Appendix 1

Report of the Peer Review Panel on the Joint Council Initiative (JCI) in Cognitive Science and Human-Computer Interaction

Peer Review Panel Members

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Executive Summary

The aim of the Joint Council Initiative was to support interdisciplinary work in those areas of Cognitive Science that are relevant to HCI. An initial motivation for setting up the Initiative came from the realisation that worthy proposals for such work were falling into the cracks between Research Councils, and that the Councils were not acting jointly to look after such proposals.

We are able to confirm that the Joint Council Initiative has delivered both scientific results and useful research training. It is early to fully assess its full downstream impact on HCI research in the UK, but in these terms alone it is to be applauded - it is a success. This conclusion is supported by the further Initiatives that it has spawned since its conclusion.

The results of the Initiative are considered under three headings: Outcomes Relevant to Progress in Cognitive Science; Outcomes Relevant to Progress in Human-Computer Interfaces; and Outcomes Relevant to Progress in Cognitive Science as a Theoretical Basis for HCI.

Recommendations are offered concerning a number of issues including: Future Interdisciplinary Initiatives; The Needs of HCI; The Future of Communication Between Councils.

1.0 Introduction

What can Research Councils expect their Initiatives to achieve? In basic science, possible outcomes that can be expected with confidence include scientific results that bear on related national priorities, and training of research personnel for recognised areas of future importance. In applied research, advances can include contributions to applied science, the development of new tools and techniques, and the improvement of artifacts. Beyond these, Initiatives may generate scientific breakthroughs of major economic significance, and ideas for novel technologies of great commercial value, but these are harder to predict.

There are difficulties in assessing the outcome of such an Initiative. Results do not become apparent immediately; they may take years to become fully apparent. Often the real value of research lies in the follow-on research it makes possible; a case in point is the ARPA Speech Project in the 1970s, whose initial cool reception by its evaluators now appears quite unjustified in view of its subsequent influence. With these issues in mind, assessments must be suitably cautious.

We are nevertheless able to confirm that the Joint Council Initiative has delivered both scientific results and training. It is early to fully assess its full downstream impact on HCI research in the UK, but in these terms alone it is to

be applauded - it is a success. This conclusion is supported by the further Initiatives that it has spawned since its conclusion.

The aims of the present Initiative were to support interdisciplinary work in those areas of Cognitive Science that are relevant to HCI. An initial motivation for setting up the Initiative came from the realisation that worthy proposals for such work were falling into the cracks between Research Councils, and that the Councils were not acting jointly to look after such proposals.

Interdisciplinary research tends to be riskier and more difficult than mainstream research, for obvious reasons. In general, knowledge, especially knowledge of the most recent results, must be acquired and maintained in more than one domain, and there are more things to go wrong. There are some exceptions to this pattern, in the form of well-established fields in which experimental work is standardly combined with a fairly narrow range of mathematical and computational models - psychophysics is an obvious example. But more novel and innovative combinations of psychological and computational techniques are likely to encounter difficulties. The high risk is justified by the possible high payoff.

There is an inevitable tension between the demands of basic and applied research. Whereas basic research can focus exclusively on enlarging the public body of scientific knowledge, applied research must achieve a balance between

developing the applied science and developing tools, techniques or artifacts of value in the external target domain. Basic research does not need to establish its applicability every time. Applied research, on the other hand, must devote more effort to justification.

Applied research can easily be undermined by external forces; for example, the target domain can prove inaccessible, or can become excessively demanding if the research is of particular value. The outcome of applied research is sometimes to discover that the application is different from what was expected. Furthermore, applied research can find itself relying on the outcome of other research, including basic research (sometimes called the 'Error 33' condition), and if this latter research fails to deliver, the applied research may fail too. The overall result, for a multidisciplinary programme such as the JCI, is that different standards must be applied to the two different kinds of projects. Allowances must be made for the various types of difficulty that applied projects can encounter.

The panel noted a number of innovations in the conduct of the JCI which were explicitly intended to minimise these problems. One was the involvement of the research Coordinator. The panel heard many enthusiastic reports on the effectiveness of this position in defining and maintaining direction in research. Others were the annual meetings of the grant holders, and the annual summer schools.

1.1 Method

The Peer Review Panel heard presentations from participants in 27 of the 80 JCI-sponsored projects, in a four-day series of meetings in Edinburgh, Nottingham, and London. We allotted about a half hour for each presentation, followed by a half hour of discussion among the panelists and the presenters, and then a fifteen-minute closed session for discussion among the panelists.

In each session we aimed to understand the work done in the projects, and the results obtained, so that we could appraise the projects from both Cognitive Science and HCI perspectives. We also aimed to understand the role of the JCI in facilitating the line of research concerned, and the situation prevailing after the JCI with respect to support for the research.

In addition to the presentations, the Panel had access to the final reports on the projects reviewed, as well as summary reports on all the projects in the JCI.

This report was prepared in a final, day-long meeting of the panel at the conclusion of the exercise.

We note some reservations about the nature of the information on which we had to base our evaluation of the projects. Projects were of different lengths and were done at different times, so that some finished long ago, while others have only recently concluded. This means that some projects had much more to say

about downstream results than others, for example. The relationship between the sample of projects we examined, and the whole list of projects supported by JCI, is another source of uncertainty, although the panel read a substantial proportion of the final reports from the longer list of projects as well.

The results of the Initiative are considered under three headings: Outcomes Relevant to Progress in Cognitive Science; Outcomes Relevant to Progress in Human-Computer Interfaces; and Outcomes Relevant to Progress in Cognitive Science as a Theoretical Basis for HCI.

2.0 Project Review

2.1 JCI as a Cognitive Science Programme

2.1.1 What is Cognitive Science?

The field of Cognitive Science has developed since the late 1970's into a broad centralised field. Although there are as yet very few Cognitive Science departments *per se*, there are by now many researchers who view themselves as cognitive scientists. The key characteristic of Cognitive Science is its breadth. There is an attempt connect a wide range of disciplines into one general field. The fields of cognitive psychology, linguistics, artificial intelligence and neuroscience count as the core of the discipline with sociology, anthropology, philosophy education and other similar areas closely related to the field.

We saw a number of interesting and important projects. In the following sections we provide an analysis of the projects we have seen and reviewed and the importance of the work as it bears on progress in Cognitive Science.

Since we only saw a portion of the total projects, we are commenting only on those that we heard presented. There is a wide range of interesting projects in the Cognitive Science area, although many of them are not explicitly HCI oriented. The projects listed below are those which we see as primarily Cognitive Science.

Among the most interesting and general projects was the work by Stenning *et al* and their work on SIGNAL and Hyperproof. Although these projects were not explicitly HCI oriented the projects were of high quality and have had a substantial influence in the Cognitive Science community.

In addition there were a number of projects that involved neural networks. Among those were the work of Willshaw *et al* on coupled neural networks, the work of Chater and Bullinari on recurrent neural networks and the work of Altman *et al* on implicit learning in relation to models of interactive sentence processing.

The work by Lee *et al* on "Visual Control of Steering" was also very interesting, although it appears that there may have well have been other resources for this project.

The work of Johnston *et al* on "Computational and Psychophysical Studies of Biological Motion Analysis" was also interesting, but may not have been as relevant to the overall project. Similarly the important work of O' Keefe and Reece work on the hippocampus was of central Cognitive Science significance, and the later work on a robotic implementation (which occurred after the end of the project) had implications for the overall aims of the Initiative.

Finally, the work of Shallice *et al* on a rational reconstruction of SOAR and other cognitive representational systems in Sceptic, and their related work on Cogent also has had a substantial impact on the field and, given the most recent work that we have heard, will no doubt have a further impact on the field.

In summary, the projects were of high quality and made a substantial contribution.

2.2 JCI as a Programme in Human-Computer Interaction

2.2.1 What is HCI?

The field of Human-Computer Interaction consists of work of many different kinds, sharing a commitment to immediate or eventual application to the development of information systems that are easier and more effective for people to use. On the application side it includes the study and development of methods for design and evaluation of systems, as well as hardware and software technologies that support human use of such systems. On the more theoretical side it includes studies of mental and social processes implicated in the use of information systems, including learning, problem-solving, and planning, in the context of such use.

Here we consider projects whose aims were mainly to advance the state of knowledge and practice in Human-Computer Interaction, with very limited intent to contribute to Cognitive Science or to draw strongly on knowledge from Cognitive Science or its constituent disciplines. We do not mean to suggest that the line separating these projects from ones with stronger Cognitive Science orientation is sharp, but we do feel that somewhat different considerations are relevant in assessing these somewhat different kinds of work.

2.2.2 Patterns of Strength and Weakness.

The panel did not feel that the work in this category is very strong overall. There is some bias in our selection, that tends toward weaker ratings for these projects, in that projects we saw as stronger scientifically were likely to be placed in our category of projects with shared emphasis on Cognitive Science and HCI.

A limitation we saw in common among many of these projects was inadequate evaluation, both formative evaluation (studies done during the development of a system in order to improve its design) and summative evaluation (studies done later in the life of a project to provide evidence for the effectiveness of the system arrived at).

Projects suffering from insufficient formative evaluation include Eisenstadt; Bornat, O'Shea, and Reeves; Long and Whitefield; and Benyon, Green, Petre. In these cases it is likely that the systems or methods developed could have been improved by a development process that included more involvement of real users and real tasks. This is a well established canon of user interface design which is as important for research projects as for real-world applications.

Projects especially in need of more summative evaluation include Long and Whitefield; and Benyon, Green and Petre. In both cases the projects aim to provide useful tools for design, but data are lacking that could be used to persuade designers that the innovations are advantageous, compared with alternatives.

Related to the narrow issues of formative and summative evaluation is the broader question of the importance of contact with users in HCI development. We note that none of these projects included sustained interaction with potential users as part of the research programme.

Another issue with some of these projects is the extraction of lessons from the work that transcend the specifics of the particular application domain addressed. On the positive side, the Bornat, O'Shea, and Reeves project did result in a paper explicitly addressing general interface design lessons for tools to support formal reasoning. Projects weak in this area include Robertson, Pain, Brna, Ormerod and Kahney; and Eisenstadt. In the latter case it appears that general lessons were learned that would be useful to people needing to design program visualisation tools for languages other than Parlog, but these have not been written up.

This matter is especially important in applied research. On the one hand, such research must be concerned to a great extent with the details of the application problem. On the other hand, work whose conclusions are bound up with such details cannot be of value to a wider audience. People need strong incentives, not to say pressure, to put in the effort necessary to relate specific projects to broader issues.

The Green, Gilmore and Winder project raises some further considerations. The original goal of this project was to apply Green's cognitive dimensions analysis to the development of a code browser, but this proved impossible because of changes in the background language technology. Despite this loss of an intended system focus, it appears that this project was quite successful in creating an awareness within Computer Science that HCI considerations are important in programming systems. We believe this positive result should be credited to the

role of JCI in promoting interactions among researchers that would not normally work together.

2.3 JCI as a Programme Linking Cognitive Science and HCI

The JCI sought to support research projects incorporating both Cognitive Science and human-computer interaction (HCI). Among the 27 projects we identified seven that we regarded as integrating Cognitive Science and HCI research (Bijl, Klein and Lee, Wann, Wood, Shadbolt and Reichgelt, Ritter and Bibby, Scrivener and Lansdale, Young and Howes, and Sommerville and Hughes).

These projects encompass a substantial range of both Cognitive Science and HCI domains: Bijl, Klein and Lee explored the role of graphical languages for user interfaces; Wann studied accommodation and vergence conflicts and other phenomena of visual perception for virtual reality displays; Wood *et al* studied instructional strategies for intelligent tutors employing multimedia, Ritter and Bibby modelled sequential aspects of learning with the Soar modelling architecture; Scrivener and Lansdale developed a theory of visual memory and demonstrated it through the development of an prototype visual database system; Young and Howes modelled the interaction of perception and learning in exploratory learning; Sommerville and Hughes developed an ethnography of the work activity of air traffic controllers, and investigated how to support this activity and the process of designing tools to support it using their ethnographic data.

The projects we found to be relatively more successful seemed to take HCI design more seriously, and to rest upon and creatively develop theory (or specific insights) from design work. For example, the Wann project and the Scrivener and Lansdale project developed novel theoretical refinements with direct and demonstrable design implications. The Sommerville and Hughes project exposed a variety of specific insights into the structure of the work activity they studied which present important guides to the design of tools to support the work.

To put this the other way round, we were disappointed by projects which did not take design *per se* seriously. An example is the Bijl, Klein and Lee project which did not identify a target user group or real application for their work (and still has not). We were also disappointed by projects which appeared to have difficulty linking their modelling work into a broader theoretical context. An example is the Ritter and Bibby project which appeared to be consumed by getting the Soar architecture to mimic various kinds of learning phenomena (e.g. getting Soar to 'reflect'), without sufficient attention to the significance of the work beyond the limitations of the Soar framework.

We found that the projects in this category paid a price for attempting to integrate Cognitive Science and HCI. Beyond all the normal difficulties of organising a research project they had to manage relationships with user groups and/or industrial partners. The Scrivener and Lansdale project had substantial

difficulties in getting access to appropriate industrial sites. The success of the Sommerville and Hughes project depended greatly on pre-existing relations with the air traffic control site they studied.

3.0 The Initiative as a Whole

We now consider the implications of what we learned about the individual projects for the JCI as a programme, leading on to recommendations about the future support of research in the areas addressed by JCI. Our discussion includes consideration of the actual and potential contributions of work in these areas, as well as the current, post-JCI, conditions for such work.

3.1 Inter-disciplinarity

It is inevitable that, as knowledge advances, acquiring new knowledge will require investigation of areas that have not previously been recognised as falling within any established discipline. The JCI delivered new results and fostered interdisciplinary collaborations across and within institutions across a wide range of disciplines including psychology, neuroscience, computational modelling and simulation, computer science and artificial intelligence, sociology and linguistics. The panel found on the basis of the final reports, the publications and the testimony of the presenters that many of these interactions and collaborations would not have occurred, or would have been reduced in extent, if the JCI had not occurred. (Not surprisingly, however, most liaisons of this kind were based on prior contact.)

3.1.1 Support for Interdisciplinary Research Post-JCI

Many but not all of the presenters voiced concerns for the future funding of interdisciplinary research. Interestingly, not all of those who believed that their JCI research had crucially depended on its interdisciplinary goals voiced concern for future funding of similar work. This may suggest that there has been a change in the attitude of the individual Councils over the lifetime of the Initiative in certain areas, particularly those directly related to neuroscience, software engineering, and human factors. The panel noted that the ESRC and EPSRC have recently announced or are about to announce Initiatives in some of these areas, and regarded this as evidence of the success of the JCI.

Nevertheless, many of the presenters reported a return since the end of JCI funding to seeing interdisciplinary proposals shunted around the Research Councils. The panel saw a continuing need for increased attention to the problems of ensuring that excellent interdisciplinary proposals attain funding.

3.2 Cognitive Science

Although some of the Cognitive Science projects that we saw made a clear attempt to combine Cognitive Science and HCI projects, the majority of the work was focused on what might be called basic Cognitive Science. This, in our opinion, is not necessarily a negative, but rather a natural outgrowth of the breadth of the field. Many, but not all, of the projects were viewed as outstanding pieces of work.

In particular, the work by Stenning, Lee and Oberlander on their SIGNAL project, the Willshaw, Hallam and McMichael work on designing systems of coupled networks, the Altman, Garnham and Dienes work on parsing and computational psycholinguistics and the Shallice, Greer and Fox work on cognitive theorising were, we believe, particularly interesting and important pieces of Cognitive Science and have made a substantial contribution to the field. It is also very likely that they would not have been funded without the project, due to the fundamentally interdisciplinary character of Cognitive Science.

3.2.1 Cognitive Science Post-JCI

It seems very likely that the future of Cognitive Science is a general broadening of the field which will most likely require another interdisciplinary programme. As mentioned earlier, we expect that there will be an increased need for broad funding including more emphasis in computational neuroscience and the connection between computational neuroscience and Cognitive Science broadly.

Among the issues that we observed was that after the project ended, it has become increasingly difficult for researchers to return to the narrow constraints of their original field. Many departments seem to feel that these highly interdisciplinary projects are not relevant to the core of their field. As a result, some of the researchers appear to be having some difficulty relocating in their home discipline. Although, there may be nothing that we can do to change the attitudes of the departments, we imagine that additional funding would help provide the rationale for this interdisciplinary work and the departments would be more open if further funding were to be made available.

3.3 HCI

HCI can best be regarded as a field of engineering science, directed towards enabling the designers of interactive systems to produce systems that provide effective support to human activity. There is also a graphics-design aspect of HCI which has not figured in the JCI to any significant degree. HCI's importance lies in the vast and still growing range of human activities that computer systems support; in the circumstances, failure in the design of interactive systems can and frequently does have disastrous consequences. On the positive side, designing with adequate attention to the human user can make all the difference between commercial failure and success.

Advances in HCI can take a number of forms

- Improved analytical models. These can assist designers in analysing proposed interactive systems more thoroughly in the course of design
- Improved design tools. These can be of use to designers for analysis, specification, prototyping
- Improvements on existing designs. Research can lead to new solutions offering better performance, added functionality or reduced cost
- Novel designs that solve hitherto unsolved design problems

We would expect to see advances of these kinds emerging in response to the JCI's concern with its second main objective, the application of advances in Cognitive Science to the design of systems involving human-computer interaction. Our overall assessment is, however, that the JCI funded relatively few projects in this area. Out of the 27 projects we reviewed, half a dozen or less were oriented specifically towards advancing design. This ratio appears to apply across the rest of the JCI-funded projects.

While the HCI projects we reviewed were performed to a reasonably high standard, there was some variability in their attention to achieving actual advances; more attention seemed to be directed towards the scientific content of the work. Thus the projects that focused on developing enhanced analytical models did not, as a rule, attempt to make these usable by designers; one exception was the ERMIA work. New designs were not, typically, related back to previous designs, and so opportunities to make comparisons were lost. From an HCI design perspective, therefore, the tangible results have been disappointing.

There are several possible reasons why HCI-oriented projects have turned out this way. First, the JCI's emphasis on developing and applying Cognitive Science may have influenced the planning of individual projects, causing them to apply a similar emphasis in their work. Second, it appears that the JCI may not have been explicit about the generation of results of the kind mentioned above, or given it enough priority.

3.3.1 HCI Post-JCI

For the reasons given earlier we would recommend giving high priority to HCI research and to the development of related engineering science. In the uni-disciplinary funding situation prevailing today, it would appear hard for researchers to gain funding for this kind of research. The EPSRC's programme in CSCW has helped, but this is now winding down.

A possible solution now lies in the passing of the JCI's HCI remit to the EPSRC, which has recently been formulating a Human Factors research programme. No details of this programme are yet publicly available, so we cannot comment on whether it can meet the need for support of engineering science research in HCI.

It is clear, however, that a large number of projects view the EPSRC's Human Factors programme as their best hope of gaining funding in the future. Indeed it seems inevitable that any proposal for government-funded work in the HCI area will find its way to the Human Factors programme, since other programmes will quite rightly claim that it is no longer their responsibility to fund such work.

The suggestion has been made that other EPSRC programmes should recognise the importance of human concerns in their areas. For example, research into integrated manufacturing will often involve the role of human operators, and this should be dealt with properly. Applicants who ignore essential human concerns should, we think, be asked to resubmit. We think such a policy would be beneficial to the EPSRC programmes concerned.

3.4 Linking HCI and Cognitive Science

The root goal of the JCI was to exploit and develop Cognitive Science as the scientific foundation for human-computer interaction. This goal was pursued under the assumption that high-quality Cognitive Science research would *ipso facto* contribute to the development of a science-base that would directly enable better HCI applications. While some projects within the JCI made direct substantive and methodological contributions to Cognitive Science set in HCI task contexts, most addressed the root goal by pursuing relatively basic Cognitive Science research in relatively non-specific task contexts.

The mapping between HCI and Cognitive Science is in fact quite complex. In general, HCI research needs to develop in specific contexts and with the direct participation of researchers and practitioners throughout the process of development. HCI research ideas need to be consistent with tool and environmental support, to be coordinated with system development practices, and so forth. The paradigm of refining a scientific insight in a separate, basic research context, and then 'transferring' it to application is in general not effective. This has limited the direct impact of Cognitive Science on HCI practice in the past.

Very few JCI projects were carried out in realistic HCI task contexts. Some project presenters explicitly took the view that their JCI work would need to mature within research contexts, and later be handed off to practitioners (e.g. Stenning). Others had no interest in HCI applications, more or less implicitly assuming that high-quality, basic research would find its application in time (e.g. Willshaw-Hallam, Chater, Johnston-Buxton). Others developed HCI prototypes as a vehicle for exploring and evaluating Cognitive Science ideas, but did not take seriously this exploration and evaluation as part of the research process (e.g. Bornat, O'Shea and Reeves). The direct impact of the JCI on the HCI science-base was limited as a result.

Nevertheless, the JCI had considerable value in helping to explicate the relation of Cognitive Science to HCI. When the Initiative was launched in 1989, the understanding of this relation was poor, and much of what may appear

retrospectively as naive, was appropriate proaction at the time. Moreover, some of the JCI projects articulated and investigated specific potential relationships between Cognitive Science and HCI, helping to form the current understanding of this relationship (especially the projects of Young and Howes, Long *et al*, Green *et al*, and Hughes and Sommerville).

A reciprocal possibility for potential interdisciplinary impact is the benefit that empirical investigations and theoretical developments within Cognitive Science might derive from being originated in or scaled to HCI tasks contexts. For example, the projects of Sommerville and Hughes seem to benefit sociology itself, quite apart from the value to HCI of sociological analyses of work activity. Young and Howes's efforts to integratively model learning and performance, Wann's work on perception in virtual reality systems, and Scrivener and Lansdale's work on visual memory are similar cases in which working in the HCI domain pushed the research agenda of basic Cognitive Science in what proved to be productive directions.

In the post-JCI period, there is a risk that the interdisciplinary development of Cognitive Science and HCI will not be pursued with as much scope as before. Most HCI research and development is carried out with little systematic consideration of Cognitive Science, and conversely. Without the guidance of multiple Councils, it seems quite likely that progress toward the root goal of the JCI will slide backwards. A good example of research activity that could be 'lost' in this event is the Lansdale project. This is sound and important work both as Cognitive Science and as HCI, but required special effort to develop both aspects within in the scope of a single project. The JCI provided encouragement for that special effort, but it is not clear that a single Council could do so.

Indeed, the narrow, disciplinary focus of current 5-year departmental research reviews in Britain, presents a serious threat to such interdisciplinary work. It may seem counterproductive to both encourage interdisciplinary work (as in the JCI) and at the same time to discourage it (through the 5-year reviews), but it would be even worse to only discourage it.

The root goal of the JCI is not inappropriate, indeed to the extent that there is a science foundation for HCI it almost certainly must originate within a broad conception of Cognitive Science. Future Initiatives need to pursue this root goal with more attention to the specific needs and nature of HCI. For example, they must more directly confront the processes of technology 'transfer' - or perhaps more accurately, technology development - from the outset. Access to realistic HCI practitioners and their contexts was not available to most JCI investigators. Yet continuous access is critical for the development of applicable Cognitive Science research.

3.5 Human Resources for Cognitive Science and HCI

Leading-edge research poses human-resources challenges. Research in areas of emerging importance often needs people with new combinations of skills and

knowledge. This is definitely true in HCI (because of the interplay of people and systems) and in Cognitive Science (because of the existence of distinct disciplinary perspectives on the same or closely related problems).

This requirement poses difficult problems in human resources which can limit progress in these areas. As we have seen, the JCI itself illustrates this: some projects had staffing difficulties attributable to the lack of people with prior interdisciplinary training, and career uncertainty contributed to staffing problems for JCI projects.

The JCI provided training and project experience for a cadre of young Cognitive Science and HCI researchers. While we have not been presented with explicit data on training in terms of numbers of RAs and graduate students funded by JCI, it s evident that the impact of JCI on training has been substantial. A research work-force trained first in the tactics of interdisciplinary research and second in computational applications of Cognitive Science in HCI is a tangible result of substantial lasting value from the Initiative, and can be expected to benefit the next twenty years of research in the field.

The JCI made some contribution to developing communication within a community of researchers. Better communication among established researchers, as well as properly-prepared young people, is a requirement for effective research in new areas. The JCI incorporated a number of elements addressing this need, including periodic meetings of grant holders, provision of a Coordinator for the Initiative, and summer schools for young people.

Presenters said they valued the grant holder meetings as a way to develop contacts within the community; some mentioned specifically that having these meetings open to non-participants made them more useful. On the other hand, no-one was extremely enthusiastic in this assessment. We think that the meetings were of some value but may not be very important.

The Coordinator's role was more appreciated by some presenters. Being familiar with work within and relevant to the Initiative she was helpful to some investigators in linking their work into the community.

We did not hear much about the summer schools, but the feeling was expressed that they had been effective in establishing communication among young people in the field.

3.5.1 Human Resources Post-JCI

After the JCI, the fate of the young cadre is uncertain. There are not established career paths for young interdisciplinary researchers, and many presenters expressed concern, often in very concrete terms, about what the future would hold for them. There are some bright spots, for example a young person trained originally in Computer Science and mathematics who has recently obtained a lectureship in a psychology department. But we also heard of bright former

physicist who was uncertain whether he would be able to pursue his new line of work in vision or would need to return to more traditional work in physics.

Part of the problem here, as we discuss elsewhere as well, is that funding for follow-on projects along the lines set by JCI projects is spotty. HCI researchers with close links to application feel they have good chances for funding through the new EPSRC Human Factors programme, but HCI researchers doing more fundamental work have dimmer prospects.The ESRC Cognitive Engineering programme provided support for some of these people, but it is not a continuing programme.

Cognitive Science workers outside applied HCI have an uncertain future. There are fears that Cognitive Science funding has returned to its pre-JCI footing, with problems of Cognitive Science projects falling between the core interests of the Research Councils.

Normal academic conservatism contributes to the career problems of the young cadre. There is a tendency to measure the value of new work only by its contribution to traditionally-established problems. This complaint was particularly common from those with appointments in psychology departments, who formed the majority overall.

The Research Assessment Exercise seems to be making matters worse by devaluing research published outside a narrow range of traditional outlets. Some presenters said that their work published in interdisciplinary journals was simply not counted in evaluating them, and that the Research Assessment Exercise criteria were encouraging this.

4.0 Recommendations

- The Councils should either jointly or singly continue to actively seek ways to ensure that interdisciplinary proposals of genuine merit do not fall by the wayside
- The Council should take a more active role in educating university academic administrators of their support for interdisciplinary research, and the need to recognise the value of this work to their institutions in terms of their expectations of research funding for those institutions
- Future interdisciplinary Initiatives should recognise the need for active modification of proposals in the direction of relevance to the goals of the Initiative. The procedures of NIH and its subdivisions in the US may provide a model. For example, the panel noted of the recent interdisciplinary NIH cross-institute Human Brain Project that very few proposals were funded in the first round of this ongoing Initiative, and that most projects funded in subsequent years have undergone at least one round of commentary and revision. UK budgeting procedures as applied

to the JCI may need to be modified to this end, particularly in respect of strict annualisation

- A selection process that provides feedback on initial submissions and routinely asks for revisions to submitted plans would be helpful in developing effective communication within the research community. Programme people can point out linkages among projects not known to the submitters, and strongly encourage proposers to explore them. The JCI Coordinator played this role to some extent, but it was apparently not linked to the selection process. This is more likely to be effective in promoting communication than simply bringing project personnel together for occasional meetings
- Thus far, emphasis has been placed on identifying research in Cognitive Science that could feed into HCI. More attention should, we think, be given to understanding what HCI actually needs in terms of supporting scientific research. This might indicate, for example, that more research is needed in sociology rather than in cognitive psychology. At present, a lot of funding (JCI excluded) goes into developing novel technologies. Pressure is brought to bear on researchers to find commercial outlets for these technologies. This is not the only way to gain benefit from HCI research, indeed it is probably the least effective
- A particular need is for increased understanding of applications, so that HCI research can draw on real-world data. The Hughes/Sommerville research illustrates the value that application-focused research can generate. Their proposals for a repository of field study materials should be taken seriously; it could be extended to cover case studies of system designs. In the meantime, it would be helpful if applicants were encouraged to draw on relevant field studies and to address known system deficiencies, especially where the objective is to develop an improved system design
- Councils and programmes should have a common policy for how to deal with HCI aspects of all application-related research projects. Methods for the design of user interfaces and interactive systems are now accessible to all applicants, and should be applied wherever human issues enter into research. Proposals that mention such issues should not be passed automatically to the EPSRC's Human Factors programme
- We believe that HCI research will be more effective if projects allocate appropriate amounts of effort to essential knowledge acquisition. In particular, any project with a system design component should ensure that the application is adequately understood. This will involve collaborations with user organisations and, in some cases, with suppliers. Consideration should be given to ways of making these collaborations attractive to partners, e.g. through payments, research seminars, etc.
- Methods of research now labelled 'interdisciplinary' need to be accepted as business as usual in many areas. For example, the use of computer models in vision science and neuroscience is already well accepted, and should be seen as a routine parts of such work not requiring special dispensation or specially targeted research support. Acceptance of these modes of working as normal will lead departments to value candidates who bring the

necessary skills. Mechanisms that now act to retard progress in this direction, in particular the Research Assessment Exercise, must be adjusted

- Support should be provided for work that develops cognitive approaches to education. HCI is not the only area of application for developments in Cognitive Science. Broadening work in Cognitive Science to support a Cognitive Engineering direction wider than HCI would provide greater career opportunity for people with interdisciplinary skills

Appendix 2

JCI Project List

Sorted by CSHCI Reference Number

Title Foundations for intelligent graphical interfaces

Grant Holders		
	Bijl	EdCAAD, Department of Architecture, University of Edinburgh
	Klein	Centre for Cognitive Studies, University of Edinburgh
	Lee(J)	EdCAAD, Department of Architecture, University of Edinburgh

CSHCI Ref. 94/09 **Grant Ref.** 8826213

Round Funded 1 **Cost** £ 147k **Duration** 36 months

Title Explanation facilities for PROLOG: Towards more versatile intelligent tutoring systems

Grant Holders		
	du Boulay	School of Cognitive and Computing Sciences, University of Sussex

CSHCI Ref. 94/10 **Grant Ref.** 8825737

Round Funded 1 **Cost** £ 123k **Duration** 24 months

Title Computer aided recognition of misconceptions about simple electrical circuits

Grant Holders		
	Howe	Department of Artificial Intelligence, University of Edinburgh
	Brna	Department of Artificial Intelligence, University of Edinburgh

CSHCI Ref. 94/11 **Grant Ref.** 8900097

Round Funded 1 **Cost** £ 89k **Duration** 36 months

Title A model of multiple activity control

Grant Holders		
	Long	Ergonomics Unit, University College London
	Whitefield	Ergonomics Unit, University College London

CSHCI Ref. 94/12 **Grant Ref.** 8825634

Round Funded 1 **Cost** £ 139k **Duration** 36 months

Title Neural network architectures for control of eye and head movement

Grant Holders		
	Mayhew	AI Vision Research Unit, University of Sheffield
	Frisby	AI Vision Research Unit, University of Sheffield
	Dean	AI Vision Research Unit, University of Sheffield

CSHCI Ref. 94/13 **Grant Ref.** 8825592

Round Funded 1 **Cost** £ 134k **Duration** months

Title Planning and instruction

Grant Holders		
	Wood	Department of Psychology, University of Nottingham
	Shadbolt	Department of Psychology, University of Nottingham
	Reichgelt	Department of Psychology, University of Nottingham

CSHCI Ref. 94/14 **Grant Ref.** 8826298

Round Funded 1 **Cost** £ 146k **Duration** 36 months

Title Cognitive architecture for integrated models of the user

Grant Holders		
	Young(R)	MRC Applied Psychology Unit, Cambridge

CSHCI Ref. 94/15 **Grant Ref.** E304/144

Round Funded 1 **Cost** £ 105k **Duration** 36 months

Title Parsing in context: computational and psycholinguistic approaches to resolving ambiguity during sentence processing

Grant Holders		
	Altmann	Department of Experimental Psychology, University of Sussex
	Garnham	Department of Experimental Psychology, University of Sussex

CSHCI Ref. 94/16 **Grant Ref.** 8920151

Round Funded 2 **Cost** £ 117k **Duration** 36 months

Title Integrated symbolic and sub-symbolic modelling

Grant Holders		
	Barrow	School of Cognitive and Computing Sciences, University of Sussex
	Thornton	School of Cognitive and Computing Sciences, University of Sussex

CSHCI Ref. 94/17 **Grant Ref.** 8920679

Round Funded 2 **Cost** £ 131k **Duration** 24 months

Title Structure of drawing for picture oriented HCI

Grant Holders		
	Bijl	EdCAAD, Department of Architecture, University of Edinburgh
	Zeevat	Centre for Cognitive Studies, University of Edinburgh
	Lee(J)	EdCAAD, Department of Architecture, University of Edinburgh

CSHCI Ref. 94/18 **Grant Ref.** 8919793

Round Funded 2 **Cost** £ 125k **Duration** 36 months

Title A multidisciplinary exploration of the problem of joint action

Grant Holders

Clarke	Department of Psychology, University of Nottingham
Bowers	Department of Psychology, University of Manchester

CSHCI Ref. 94/19 **Grant Ref.** 8917838

Round Funded 2 **Cost** £28k **Duration** 24 months

Title Lexical segmentation of realistically imperfect speech

Grant Holders

Cutler	Max Planck Institute, Holland
Briscoe	MRC Applied Psychology Unit, Cambridge
Norris	MRC Applied Psychology Unit, Cambridge

CSHCI Ref. 94/20 **Grant Ref.** E304/148

Round Funded 2 **Cost** £61k **Duration** 36 months

Title Knowledge based systems for scientific enquiry: requirements for design

Grant Holders

Edmonds	LUTCHI Research Centre, Loughborough University of Technology
O'Brien	LUTCHI Research Centre, Loughborough University of Technology

CSHCI Ref. 94/21 **Grant Ref.** 8920394

Round Funded 2 **Cost** £186k **Duration** 36 months

Title User-centred visualisation and navigation in parallel logic programming

Grant Holders

Eisenstadt	Human Cognition Research Lab., Open University, Milton Keynes

CSHCI Ref. 94/22 **Grant Ref.** 8920168

Round Funded 2 **Cost** £77k **Duration** 36 months

Title The organisation of human-computer interaction

Grant Holders

Heath	Department of Social Science, University of Surrey
Anderson	Rank Xerox EuroPARC, Cambridge
Moran	Rank Xerox EuroPARC, Cambridge

CSHCI Ref. 94/23 **Grant Ref.** 8918570

Round Funded 2 **Cost** £44k **Duration** 24 months

Title Interactive generative organisational frame of reference

Grant Holders Humphreys(P) Department of Social Psychology, London School of Economics, London

CSHCI Ref. 94/24 **Grant Ref.** 8920539

Round Funded 2 **Cost** £ 86k **Duration** 24 months

Title A computational investigation of natural surface reflectance

Grant Holders Morgan Department of Pharmacology, University of Edinburgh
Wallace Department of Mathematics, University of Edinburgh
Milton Department of Geography, University of Southampton

CSHCI Ref. 94/25 **Grant Ref.** 8920590

Round Funded 2 **Cost** £ 56k **Duration** 36 months

Title The development of cognitive model for computer support of collaborative writing

Grant Holders Sharples School of Cognitive and Computing Sciences, University of Sussex

CSHCI Ref. 94/26 **Grant Ref.** 8919574

Round Funded 2 **Cost** £ 102k **Duration** 24 months

Title The human observation and control of automated design

Grant Holders Spence Department of Electrical Engineering, Imperial College, London

CSHCI Ref. 94/27 **Grant Ref.** 9019856

Round Funded SG **Cost** £ 19k **Duration** 9 months

Title Neural nets perception association: clues for the hippocampus

Grant Holders Aleksander Department of Electrical Engineering, Imperial College, London

CSHCI Ref. 94/28 **Grant Ref.** 9016934

Round Funded SG **Cost** £ 19k **Duration** 12 months

Title A pilot study of consistency: state display conformance

Grant Holders

Harrison	Department of Computer Science, University of York
Monk	Department of Psychology, University of York

CSHCI Ref. 94/29 **Grant Ref.** 9105050

Round Funded SG **Cost** £ 17k **Duration** 10 months

Title Applying and extending a common computational framework for cognitive science and HCI

Grant Holders

Willshaw	Centre for Cognitive Studies, University of Edinburgh
Stenning	HCRC, University of Edinburgh
Foster	Centre for Cognitive Studies, University of Edinburgh

CSHCI Ref. 94/30 **Grant Ref.** 9104276

Round Funded SG **Cost** £ 20k **Duration** 10 months

Title Perceptual categorisation: sub-symbolic invariant feature recognition and classification

Grant Holders

Lee(M)	Department of Computer Science, University of Wales

CSHCI Ref. 94/31 **Grant Ref.** 9118512

Round Funded SG **Cost** £ 17k **Duration** 12 months

Title Representation of organisational knowledge for requirements analysis and specification using cognitive mapping

Grant Holders

Jones(M)	Management Studies Group, Dept. of Engineering, Uni. of Cambridge
Eden	Dept. of Mgmt. Science, Strathclyde Bus. School, Uni. of Strathclyde

CSHCI Ref. 94/32 **Grant Ref.** 9019194

Round Funded 5 **Cost** £ 36k **Duration** 24 months

Title Psychological inference by psychological simulation

Grant Holders

Pratt	Department of Computer Science, University of Manchester
Leudar	Department of Psychology, University of Manchester

CSHCI Ref. 94/33 **Grant Ref.** 8920254

Round Funded 2 **Cost** £ 62k **Duration** 36 months

Title Social analysis of control systems for HCI design

Grant Holders

Sommerville	Department of Computing, University of Lancaster
Hughes	Department of Sociology, University of Lancaster

CSHCI Ref. 95/04 **Grant Ref.** 8931598

Round Funded 4 **Cost** £ 181k **Duration** 36 months

Title The efficacy of 'good' interface design features under different conditions of learning

Grant Holders

Briggs	Department of Applied Social Science, University of Northumbria

CSHCI Ref. 95/05 **Grant Ref.** 8921258

Round Funded 2 **Cost** £ 61k **Duration** 36 months

Title Masking and temporal integration in face recognition

Grant Holders

Craw	Department of Mathematical Sciences, University of Aberdeen
Ellis	Department of Psychology, University of Wales, College of Cardiff
Shepherd	Department of Psychology, University of Aberdeen

CSHCI Ref. 95/06 **Grant Ref.** 9002054

Round Funded 5 **Cost** £ 57k **Duration** 24 months

Title Designing knowledge from natural science experiments

Grant Holders

Gooding	Science Studies Centre, School of Social Sciences, University of Bath
Addis	Dept. of Comp. Science, School of Eng. and Info. Sci., Uni. of Reading

CSHCI Ref. 95/07 **Grant Ref.** 9107137

Round Funded 6 **Cost** £ 143k **Duration** 26 months

Title Formalisation of SOAR and other models of cognition using executable specifications

Grant Holders

Shallice	Department of Psychology, University College London
Greer	Department of Psychology, University College London
Fox	Biomedical Computing Unit, Imperial Cancer Research Fund, London

CSHCI Ref. 95/08 **Grant Ref.** 8920199

Round Funded 2 **Cost** £ 122k **Duration** 36 months

Title Computational and psychophysical studies of biological motion analysis

Grant Holders		
	Johnston	Department of Psychology, University College London
	Buxton	School of Cognitive and Computing Sciences, University of Sussex

CSHCI Ref. 95/09 **Grant Ref.** 8919938

Round Funded 2 **Cost** £92k **Duration** 36 months

Title A distributed artificial intelligence based investigation into the emergence of social complexity

Grant Holders		
	Doran	Department of Computer Science, University of Essex
	Gilbert	Department of Sociology, University of Surrey
	Mellars	Department of Archaeology, University of Cambridge

CSHCI Ref. 95/10 **Grant Ref.** 8930879

Round Funded 3 **Cost** £81k **Duration** 36 months

Title Testing a theory of belief revision: human-computer collaboration for information retrieval

Grant Holders		
	Sparck Jones	Computer Laboratory, University of Cambridge
	Galliers	Computer Laboratory, University of Cambridge

CSHCI Ref. 95/11 **Grant Ref.** 8930752

Round Funded 3 **Cost** £107k **Duration** 36 months

Title Mental and qualitative (AI) models of cardiac electrophysiology: a study in comparative cognitive science

Grant Holders		
	Gilhooly	Department of Psychology, University of Aberdeen
	Hunter	Department of Computing, University of Aberdeen
	Rawles	Department of Medicine, University of Aberdeen

CSHCI Ref. 95/12 **Grant Ref.** 8917814

Round Funded 2 **Cost** £72k **Duration** 24 months

Title The cognitive browser: a user interface for the SOLVE system

Grant Holders		
	Green(T)	MRC Applied Psychology Unit, Cambridge
	Gilmore	Department of Psychology, University of Nottingham
	Winder	Department of Computer Science, University College London

CSHCI Ref. 95/13 **Grant Ref.** 8931094

Round Funded 3 **Cost** £200k **Duration** 36 months

Title Multi-level input in neurocomputational systems: computational and psychological investigations

Grant Holders		
	Jordan	Department of Psychology, St. Andrews University
	Smith	Department of Computing Science, University of Stirling
	Phillips	Department of Psychology, University of Stirling

CSHCI Ref. 95/14 **Grant Ref.** 8931914

Round Funded 4 **Cost** £ 143k **Duration** 36 months

Title Computational theory of the hippocampus

Grant Holders		
	O'Keefe	Department of Anatomy and Developmental Biology, University
	Reece	Department of Computer Science, University College London

CSHCI Ref. 95/15 **Grant Ref.** 9113850

Round Funded 6 **Cost** £ 66k **Duration** 24 months

Title Synchronisation in neural networks and attention approaches using synchronous concurrent algorithms

Grant Holders		
	Holden	Department of Physiology, University of Leeds
	Tucker	Dept. of Mathematics and Computer Science, Uni. College of Swansea
	Thompson	Dept. of Mathematics and Computer Science, Uni. College of Swansea

CSHCI Ref. 95/16 **Grant Ref.** 9017859

Round Funded 5 **Cost** £ 80k **Duration** 39 months

Title Learning to discriminate and classify colour and shape

Grant Holders		
	Hurlbert	Department of Physiological Sciences, University of Newcastle
	Parker	Department of Physiology, Oxford University

CSHCI Ref. 95/18 **Grant Ref.** 9030578

Round Funded 6 **Cost** £ 41k **Duration** 36 months

Title The use of an electronic information source in the medical environment: search strategies and medical comprehension

Grant Holders		
	Jones(R)	Department of Chemical Pathology, University of Leeds
	Howes(M)	Department of Psychology, University of Leeds
	Ward	Department of Anatomy, University of Leeds

CSHCI Ref. 95/19 **Grant Ref.** 9021619

Round Funded SG **Cost** £ 18k **Duration** 12 months

Title Entity relationship modelling for information artefacts (ERMIA)

Grant Holders		
	Benyon	Department of Computing, The Open University, Milton Keynes
	Green(T)	MRC Applied Psychology Unit, Cambridge
	Petre	Institute of Educational Technology, Open University, Milton Keynes

CSHCI Ref. 96/05 **Grant Ref.** 9214513

Round Funded 9 **Cost** £91k **Duration** 24 months

Title Cognitive skills in formal reasoning about programs

Grant Holders		
	Bornat	Department of Computer Science, QMW, University of London
	O'Shea	IET, The Open University, Milton Keynes
	Reeves	IET, The Open University, Milton Keynes

CSHCI Ref. 96/06 **Grant Ref.** 9019558

Round Funded 5 **Cost** £171k **Duration** 36 months

Title Double dissociation in distributed systems: non-linear dynamics of recurrent neural networks

Grant Holders		
	Chater	Department of Psychology, University of Edinburgh

CSHCI Ref. 96/07 **Grant Ref.** 9029590

Round Funded 6 **Cost** £69k **Duration** 36 months

Title Music performance and representation of musical knowledge

Grant Holders		
	Clarke	Music Department, City University, London

CSHCI Ref. 96/08 **Grant Ref.** 9018013

Round Funded 5 **Cost** £92k **Duration** 36 months

Title Multiple task learning in PDP systems and models of implicit learning in humans

Grant Holders		
	Dienes	Department of Experimental Psychology, University of Sussex
	Altmann	Department of Experimental Psychology, University of Sussex

CSHCI Ref. 96/09 **Grant Ref.** 9110957

Round Funded 7 **Cost** £110k **Duration** 36 months

Title Algorithm visualisation techniques. Integrating automatic algorithm animation and graphical tracing

Grant Holders

Eisenstadt	Human Cognition Research Lab., Open University, Milton Keynes

CSHCI Ref. 96/10 **Grant Ref.** 9018876

Round Funded 5 **Cost** £105k **Duration** 36 months

Title Computational modelling of aspects of human speech perception

Grant Holders

Faulkner	Department of Phonetics and Linguistics, University College London
Huckvale	Department of Phonetics and Linguistics, University College London
Rosen	Department of Phonetics and Linguistics, University College London

CSHCI Ref. 96/11 **Grant Ref.** 8920412

Round Funded 3 **Cost** £89k **Duration** 36 months

Title Social knowledge representation: an anthropological perspective

Grant Holders

Finkelstein	Department of Computing, Imperial College, London
Fischer	Department of Social Anthropology, University of Kent

CSHCI Ref. 96/12 **Grant Ref.** 8920754

Round Funded 2 **Cost** £82k **Duration** 36 months

Title Temporal aspects of usability

Grant Holders

England	Department of Computing Science, University of Glasgow
Draper	Department of Psychology, University of Glasgow
Gray	Department of Computing Science, University of Glasgow
O'Donnell	Department of Psychology, University of Glasgow

CSHCI Ref. 96/13 **Grant Ref.** 9201233

Round Funded 8 **Cost** £100k **Duration** 36 months

Title Cognitive science investigation into the auditory speech sketch: 'mapping the auditory scene'

Grant Holders

Green(P)	Department of Computer Science, University of Sheffield
Williams	Department of Computer Science, University of Sheffield
Nicholson	Department of Psychology, University of Sheffield

CSHCI Ref. 96/14 **Grant Ref.** 8921799

Round Funded 3 **Cost** £177k **Duration** 36 months

Title Action selection by dynamic neural system: a tool for programming robots

Grant Holders		
	Hallam	Department of Artificial Intelligence, University of Edinburgh
	Hayes	Department of Artificial Intelligence, University of Edinburgh
	Willshaw	Centre for Cognitive Studies, University of Edinburgh

CSHCI Ref. 96/15 **Grant Ref.** 9213053

Round Funded 9 **Cost** £ 190k **Duration** 27 months

Title Serial order from parallel systems

Grant Holders		
	Harley	Department of Psychology, University of Warwick
	Jones(G)	Department of Psychology, University of Warwick
	Dunbar	Department of Psychology, University of Warwick

CSHCI Ref. 96/16 **Grant Ref.** 9018232

Round Funded 5 **Cost** £ 67k **Duration** 36 months

Title Representation and control of serial order in linguistic output systems

Grant Holders		
	Houghton	Department of Psychology, University College London
	Shallice	Department of Psychology, University College London

CSHCI Ref. 96/17 **Grant Ref.** 9200174

Round Funded 8 **Cost** £ 87k **Duration** 36 months

Title A connectionist model of the development of visual word recognition

Grant Holders		
	Hulme	Department of Psychology, University of York
	Allinson	Department of Electronics, University of York
	Snowling	National hospital College of Speech Sciences, London

CSHCI Ref. 96/18 **Grant Ref.** 8920217

Round Funded 2 **Cost** £ 140k **Duration** 36 months

Title Temporal image segmentation

Grant Holders		
	Humphreys(G)	School of Psychology, University of Birmingham
	Beale	Department of Computer Science, University of Birmingham
	Muller	Department of Psychology, Birbeck College, London

CSHCI Ref. 96/19 **Grant Ref.** 9217277

Round Funded 9 **Cost** £ 103k **Duration** 36 months

Title Real-time language generation and task-oriented dialogue

Grant Holders	Isard	HCRC, University of Edinburgh

CSHCI Ref. 96/20 **Grant Ref.** 9111013

Round Funded 6 **Cost** £ 143k **Duration** 36 months

Title Visual control of steering

Grant Holders	Lee(D)	Department of Psychology, University of Edinburgh
	Wann	Department of Psychology, University of Edinburgh
	Young(D)	School of Cognitive and Computing Sciences, University of Sussex
	Land	School of Biological Sciences, University of Sussex

CSHCI Ref. 96/21 **Grant Ref.** 9212693

Round Funded 9 **Cost** £ 217k **Duration** 36 months

Title Cognitive modelling and the design of artificially intelligent systems

Grant Holders	Lee(M)	Department of Computer Science, University College of Wales
	McGonigle	Department of Psychology, University of Edinburgh

CSHCI Ref. 96/22 **Grant Ref.** 9110835

Round Funded 6 **Cost** £ 163k **Duration** 36 months

Title New tools for modelling memory processes

Grant Holders	Levy	HCRC, University of Edinburgh
	Bairaktaris	HCRC, University of Edinburgh
	Stenning	HCRC, University of Edinburgh

CSHCI Ref. 96/23 **Grant Ref.** 9200496

Round Funded 8 **Cost** £ 89k **Duration** 24 months

Title Unification based models of lexical access and incremental interpretation

Grant Holders	Marslen-Wilson	Department of Psychology, Birbeck College, London
	Pulman	Computer Laboratory, University of Cambridge
	Tyler	Department of Psychology, Birbeck College, London

CSHCI Ref. 96/24 **Grant Ref.** 8931677

Round Funded 3 **Cost** £ 160k **Duration** 36 months

Title A psychologically relevant model of belief

Grant Holders

Mellish	Department of Artificial Intelligence, University of Edinburgh
Carletta	HCRC, University of Edinburgh
Stenning	HCRC, University of Edinburgh

CSHCI Ref. 96/25 **Grant Ref.** 9200319

Round Funded 8 **Cost** £127k **Duration** 36 months

Title Configuration of video links as an adjunct to shared tools

Grant Holders

Monk	Department of Psychology, University of York

CSHCI Ref. 96/26 **Grant Ref.** 9200095

Round Funded 8 **Cost** £109k **Duration** 36 months

Title Connectionist modelling of short-term memory

Grant Holders

Norris	MRC Applied Psychology Unit, Cambridge
Baddeley	MRC Applied Psychology Unit, Cambridge

CSHCI Ref. 96/27 **Grant Ref.** E304/187

Round Funded 8 **Cost** £79k **Duration** 36 months

Title Computational modelling of the development of mental models in interaction devices

Grant Holders

Ritter	Department of Psychology, University of Nottingham
Bibby	Department of Psychology, University of Nottingham

CSHCI Ref. 96/28 **Grant Ref.** 9018736

Round Funded 5 **Cost** £152k **Duration** 36 months

Title Improving system design through use of creativity techniques

Grant Holders

Roberts	Manchester Business School, University of Manchester
Rickards	Manchester Business School, University of Manchester
Pearson	Manchester Business School, University of Manchester

CSHCI Ref. 96/29 **Grant Ref.** 9202870

Round Funded 8 **Cost** £150k **Duration** 24 months

Title The construction and evaluation of PROLOG techniques editor

Grant Holders		
	Robertson	Department of Artificial Intelligence, University of Edinburgh
	Pain	Department of Artificial Intelligence, University of Edinburgh
	Brna	Department of Artificial Intelligence, University of Edinburgh
	Ormerod	Dept. of Human Sciences, Loughborough University of Technology
	Kahney	Department of Psychology, The Open University, Milton Keynes

CSHCI Ref. 96/30 **Grant Ref.** 9030396

Round Funded 6 **Cost** £ 153k **Duration** 36 months

Title Signal processing and modelling techniques for biological neural networks with application to neural computing

Grant Holders		
	Rosenberg	Department of Physiology, University of Glasgow
	Murray-Smith	Dept. of Electronics and Electrical Engineering, University of Glasgow
	Whitehead	Department of Astronomy and Physics, University of Glasgow

CSHCI Ref. 96/31 **Grant Ref.** 9019054

Round Funded 5 **Cost** £ 156k **Duration** 60 months

Title Searching pictorial databases by visiospatial depictions

Grant Holders		
	Scrivener	LUTCHI Research Centre, Loughborough University of Technology
	Lansdale	CERG, Dept. of Human Sciences, Loughborough Uni. of Technology

CSHCI Ref. 96/32 **Grant Ref.** 9200538

Round Funded 8 **Cost** £ 213k **Duration** 36 months

Title Student modelling in intelligent learning environments

Grant Holders		
	Self	Department of Computing, University of Lancaster
	Hartley	School of Education, University of Leeds
	Dillenbourg	Department of Psychology and Education, University of Geneva

CSHCI Ref. 96/33 **Grant Ref.** 9111130

Round Funded 6 **Cost** £ 90k **Duration** 36 months

Title Formal methods for norm-governed regulation of human-computer interaction

Grant Holders		
	Sergot	Department of Computing, Imperial College, London

CSHCI Ref. 96/34 **Grant Ref.** 9212036

Round Funded 9 **Cost** £ 292k **Duration** 36 months

Title An executable specification language for cognitive theorising: user modelling and hybrid models

Grant Holders

Shallice	Department of Psychology, University College London
Fox	Biomedical Computing Unit, Imperial Cancer Research Fund, London

CSHCI Ref. 96/35 **Grant Ref.** 9212530

Round Funded 9 **Cost** £ 192k **Duration** 36 months

Title Short-term memory mechanisms for processing verbal sequences: psychological experiments and connectionist modelling

Grant Holders

Shapiro	Department of Computer Science, University of Manchester
Hitch	Department of Psychology, University of Lancaster

CSHCI Ref. 96/36 **Grant Ref.** 9212292

Round Funded 9 **Cost** £ 194k **Duration** 36 months

Title The attention and affect project

Grant Holders

Sloman	School of Computer Science, University of Birmingham
Humphreys(G)	School of Psychology, University of Birmingham

CSHCI Ref. 96/37 **Grant Ref.** 9200393

Round Funded 8 **Cost** £ 51k **Duration** 36 months

Title Computer support for collaborating in the system design process

Grant Holders

Sommerville	Department of Computing, University of Lancaster
Hughes	Department of Sociology, University of Lancaster

CSHCI Ref. 96/38 **Grant Ref.** 9018712

Round Funded 5 **Cost** £ 174k **Duration** 36 months

Title SIGNAL: Specificity of information and graphics and natural languages

Grant Holders

Stenning	HCRC, University of Edinburgh
Lee(J)	EdCAAD, Department of Architecture, University of Edinburgh
Oberlander	HCRC, University of Edinburgh

CSHCI Ref. 96/39 **Grant Ref.** 9018050

Round Funded 6 **Cost** £ 176k **Duration** 36 months

Title Modelling high order receptive fields using an artificial neural network

Grant Holders		
	Stone	School of Cognitive and Computing Sciences, University of Sussex
	Collett	Department of Biological Sciences, University of Sussex
	Willshaw	Centre for Cognitive Studies, University of Edinburgh

CSHCI Ref. 96/40 **Grant Ref.** 9200332

Round Funded 8 **Cost** £131k **Duration** 36 months

Title Principles for perception and action in virtual realities

Grant Holders		
	Wann	Department of Psychology, University of Edinburgh

CSHCI Ref. 96/41 **Grant Ref.** 9113691

Round Funded 6 **Cost** £97k **Duration** 36 months

Title Post-lexical and prosodic phonological processing

Grant Holders		
	Warren	Department of Linguistics, University of Cambridge
	Nolan	Department of Linguistics, University of Cambridge
	Briscoe	Computer Laboratory, University of Cambridge

CSHCI Ref. 96/42 **Grant Ref.** 9030657

Round Funded 6 **Cost** £135k **Duration** 36 months

Title Designing systems of coupled neural networks

Grant Holders		
	Willshaw	Centre for Cognitive Studies, University of Edinburgh
	Hallam	Department of Artificial Intelligence, University of Edinburgh
	McMichael	Department of Electrical Engineering, University of Manchester

CSHCI Ref. 96/43 **Grant Ref.** 9213375

Round Funded 9 **Cost** £195k **Duration** 36 months

Title Towards an integrated model of learning and performance in HCI

Grant Holders		
	Young(R)	MRC Applied Psychology Unit, Cambridge
	Howes(A)	Department of Psychology, University College Cardiff

CSHCI Ref. 96/44 **Grant Ref.** E304/186

Round Funded 8 **Cost** £127k **Duration** 36 months

Appendix 3

Exit Interview Checklist

JCI Evaluation Exit Interview Checklist

1 Background

- **Project description** Objectives? Goals?
- **Origin and history of project** How did the idea come up? Who was involved? How were they identified? Did it involve people from different disciplines? A move out of the interviewee's area? Why was the Initiative chosen as a source of funding?
- **Position within the Initiative** Are there any connections between this project and others in the Initiative?
- **Position of the project within the department/institution** Other projects, grants etc.? Significance in terms of departmental project portfolio? How did the project develop? Where it will lead? Is there any nearer-market research within the department for which it might have significance?

2 Project Management and Organisation

- **Project management** How was the work divided? Between individuals, departments, institutions etc.?
- **Inter-disciplinary nature of Initiative** Was the project in any sense inter-disciplinary? What problems and opportunities came up as a result of inter-disciplinarity?

3 Progress and Outputs

- **Progress** Current status of project? Have goals been achieved?
- **Outputs** Major outputs of the project? Were any unforeseen?
- **Success factors** What were the main success factors for the project?
- **Barriers** What were the main barriers to progress?

4 Impact on the Individual Researcher

- **Careers** What impact has involvement in the Initiative had on their career? The careers of others in their project? Has it caused them to alter course? Do they intend to go in different directions, or stay on the same paths?
- **Contacts** Have they made new research contacts since the start of the Initiative? Are they in the same or different areas?
- **Behaviour** Have they changed their publishing behaviour? Publishing in different journals? Writing papers with different people? Do they now attend different conferences? Has their grant application behaviour changed?

5 Impact on the Institution

- **Impact on the department/institution/local research community** What impact has having this project(s) had? Have different alliances, working patterns formed between individuals / departments / institutions?

6 Impact on the Research Community and Other Users

- **Research users** Who are the 'users' of this research? Who will read the papers and apply the results? Academics (which areas)? Industry?
- **Industrial implications** Are there any intended / unintended industrial implications (names of relevant industrial contacts)?
- **Research community** What is the significance of this project for the research community in this area? Potential impact on research directions? What is the significance of the Initiative for the research community in this area? Potential impact on research arena?

7 Significance/Appropriateness of the Initiative

- **Funding** How significant was the opportunity to obtain funding from the Initiative? Could funds have been obtained from elsewhere?
- **Programme aims of the Initiative** Were they valid? Are they still valid?
- **Inter-disciplinarity** Were they influenced by the original call for inter-disciplinarity? Have these links been created? Will they now remain in place? Was there any point in trying to set up these links? Was this the right model for building such links?
- **Research** Are they aware of other projects in the Initiative? Has it supported the right kind of research? Which areas should have been included? Which of their own areas of research should have been included? Were there any areas that should have been excluded? Which of their own research areas should have been excluded from the Initiative?

8 Opinion of the Administration and Committee

- **Coordinator** What is their opinion of the work of the Coordinator?
- **Tripartite structure** How has the tripartite Research Council structure affected them? What is their opinion of the tripartite structure?
- **Annual Conference** How useful has the Annual Conference been? For new contacts? For tracking the progress of research? As an introduction to new areas?
- **Improvements in the administrative structure**? How could the administration have been more effective and efficient?

9 Future Intentions

- **Future intentions** What do they intend to do in the future? Carry on with the work? Go in a different direction?
- **Follow-up initiatives** Have they / do they intend to apply? Are other initiatives the most appropriate way to extend the work of the JCI?

10 Training

- **Research Studentships** Have they had any interaction with the holders of JCI Research Studentships? Have these Students had any impact on their research / the department etc.?
- **Training Fellows** Have they had any interaction with JCI Training Fellows? Have these Fellows had any impact on their research / the department etc.?
- **PhDs, RAs** Have they been able to take on PhD students and Research Assistants to work and be trained on JCI projects? Has this been successful?
- **Training aspect of the Initiative** How successful has this been overall (including the summer schools)? Has it been a significant part of the Initiative?

11 Overall Opinion of the Initiative

- **Overall opinion of the Initiative** What have been the major successes / failures? What changes would they like to see?

Appendix 4

Exit Questionnaire and Survey Data

Self-assessment Questionnaire
for JCI Grantholders

The Evaluation of the Joint Council Initiative in Cognitive Science and Human-Computer Interaction

This questionnaire is part of an independent evaluation conducted for the Research Councils by Technopolis Ltd. and PREST, University of Manchester. Your co-operation in answering the questions is kindly requested. All individual answers and comments will be treated as strictly confidential and non-attributable. Please complete a separate questionnaire for each of the JCI projects in which you participated.

NAME OF PROJECT	
NAME OF RESPONDENT	
NAME OF ORGANISATION	
ADDRESS	
TEL/FAX	

Please return the completed questionnaire to Technopolis
in the pre-paid envelope.

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Section A Self-assessment based on the Rapporteur Comment Form

The main purpose of this Section is to elicit structured comments on your JCI project. This will help us in our appraisal of the programme as a whole.

For each project, you are requested to comment on a number of evaluation dimensions or issues. These span aspects such as the initial potential of the project; its relevance to programme aims; goal attainment; the soundness of project performance; the quality of the work conducted; and the impact of the project - on the people and teams involved, on the scientific community at large, and even impacts further downstream if applicable.

The dimensions used mirror those employed in a similar exercise conducted by the JCI Committee using UK-based rapporteurs. These rapporteurs were asked to review final project reports and to structure their responses under similar headings. Using the same categories in this self-assessment exercise will help us compare and contrast the results.

We are also asking you to score each project along the evaluation dimensions of interest. The aim here is not to conduct sophisticated analyses but to use simple quantitative techniques to make aggregate statements about the Initiative as a whole. Consequently, we have not attempted to break each evaluation issue (e.g. project performance) into a myriad of independent constituent elements (e.g. adequacy of resources, project organisation, management skills etc.), each of which needs to be separately scored and analysed. Rather, for each evaluation issue, we are asking you to consider all the separate factors which affect or colour the issue before arriving at a composite score along a simple 1-5 scale, with '1' representing 'low' and '5' high. A sixth box can be ticked if, for any reason, you are unable to provide a score.

For each issue, descriptive anchor statements are given for all points along the scale. Given the complexity of each issue, these invariably conflate many constituent elements. The descriptions are intended only as rough guides to help you arrive at composite scores for each evaluation dimension.

To answer some of the questions, you will need to bear in mind the aims of the Joint Council Initiative. The instructions sent by the JCI Committee to UK rapporteurs summarised the aims thus:

> *The Joint Council Initiative was set up with the broad aim of advancing multidisciplinary research leading to a better understanding of computational principles of cognition, and the application of these principles to the design of systems requiring human-computer interaction. The initiative was awarded £12m to spend over a period of five years. This included £2m to be directed towards training. The MRC acts as the administrating body for the JCI Committee and oversees the running and commissioning of the initiative. The focus of the work is on principles of intelligence, both natural and artificial, and implementation of such principles in engineering design. The aims can be summarised into four areas*
>
> - *To enhance the understanding of computational principles, i.e. design and implementation of working computer models. (There will be, however, some cases where fields important to the general aims may not have reached a stage where specific modelling is possible e.g. some aspects of social or organisational factors)*
> - *To establish a multidisciplinary programme. Although each individual project need not involve all disciplines (the programme as a whole will combine them), nevertheless a project within one discipline would need to be justified by the impact it was likely to have on other disciplines or the field as a whole*
> - *To gain generalisable knowledge, so that it can be applied to any new problems*
> - *To sustain basic and strategic work; work is likely to be in academic institutions, but industrial collaboration is welcomed*

A1 Scientific Potential

In **conception**, did the project have the potential to make significant contributions to knowledge? Was it in an area of high scientific and technological interest? Did it promise to be of significant utility?

1	2	3	4	5	6

1 Very low potential. Difficult to see why the project was funded
2 Limited potential. Unlikely to be of great interest to peers
3 Modest potential. Only ever likely to make modest contribution to its own academic field or application area
4 High potential. Likely to make important contribution to its own academic field or intended application area
5 Impressive potential. Excellent chance of making significant international impact in its own and other spheres
6 Unable to make a judgment

Comments

1	2	3	4	5	6
0%	0%	4%	70%	24%	2%

A2 Scientific Impact

In **reality**, did the project make significant contributions to knowledge (or look set to in the near future)? Has it led to greater understanding, conceptual breakthroughs, new principles, methodological advances, a novel approach to computational modelling etc? (These achievements need not necessarily relate to the originally stated aims of the project.)

1	2	3	4	5	6

1 Very low achievements and little value for money
2 Limited achievements. Not of great interest to peers
3 Modest achievements in terms of contribution to its own academic field or application area
4 High achievements. Important contribution to its own academic field or intended application area
5 Impressive achievements, with significant international impact in its own and other spheres
6 Unable to make a judgment

Comments

1	2	3	4	5	6
0%	0%	40%	38%	23%	0%

A3 Scientific Fields

To which of the following scientific fields has the project contributed? Please tick one or more boxes and specify any fields not included in the list.

	Minor Contribution	Major Contribution
The visual system	12%	22%
The auditory system	20%	12%
Other sensory systems	17%	15%
Speech and language	7%	24%
Memory	15%	15%
Spatial behaviour, movement and action	15%	15%
Conceptual knowledge	10%	17%
Learning and instruction	24%	2%
Cognitive activity in social, informational and physical systems	15%	2%
Communication	5%	5%
Neural networks and connectionism	2%	2%
Other	2%	2%
Other		
Other		

A4 Goal Attainment

Were the stated project goals and objectives achieved, surpassed or underachieved?

1	2	3	4	5	6

1 Significant underachievement of all goals
2 Few goals or objectives met
3 Most goals met
4 Most goals met and some surpassed
5 Most goals surpassed
6 Unable to make a judgment

Comments

1	2	3	4	5	6
0%	6%	41%	45%	8%	0%

A5 Relevance of Project Goals and Achievements

Were project goals and achievements in line with the overall aims of the initiative?

1	2	3	4	5	6

1 Totally out of line with the aims of the programme
2 Poor alignment with programme aims
3 Acceptable alignment
4 Very good alignment with programme aims
5 Almost complete alignment with programme aims
6 Unable to make a judgment

Comments

1	2	3	4	5	6
2%	2%	25%	44%	25%	2%

A6 Project Outcomes

Is the project likely to have led to a strengthening of the overall research capability of the teams involved?

1	2	3	4	5	6

1 Little or no strengthening likely
2 Weak improvement of scientific and technological capability
3 Modest improvement of scientific and technological capability
4 Very good improvement of scientific and technological capability
5 Exemplary improvement of scientific and technological capability
6 Unable to make a judgment

Comments

1	2	3	4	5	6
2%	0%	23%	58%	17%	0%

A7 Downstream Impact

Are the research products (publications, patents, software..) of interest or utility to audiences or users outside of the academic research community (e.g. industry, the health services, policy makers etc.)?

1	2	3	4	5	6

1 Research products of no interest or utility to any non-academics
2 Products of limited interest to a few non-academics
3 Products of modest interest to a modest number of non-academics
4 Products of high interest to many non-academics
5 Products of exceptional interest to most non-academics
6 Unable to make a judgment

Comments

1	2	3	4	5	6
13%	19%	45%	15%	2%	6%

A8 Dissemination Strategies

Did dissemination strategies and activities for research products demonstrate the multidisciplinary nature of the work (via multiple authorship, publication in journals of different disciplines, publication in multidisciplinary journals)? How could the dissemination of research products be improved?

1	2	3	4	5	6

1 No demonstration of multidisciplinary nature
2 Limited demonstration of multidisciplinary nature
3 Modest demonstration of multidisciplinary nature
4 Ample demonstration of multidisciplinary nature
5 Exemplary demonstration of multidisciplinary nature
6 Unable to make a judgment

Comments

1	2	3	4	5	6
0%	17%	29%	46%	6%	2%

A9 Training and Experience

Did the project provide adequate training and experience in interdisciplinary approaches and practices? Please comment on the number of Research Assistants and Research Students trained on the project, the quality of training, the destinations of trained personnel etc.

1	2	3	4	5	6

1 Totally inadequate training and experience
2 Limited training and experience
3 Modest training and experience
4 Ample training and experience
5 Exemplary training and experience
6 Unable to make a judgment

Comments

1	2	3	4	5	6
0%	11%	32%	38%	15%	4%

A10 Performance

How would you describe project performance? Consider aspects such as soundness of the research agenda, adequacy and deployment of resources, and overall project organisation and management.

1	2	3	4	5	6

1 Very poor performance
2 Weak performance
3 Adequate performance
4 Good performance
5 Exemplary performance
6 Unable to make a judgment

Comments

1	2	3	4	5	6
0%	0%	25%	67%	8%	0%

A11 Quality

How would you describe project quality? Consider aspects such as demonstration of an adequate understanding of existing scientific knowledge and methodological approaches, or whether the project produced high quality outputs.

1	2	3	4	5	6

1 Very poor quality
2 Weak quality
3 Adequate quality
4 Good quality
5 Exemplary quality
6 Unable to make a judgment

Comments

1	2	3	4	5	6
0%	0%	15%	69%	17%	0%

A12 Overall Score

How would you rate the overall project and its results?

1	2	3	4	5	6

1 Work which was badly executed or clearly misconceived, with no research product
2 Unsatisfactory work with limited or no impact, or which is compromised by poor design or execution
3 Competent work unlikely to make anything more than a modest contribution to its own academic field
4 Soundly conducted work which has or is likely to make an important contribution to its own academic field
5 Well executed work which contributes substantially to theory and/or practice, and which has made, or is likely to make, a major impact internationally, both within and beyond its immediate academic focus
6 Unable to make a judgment

Comments

1	2	3	4	5	6
0%	0%	17%	54%	29%	0%

A13 Future

How well has this project succeeded in opening up promising lines of enquiry for the future?

1	2	3	4	5	6

1 Work which has suggested no promising lines of enquiry
2 Work which has opened up limited new lines of enquiry
3 Work which has opened up lines of enquiry of modest promise
4 Work which has opened up very promising lines of enquiry
5 Work which has opened up lines of enquiry of outstanding promise
6 Unable to make a judgment

Comments

1	2	3	4	5	6
0%	2%	15%	50%	33%	0%

A14 Other Comments

Please use the space below to express any other opinions you may have about the project.

Section B Self-assessment based on Peer Review Panel Headings

In this Section, we want to give JCI participants the chance to comment in a very open-ended way on the contribution of their projects to the overall development of the fields of Cognitive Science and Human-Computer Interaction, with particular reference to the link between the two. We would also appreciate comments on the JCI programme as a whole and the need for future initiatives in this area, including arguments for and against different types of research support mechanisms.

To do this, we would like you to comment on your project under the headings used by the recent JCI Peer Review Panel to structure its report on the Initiative. This international Panel, which visited and reviewed 27 JCI projects in June 1996, was asked to score and comment on projects employing the structure used by UK rapporteurs to review the final project reports. Instead, the Panel decided to follow its own procedures for conducting and reporting its review. The intention is to include its independent report as an appendix to the final JCI evaluation report, but to include within the body of the main text an appraisal of projects based on a number of other sources - including the self-assessments provided in this Section.

B1 Outcomes Relevant to Progress in Cognitive Science

How has your project contributed to the development of Cognitive Science?

B2 Outcomes Relevant to Progress in Human-Computer Interaction

How has your project contributed to the development of Human-Computer Interaction?

B3 Outcomes Relevant to Progress in Cognitive Science as a Theoretical Basis for Human-Computer Interaction

How has your project contributed to the development of Cognitive Science as a theoretical basis for Human-Computer Interaction?

B4 Comments on the JCI as a Whole

How has the JCI Initiative as a whole contributed to the development of Cognitive Science, HCI and the link between the two?

B5 Comments on Future Support in this Area

Is there a need for future support in the areas covered by the JCI? How should it be provided? How should it be focused? Are current support mechanisms adequate?

Section C Self-assessment of the Nature of JCI Projects

The purpose of this Section is to explore and characterise the nature of the work conducted under the umbrella of the JCI, and to compare it with the previous research activities of participants and their future priorities. Simple characterisations such as these can throw light on the impacts and achievements of the programme as a whole. They can also help policy makers understand and cater for shifts in the research needs and priorities of the JCI community.

C1 Research Areas

Please characterise the JCI Research Areas spanned by your JCI project and your own mainstream research activities before and after the JCI project by ticking in the appropriate boxes.

JCI Research Areas	Pre-project Research Activities	JCI Project Research Activities	Post-project Research Activities
Cognitive Science	47%	48%	48%
Mainly Cognitive Science, some Human-Computer Interaction	12%	16%	14%
50/50 Cognitive Science and Human-Computer Interaction	12%	14%	14%
Mainly Human-Computer Interaction, some Cognitive Science	12%	11%	7%
Human-Computer Interaction	12%	7%	9%
Other (Please Specify)	7%	5%	9%

C2 Research Themes

Please indicate the JCI Research Themes spanned by your JCI project and your own mainstream research activities before and after the JCI project.

JCI Research Themes	Pre-project Research Activities	JCI Project Research Activities	Post-project Research Activities
SYSTEM DESIGN			
Tools, Methods and the Design Process	18%	13%	13%
Linking Language to Image	4%	7%	7%
PRINCIPLES OF INTERACTION			
Models of Users in Interaction with the System	20%	22%	20%
Modelling of Communication and Collaboration among Active Agents	13%	22%	24%
Representation of Organisational Knowledge	11%	13%	16%
COMPUTATIONAL LEARNING ENVIRONMENTS			
Effects on Learning of the Forms of Presentation, Action and Feedback	20%	18%	22%
Intelligent Tutoring	18%	11%	20%
Support of Programming	16%	11%	16%
COMPUTATIONAL MODELLING OF COGNITION			
Models of Cognition and Learning	53%	62%	62%
General Theoretical Principles of Network Models	11%	20%	20%
Psychophysics and Modelling of Neural Phenomena, especially Low Level Vision and Speech	13%	16%	18%
OTHER (Please Specify)			
	2%	0%	0%

C3 Research Disciplines/Sub-disciplines

Please indicate the Disciplines / Sub-disciplines spanned by your JCI project and your own mainstream research activities before and after the JCI project.

Disciplines	Pre-project Research Activities	JCI Project Research Activities	Post-project Research Activities
Active agents	4%	7%	13%
AI programming	20%	22%	17%
Anthropology	2%	4%	4%
Artificial and natural perceptual systems	22%	22%	24%
Artificial intelligence	30%	30%	30%
Biological and computational architectures	7%	15%	15%
Biological science	7%	7%	7%
Biophysics	4%	2%	2%
CAD and advanced graphics	0%	0%	2%
Cognitive architectures	13%	15%	17%
Cognitive neuroscience	7%	11%	15%
Cognitive psychology	35%	35%	35%
Cognitive science	46%	57%	50%
Computational learning environments	22%	15%	24%
Computational modelling	48%	48%	41%
Computational linguistics	11%	13%	13%
Computer science	13%	13%	20%
Computer supported co-operative working	4%	9%	13%
Connectionist modelling	17%	15%	20%
Electrical engineering	4%	4%	2%
Ergonomics	7%	7%	7%
Ethnography	7%	9%	9%
Experimental psychology	35%	37%	37%
Expert systems	9%	2%	4%
Grammars and formal semantics	4%	4%	7%
Human-computer interaction	33%	39%	33%
Human information processing	24%	30%	28%
Information technology	26%	17%	24%
Intelligent interfaces	15%	15%	11%
Intelligent knowledge based systems	17%	13%	20%
Intelligent tutoring systems	15%	11%	15%
Interactive systems design	11%	13%	13%
Knowledge-based systems	17%	15%	20%
Knowledge representation	17%	15%	20%
Language acquisition	2%	4%	9%
Language and communication	15%	20%	20%
Language and data structures	4%	4%	2%
Learning and instruction	15%	15%	17%
Linguistics	4%	9%	9%
Logic	2%	4%	4%
Low level vision	9%	11%	11%
Machine vision	13%	11%	11%
Mathematics	4%	4%	4%
Memory and NN memory models	11%	15%	11%
Natural language processing	11%	7%	7%
Natural language semantics	7%	2%	7%
Natural language syntax	2%	2%	2%
Neural networks	17%	22%	20%
Neurobiology	7%	4%	7%
Neuroscience	15%	11%	15%
Object oriented programming	9%	7%	13%
Organisational knowledge	2%	4%	4%
Parallel distributed processing	7%	9%	11%
Philosophy	13%	11%	9%
Phonetics and linguistics	4%	4%	7%
Programming	13%	15%	13%
Psychology	37%	43%	46%
Psychophysics	11%	11%	15%
Robotics	7%	7%	7%
Sociology	4%	2%	9%
Software engineering	17%	15%	15%
Speech and natural language processing	17%	15%	15%
Systems design and evaluation	13%	15%	15%
User interface design	26%	28%	28%
User modelling	17%	22%	17%
Other (Please specify)	9%	7%	7%
Other (Please specify)			
Other (Please specify)			
Other (Please specify)			
Other (Please specify)			

C4 Research Dimensions

Please tick the following scales to characterise the nature of your JCI project.

Low cost	20%	49%	27%	4%	0%	High cost
Low risk	4%	39%	37%	15%	4%	High risk
Technically trivial	2%	10%	18%	47%	22%	Technically complex
Mundane	0%	0%	8%	46%	46%	Exciting
Necessary	17%	51%	19%	13%	0%	A luxury
Short-term	0%	2%	27%	41%	31%	Long-term
Fundamental	29%	37%	20%	12%	2%	Applied
Curiosity-driven	23%	40%	13%	19%	4%	Mission-oriented
Single discipline	0%	6%	12%	33%	49%	Multi-disciplinary
Single discipline	0%	6%	11%	34%	49%	Inter-disciplinary
Cognitive Science oriented	39%	22%	24%	10%	4%	HCI-oriented
In your core research area	45%	33%	10%	6%	6%	In a peripheral area
Builds on existing work	31%	39%	18%	12%	0%	Entirely new area
Aimed at generalisable knowledge	45%	39%	16%	0%	0%	Not aimed at generalisable knowledge
Aimed at methodological development	12%	35%	29%	14%	10%	Not aimed at methodological development
Aimed at theoretical development	41%	35%	20%	4%	0%	Not aimed at theoretical development
Aimed at computational model development	45%	27%	10%	4%	14%	Not aimed at computational model development
Aimed at programming / architecture development	8%	10%	10%	21%	50%	Not aimed at programming / architecture development
Aimed at software tool development	6%	14%	16%	22%	41%	Not aimed at software tool development
Enhances understanding of computational principles	11%	33%	24%	11%	22%	Doesn't enhance understanding of computational principles

C5 Research Funding

Please indicate your major research funding sources with a plus (+), and minor sources with a minus (-).

Research Funding Sources	Pre-JCI	During JCI	Post-JCI
HEFC (Dual Support System)	25%	23%	25%
MRC	27%	30%	27%
SERC	43%	11%	5%
EPSRC	16%	20%	39%
ESRC	23%	14%	36%
BBSRC	5%	5%	14%
Other Research Councils (Please specify)	0%	0%	0%
Joint Council Initiatives (Please specify)	0%	41%	0%
DTI	11%	7%	2%
MOD	2%	2%	0%
Other Government Departments (Please specify)	0%	0%	2%
Joint Research Council / Government Department Initiatives (e.g. LINK - please specify)	0%	0%	2%
European Commission	27%	18%	25%
Industry	16%	14%	18%
Foundations (e.g.Wellcome, Rowntree - please specify)	7%	0%	23%
Other (Please specify)	11%	7%	16%

Thank you very much for taking the time to complete this questionnaire.
Your co-operation is greatly appreciated.

Appendix 5

Rapporteur and Committee Scores for JCI Projects

Sorted by CSHCI Reference Number

The material in this Appendix links evaluation outcomes to individual grant holders. It has therefore only been made available to the relevant Research Councils.

Appendix 6

Published Outputs of JCI Projects

Sorted by CSHCI Reference Number

The material in this Appendix links evaluation outcomes to individual grant holders. It has therefore only been made available to the relevant Research Councils.

N.B. This Appendix lists documentary outputs from the projects funded by the Initiative, as detailed in the final reports to the Research Councils.

The list includes journal papers, books and chapters of books, published proceedings and conference papers, papers accepted for publication, many papers described as 'in preparation', working papers which are available to the community, etc.

It does not include talks, posters, papers only indirectly related to the project, or any other outputs not readily available to interested researchers.