognitive Science
Four from the following:
Topics in Philosophy of Cognitive Science
Language Processing in the Mind
Programming for Cognitive Science 1
Programming for Cognitive Science 2
Current Issues in Cognitive Science
Meaning and Mind

University of Sussex: Psychology with Cognitive Science BSc

Year 1
Psychology
Approaches to Psychology
Research Methods in Psychology I
Courses in other subjects chosen from an array of options

Cognitive Science
The Ghost in the Machine: an Introduction to Cognitive Science
One of:
Solving Real-World Problems
Philosophy of Science

Year 2
Psychology
Learning, Thinking and Memory
Social Psychology
Developmental Psychology
Personality and Individual Differences
Psychobiology (BA) or Brain and Behaviour (BSc)
Research Methods in Psychology 2
Courses from psychology or other subjects

Cognitive Science
Two from the following:
- Biology and Evolution of Language
- Philosophical Foundations of Cognitive Science 1
- Philosophical Foundations of Cognitive Science 2
- Human-Computer Interaction
- Perception and Attention
- Grammar and Mind
- Language Acquisition
- Evolution and Human Behaviour

Year 3
Psychology
Psychology project
Options:
- Clinical Psychology
- Psychology in Education
- Health Psychology
- Organisational Psychology
- Economic and Consumer Psychology
- Vocal Communication
- Biological Basis of Mental Disorders

Cognitive Science
Two from the following:
- Topics in Philosophy of Cognitive Science
- Language Processing in the Mind
- Programming for Cognitive Science 1
- Programming for Cognitive Science 2
- Current Issues in Cognitive Science
- Meaning and Mind

University of Westminster: Cognitive Science BSc

Year 1
Core modules:
- Fundamentals of Cognition
- Neurons and Symbols
- Introduction to Linguistics
- Research Methods in Cognitive Science 1

A maximum of three from:
- Introduction to Neuroscience
- Cultural Anthropology
- Word and Sentence Structure
- Introduction to Psychology 1
- Artificial Intelligence Fundamentals
- Introduction to Interactive Multimedia
- Introduction to Computer Programming

A free choice module

Year 2

Core modules:
- Experimentation in Cognitive Science 2

A minimum of one from:
- Human-Computer Interaction
- Applied Cognitive Science
- Logic Programming

A minimum of two from:
- Philosophical Foundations
- Cognitive Psychology
- Cognition and Language
- Advanced Neuroscience

A maximum of four from:
- Classical and Alternative Logics
- Multimedia Development Tools
- Digital Media Tools
- Social Psychology
- Expert Systems
- Knowledge Representation
- Intelligent Information Retrieval
- Developmental Psychology
- Individual Differences
- Semantics
- Syntax 2

A free choice module

Year 3

Core modules
- Cognitive Science Project (double module)

A minimum of one from:
- Cognitive Science of Perception
- Connectionism and Cognition

A minimum of two from:
- Studies on Consciousness
- Cognitive Neuroscience
- Music and the Mind
- Cognitive Anthropology

A maximum of three from:
- Knowledge Acquisition
- Neural Networks
- Written Discourse Analysis
- Pragmatics
- Psychology of Language
- Pharmacology of Cognition
- Machine Learning
- Natural Language Processing
- Fuzzy Logic and Systems
- Intelligent Agents

Clinical Psychology
A free choice module

University of Westminster: Cognitive Science BSc GBR route

Year 1
Core modules:
Fundamentals of Cognition
Introduction to Psychology 1
Introduction to Neuroscience
Linguistics for Cognitive Science
Neurons and Symbols
Research Methods in Cognitive Science 1
A maximum of one from:
Cultural Anthropology
Word and Sentence Structure
Artificial Intelligence Fundamentals
Introduction to Interactive Multimedia
A free choice module

Year 2
Core modules:
Experimentation in Cognitive Science 2
Cognitive Psychology
Social Psychology
Advanced Neuroscience
Developmental Psychology
Individual Differences
A minimum of one from:
Human-Computer Interaction
Applied Cognitive Science
Logic Programming
A minimum of one from:
Philosophical Foundations
Cognition and Language
A maximum of one from:
Classical and Alternative Logics
Multimedia Development Tools
Digital Media Tools
Expert Systems
Knowledge Representation
Intelligent Information Retrieval
Semantics
Syntax 2
A free choice module

Year 3
Core modules
Cognitive Science Project (double module)
A minimum of one from:

Cognitive Neuroscience
Cognitive Disorders

A minimum of one from:

Cognitive Science of Perception
Connectionism and Cognition

A minimum of three from:

Studies on Consciousness
Music and the Mind
Cognitive Anthropology
Psychology of Language
Neuropharmacology of Cognition
Clinical Psychology

A maximum of one from:

Knowledge Acquisition
Neural Networks
Pragmatics
Machine Learning
Natural Language Processing
Fuzzy Logic and Systems
Intelligent Agents

A free choice module

Supporting academics teaching on Cognitive Science courses: The nature and curricula of Cognitive Science courses in UK higher education

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