

Review of the
Foresight Cognitive Systems Project

“One year on”

November 2003 to December 2004

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1. Executive Summary

Purpose

The aim of this document is to review the outputs and outcomes of the Foresight project on Cognitive Systems and the process that it followed one year after the completion of the project. There are still some ongoing activities and it is relatively early to assess the outcomes of project, so the report also identifies ongoing work and areas where we will need to keep a track on progress.

Introduction

The Foresight project on cognitive systems started in April 2002 and it launched its findings in November 2003. It was the first of the new Foresight projects following the review of the Foresight programme in 2001. There was no prescription on process for the new projects and each project was to be designed to deliver its own objectives.

At the start the project had a budget of £250k and the aim was to complete the project within 18 months. The full cost of the project so far is £355k. While the project launched the findings of its analysis 20 months after it started, follow on activity on the project is still continuing, due to the success of the project.

The objectives of the project were to:

- *Examine recent progress in biological and artificial cognition*
- *Produce a 10 to 20 year prognosis for both fields*
- *Scope the opportunities for sharing insights between both fields*
- *Communicate significant conclusions to a wider audience*

Or, as the project Director Sir John Taylor put it at the start of the project:

“Both our understanding of cognition in living systems and capabilities in computing systems are advancing rapidly though largely separately. The project set out to explore whether now was the time to bring the two communities together”.

Two of the key conclusions of the project were that: there were clear areas where it would be valuable for the two communities to work together; and that without co-operation there were unlikely to be advances in some of those areas.

Project Outputs

A new process:

A process was designed to bring together leading scientists in two rapidly moving areas of science to identify areas where cross disciplinary collaboration would help to take the science forward.

High quality analysis and reports:

11 areas were identified as being rapidly moving areas of science where there might be value in the two communities working together. State of science reviews were written and peer reviewed on these areas. The state of science reviews set out the current limits, possible future advances and the open questions where collaboration could be fruitful. (Objectives 1 and 2)

Four Grand Challenges were then identified which suggested key areas for collaboration, an interactive conference was held to review these grand challenges and three were supported and one rejected. (Objective 3)

The state of science reviews were used as the basis for a paper “Cognitive Systems Applications and Impacts” which set out potential future applications of the potential advances in technology and also sought to highlight some of the issues this would raise in society. (Objectives 2 and 4)

Creation of a network:

The project up until the launch of the findings included 7 workshops, and 2 interactive conferences involving 352 experts and key stakeholders, presentations at ten international or national events. The project attracted coverage from three specialist papers and one major article in a national paper. (Objective 4)

At the end of the project there was a community with a shared vision for areas where they should work together across the disciplines. An action plan was produced to take forward the work of the project.

Follow on activity:

After the launch, Foresight:

- provided a series of briefings to key research organisations (Objective 4)
- worked with Library House to communicate the conclusions of the project to the investors community. 25 investor companies had representatives at an initial event. In response to their interest Foresight ran three dinner briefings on the areas of greatest interest, 6 to 8 investors attended each of the dinners. (Objective 4)
- delivered a one day workshop to 60 officials in the European Commission (Objective 4)
- developed a list of community of 60 referees who were involved in the project and understood the cross disciplinary work at the interfaces. The list of referees was offered to and welcomed by the research councils.
- commissioned independent research on the extent of networks created through the project. 30 of 110 people invited to comment provided input. The work found that three new multi disciplinary networks had been created. It was too early to say what the impact of those networks would be.

The project provided material for an exercise which was co-funded and run by the BA which explored the best language to use to discuss cognitive systems with the public.

Also, Elsevier approached Foresight asking to publish the state of science as a book "Cognitive Systems – information processing meets brain science" in May 2005. (Objective 4)

Project outcomes

New directions for research:

With no promise of funding, the community ran five cross disciplinary workshops to see if it would be possible to draw up high quality cross disciplinary proposals in five key areas identified by the project. Costs for the venues were covered by Foresight and EPSRC. Over 150 scientists were involved in these workshops. One group has also written an additional state of science on an area not covered by the main project – robotics.

In parallel Wellcome Trust offered funding to take forward research on cognitive systems if it was match funded. This provided the basis for a discussion with the Research Councils on how best to support research in this area.

In response Four Research Councils together with the Wellcome Trust issued a highlight notice seeking cross disciplinary proposals in response to the cognitive systems project. 15 proposals have already been received. There is also specific encouragement for bids on cognitive systems under the MRC EPSRC discipline hopper scheme.

Widening interest in collaboration on research on cognitive systems (Objective 4):

A network has been set up on memories for life funded by the EPSRC and led by a small group who were involved in the project.

The Royal Society of Arts is using the information from the reports as the basis for a Design Competition it is running with the Royal College of Arts.

The British Computer Society has run a series of three meetings to foster debate with a wider community of scientists and business people. The BCS commented that there was no way that you would have got such eminent people from both communities involved in a meeting of this type if it had not been for the Foresight project.

New process for wider use:

The project was an effective pilot and the learning from it has shaped the approach used by subsequent Foresight projects.

The project has also created a good model for the exploration of links between two rapidly moving areas of science, which will:

- facilitate the free flow of information between those two communities,
- identify areas where there would be value engaging in joint research and
- create a cross disciplinary network with a shared vision to answer their common open questions.

Review of the process

The process for this project was developed in an open way with the community. It was a project “run by the community for the community” supported by Foresight. This is perhaps one of the key reasons why at the end of the project there was such strong support for the areas identified by the community and why there has been such a high level of continued activity on the project. Two other critical factors in the project’s success were the support and considerable involvement of Sir John Taylor who directed the project and the project’s scientific experts who devoted an enormous amount of their time energy and influence to ensure that the project was a success.

The state of science were an innovation which allowed each area to summarise the its key issues for that then to be translated by a science writer and then for these documents to serve as the basis for an open dialogue on areas where the communities could work together. The Grand Challenge concept then helped to develop those discussions into more specific proposals for areas for collaborative research.

As a pilot it was a learning process and with hindsight it would have been possible to reduce the time scale of the project. It is also clear that we had not prepared for its success and no thought had been given to the development of an action plan to take forward activities flowing from the project nor a budget to support those activities which needed a little pump priming. The development of an action plan and budget for aftercare activities has been built in to all the following Foresight projects.

Ongoing activities

The project has highlighted the potential social implications of cognitive systems. The RS, BA, RAE and AMS have drawn up a proposal to explore the potential future social ethical and legal implications of cognitive systems. Their aim was to trial a process which might have wider application for future emerging technologies so there could be public engagement at the early stage of the development of new emerging area of science.

Keeping track on future outcomes and long term impacts

It is a very early stage to assess the full impact of this project. In order to fully assess its impact it is important to keep track on:

- The number of high quality cross disciplinary research proposals in this area
- The effectiveness of the highlight notice and cross council approach to assessment of proposals at the interface
- The effect of the project on areas of funding offered under the European Framework Programme
- Any links made between investors and the science community.

- The project has developed and demonstrated an effective approach to explore areas of emerging cross-disciplinary research. The Council for Science and Technology is interested to see whether this good practice is adopted more widely
- Whether the approach used for public engagement proves to be an effective trial and is adopted for other areas

The CST has asked that, in particular, an assessment should be made of whether:

- the project approach is adopted by others to nurture emerging cross disciplinary research;
- the innovative interdisciplinary appraisal method introduced by the Research Councils and Wellcome Trust leads to high quality projects within the current funding mechanism; and
- projects of this type are a good base for public engagement on emerging areas of science.

These longer term outcomes will be assessed in two years.

The support of the project's Stakeholder Group is sought to put in place mechanisms to record outcomes in these categories over that period. Their suggestions are also sought on success measures against which each of these areas can be tracked over this period.