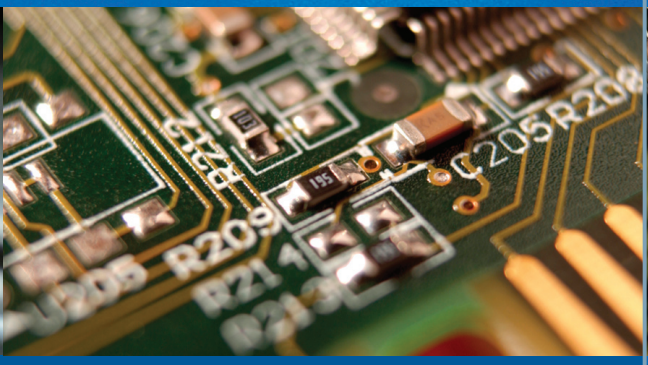
Publications of the Academy of Finland 2/07

Research Programme on Proactive Computing (PROACT) 2002–2005



Evaluation Report

Academy of Finland
Research funding and expertise

Publications of the Academy of Finland 2/07

Research Programme on Proactive Computing (PROACT) 2002–2005

Evaluation Report

Academy of Finland in brief

The Academy's mission is to finance high-quality scientific research, act as a science and science policy expert and strengthen the position of science and research. The Academy's activities cover all scientific disciplines.

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Kuvailulehti

Julkaisija	Suomen Akatemia	Päivämäärä 12.1.2007
Tekijä(t)	Arviointipaneeli	
Julkaisun nimi	Proaktiivinen tietotekniikka (PROACT) -tutkimusohjelman loppuarviointiraportti	
Tiivistelmä	Suomen Akatemian hallitus päätti 6.11.2001 käynnistää kolmivuotisen tutkimusohjelman proaktiivisen tietotekniikan alalla. Ohjelma ajoittui vuosille 2002-2005 ja sen tavoitteina oli muun muassa tukea korkeatasoista tutkimusta, tuottaa jokapäiväistä elämää helpottavia sovelluksia, edistää tutkimusyhteistyötä sekä sisältää rahoittajaorganisaatioiden välistä yhteistyötä. Ohjelman rahoittajatahoina toimivat Suomen Akatemian lisäksi teknologian ja innovaatioiden kehittämiskeskus Tekes, sekä Ranskan tutkimusministeriö. Yhteensä 14 hanketta rahoitettiin noin 8 miljoonalla eurolla. Kolme hanketta toteutettiin suomalaisten yksittäisten tutkimusryhmien toimesta. Yhdestätoista konsortiosta kolme oli suomalais-ranskalaisia ja loput kahdeksan konsortiota oli kokonaan suomalaisia. Suomen Akatemia rahoitti kolmeatoista hanketta 5,7 miljoonalla eurolla, Ranskan tiedeministeriö rahoitti ranskalaisia osapuolia kolmessa suomalais-ranskalaisessa konsortiossa yhteensä 1,83 miljoonalla eurolla ja Tekes osallistui yhden suomalaisen ryhmän rahoittamiseen suomalais-ranskalaisessa konsortiossa. Kansainvälinen arviointipaneeli nimitettiin arvioimaan PROACT-ohjelmaa. Paneelia pyydettiin arvioimaan PROACT-ohjelmaa pääasiassa kokonaisuutena, mutta erityishuomiota pyydettiin kiinnittämään ohjelman suunnitteluun, PROACT-ohjelman tieteelliseen laatuun, ohjelman tavoitteiden saavuttamiseen, tutkijankoulukseen, yhteistyöhön ja verkottumiseen sekä tutkimuksen vaikuttavuuteen. Paneelilta pyydettiin myös suosituksia Akatemialle tulevaisuuden varalle. Tässä raportti sisältää arviointipaneelin työn tulokset. Yleisesti ottaen paneeli oli vaikuttunut PROACT-ohjelmasta. Tieteelliset tuotokset ovat erittäin korkeatasoisia ja ohjelman tuloksia on julkaistu arvostetuissa aikakausi- ja konferenssijulkaisuissa. Joillakin projekteilla on ollut huomattavaa kansainvälistä merkittävyyttä. Tärkeimpinä suosituksina paneeli korosti muun muassa seuraavia seikkoja: vahva tuki proaktiivisen tietotekniikan alalla tulisi jatkua tulevina vuosina; tieteidenvälinen ote ja suomalais-ranskalainen ohjelmallinen yhteistyö toimivat hyvinä esimerkkeinä tulevien ohjelmien suunnittelussa; koordinoidumpi tuki Akatemialta ja Tekesiltä hyödyttäisi proaktiivisen tekniikan kaltaisilla aloilla toteutettuja ohjelmia; PROACTin ”kevyt” koordinaatiotyyli oli toimiva, mutta muutaman seminaarin lisäämistä voisi harkita. Paneelin mielestä Akatemian tulisi kehittää tapoja ylläpitää ohjelmissa syntynyttä tieteidenvälistä yhteistyötä, jotta siitä voisi jatkossa syntyä uusia innovaatioita ja keksintöjä.	
Asiasanat	proaktiivinen tietotekniikka, perustutkimus, tutkimusohjelmat, loppuarviointi, tutkimuksen rahoitus	
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Description

Publisher	Academy of Finland	Date 12.1.2007
Author(s)	Evaluation panel	
Title	Research Programme on Proactive Computing (PROACT) 2002–2005. Evaluation report	
Abstract	The Board of the Academy of Finland decided on 6 November 2001 to launch a three-year Research Programme on Proactive Computing. The programme was carried out during 2002–2005. The objectives of the programme were, among other things, to support quality research, develop solutions to make everyday life easier, promote bilateral research cooperation and attain funding cooperation. The programme funding was organised in collaboration with Tekes – Finnish Funding Agency for Technology and Innovation and the French Ministry of Research and New Technologies. The programme supported 14 projects with about eight million euros. Eleven projects were carried out by consortia, three of which were French-Finnish and eight Finnish. Three projects were managed by individual Finnish research teams. The Academy of Finland funded 13 projects with 5.7 million euros and the French Ministry of Research and New Technologies the French partners in three French-Finnish consortia with 1.84 million euros. Tekes participated in the funding of the Finnish partners in one French-Finnish consortium. An international evaluation panel was appointed to evaluate the PROACT programme. The panel was asked to assess the programme as a whole and focus especially on the following issues: planning of the programme and its scientific quality, success of the implementation of the programme goals and objectives, contribution to researcher and expert training, collaboration and networking, applicability of research and importance to end-users as well as recommendations to the Academy for future programmes. This publication includes the report of the evaluation panel. Regarding PROACT as a whole, the evaluation panel was impressed. The scientific outcomes were, on the whole, very good. The projects resulted in publications in well-recognised journals and conferences. Some of the projects had considerable impact internationally. Key recommendations of the panel include the following issues: strong support for areas of research covered by PROACT should continue; the interdisciplinary approach, and the Finnish-French experimental common call should be considered as tools for preparing future programmes; a more coordinated support from the Academy and Tekes would benefit programmes in fields such as proactive computing; the “lightweight” way of coordination seems appropriate, but one or two additional seminars should be considered. The Academy should develop exit strategies to promote interaction across fields, sustain promising collaborations and foster interdisciplinary research towards new inventions and innovations	
Key words	proactive computing, basic research, research programmes, evaluation, research funding	
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Preface

The Research Programme on Proactive Computing (PROACT) was established to support research on ways for computers to be proactive in providing users with the information and services needed [ref; Tennenhouse, David. 2000. Communications of the ACM 43, 43–50.] The programme was funded by the Academy of Finland, the French Ministry of Research and New Technologies (MRNT) and Tekes - Finnish Funding Agency for Technology and Innovation. The objectives were to support quality research, promote bilateral research cooperation and attain funding cooperation. The programme supported **14 projects for three years** (2002–2005) with about **eight million euros**.

PROACT planning began in June 2000. In March 2002 the Academy solicited informal expressions of interest. In April, one month later, the Academy received letters of intent. Topics of the research projects included many current themes in user-centred design, context awareness, user research, AI, smart objects, new application concepts, and basic research in signal analysis, wireless networks, technologies and infrastructures, as well as data analysis and mining. The evaluation panel rated the project proposals. Top projects were funded together with some moderately well rated, but potential endeavours. Some project budgets were also cut, for example, due to an inappropriate budget (e.g. to support a professor) or purpose (e.g. not considered part of PROACT).

There were 46 letters of intent in total. Of these, 23 were encouraged to proceed. One project had to decline for external reasons. The application deadline was August 2002. The applications were evaluated in September 2002, and the first projects began in November. Altogether 14 projects were funded, with 41 partners. Among these, there were three French-Finnish consortia (with 6 Finnish and 10 French partners), eight Finnish consortia (22 partners) and three individual projects. The proposal approval rate was 30 per cent of the original letters of intent and 64 per cent of those invited to submit full proposals.

From a programme perspective, PROACT successes included good funding cooperation with French partners, agreement with the funding organisations and benefits from sharing experience and knowledge. At the project level, the French-Finnish cooperation between researchers will facilitate future contacts. Furthermore, the research funding supported joint activities, researcher mobility and dissemination of results. Barriers included a tight schedule and some difficulties in evaluating projects. There were no serious cultural barriers.

The coordinators organised an opening seminar, a PhD student workshop (2004), a lecture series in Helsinki and a final seminar (2005). Projects involved also organised six workshops, for example, at nordiCHI 2005.

An international evaluation panel was selected by the PROACT steering group to review the programme. Members of the Panel were Professor Edward Delp, School of Electrical and Computer Engineering, Purdue University, USA; Dr Jean-Luc Dormoy, Programme Strategy Manager, CEA Technological Research Directorate, France; Professor Sara Kiesler, Human Computer Interaction Institute, Carnegie-Mellon University, USA; and Professor Heikki Saikkonen, Helsinki University of Technology and Nokia Research Center, Finland (see Annex 1 and 2).

This publication includes the report of the Evaluation Panel. Programme and project documentation is available on the programme website at www.aka.fi/proact and in the final report.

Espoo, December 2006

Heikki Saikkonen
Professor of Software Technology
Chair of the Evaluation Panel

1 The PROACT programme

1.1 Background

Recent advances in the development of ICT components and wireless technology have led to ever smaller, lighter and faster systems in miniature size. Computing devices are rapidly being integrated into our everyday life, hidden in utility goods such as clothes or watches, or in the environment surrounding us. As well as opening up new opportunities, ubiquitous information technology presents many security problems, as well as technological, social, legislative, political and economic challenges. As defined by Tennenhouse in 2000, proactive computing would solve the problem by providing users with appropriate information and technology anywhere, anytime, satisfying the needs of the users. Proactive technology would release the users from having to interact with ever increasing numbers of systems and it would adapt and adjust to users' actions and movements without their conscious control. As a result, many research programmes were started internationally in proactive computing and related fields. Finland has long been one of the world's leading information societies, and is widely considered one of the innovative leaders in the field of proactive computing.

The PROACT programme for the years 2002–2005 was initiated by the Academy of Finland with the aim of boosting research in proactive computing in Finland. In the early phase, the Academy sought to extend the programme by looking for bilateral funding cooperation, and the programme came to be jointly executed by the Academy, the French Ministry of Research and New Technologies (MRNT) and Tekes – Finnish Funding Agency for Technology and Innovation. The Academy supported the programme at a level of 5.7 million euros (incl. 380,000 euros for coordination) and the MRNT with about two million euros. Tekes funded one project and supported the Finnish business companies involved in the programme.

The PROACT programme, as it was finally executed, was the result of a call for proposals to which 46 applications were received. A first screening by the funding organisations reduced the number of applicants to 23; these applicants submitted full applications that were reviewed and ranked by an international panel consisting of eight experts in proactive computing and related areas. The experts in the panel were: Hans-Werner Gellersen, Germany and UK; Kalman Fazekas, Hungary; Jari Aro, Timo Honkela and Heikki Saikkonen, Finland; and Michel Beaudoin-Lafon, Jean-Luc Dormoy and Gérard Roucairol, France. With the panel reviews as a basis the funding organisations decided to fund 14 projects.

1.2 Objectives

The focus of the PROACT programme was on research in proactive computing and related fields. The objectives were

- to support high-quality research in the field of proactive computing,
- to combine technical innovations into proactive applications,
- to integrate psychological and jurisprudential and other multidisciplinary basic scientific research in IT applications,

- to develop solutions to make everyday life easier, especially for the elderly and the disabled as well as for children,
- to maintain the high international standard of information technology research in Finland and France, and
- to strengthen research cooperation between Finland and France.

An administrative objective of the programme was also to strengthen cooperation between European funding organisations.

1.3 Contents of the programme

The programme had a very wide scope and comprised such different areas as electrical engineering, computer science, sociology and psychophysiology. Themes that occurred in several projects included context-awareness, design principles for proactive applications, smart objects and garments, user interfaces and user research, signal analysis, wireless technologies and infrastructure.

Projects in the programme:

- Adaptive Middleware Platform for Proactive and Reconfigurable Systems (AMPROS)
- Adaptive Mobile Services – Design Parameters and User Experience Factors (ADAMOS)
- Behavioural Modeling in Context-Aware Systems (BEACON)
- Context Management for Proactive Computing (CONTACT)
- Context Recognition by User Situation Analysis (CONTEXT)
- Living in Metamorphosis: Control and Awareness in a Proactive Home Environment (MORPHOME)
- Machine Vision for Sensing and Understanding Human Actions (PROVISION)
- Methods and Models for Intelligent Garment Design: Interdisciplinary Approach to Accessible and Usable Wearable Products (MEMOGA)
- Networking and Architecture for Proactive Systems (NAPS) - Algorithms and Protocols
- On-line Adaptive Brain-Computer Interface
- Proactive Agents Supporting Children's Exploratory Learning (PROAGENTS)
- Proactive Health Monitoring (PROHEMON)
- Proactive Information Retrieval by Adaptive Models of Users' Attention and Interests (PRIMA)
- Wireless Technology and Psychophysiological Computing (WTPC)

1.4 Organisation

In December 2001, the Board of the Academy of Finland appointed a Steering Group (see Annex 2) to plan the research programme, and a sub-committee to make the funding decisions of the Academy. The coordination was contracted to Helsinki Institute for Information Technology HIIT. Dr Greger Lindén was appointed full-time coordinator and Professor Heikki Mannila was appointed programme manager.

The work of the Steering Group, composed of members of the funding organisations and technology experts, was greatest at the onset of the research programme. One of the duties of the Steering Group was to process letters of intent from researchers and in cooperation with the French MRNT and Tekes make suggestions on projects that were to be invited to the second round. An international evaluation panel reviewed and rated all second round applications. After negotiations, the funding organisations made their own funding decisions.

The role of the coordinator was to interact with the different projects, encourage interdisciplinarity through seminars and site visits, and collect and disseminate information on the projects.

As mentioned above, the programme consisted of 14 projects. Eleven were carried out by consortia of several partners sharing common research plans and goals. Three of these were French-Finnish, with six Finnish and ten French partners. Eight were Finnish with 22 partners. Three of the projects were managed by individual Finnish research teams. A total of 41 research teams participated, of which 31 were Finnish and ten were French.

Participating universities:

- Helsinki School of Economics, Finland: one research team
- Helsinki University of Technology, Finland: eight research teams
- Tampere University of Technology, Finland: five research teams
- University of Art and Design Helsinki, Finland: one research team
- University of Helsinki, Finland: two research teams
- University of Kuopio, Finland: one research team
- University of Lapland, Finland: one research team
- University of Oulu, Finland: three research teams
- University of Tampere, Finland: six research teams
- Institut National des Télécommunication (INT), Évry, France: one research team
- Institut National Polytechnique de Grenoble (INPG), France: one research team
- Université J. Fourier, Grenoble, France: one research team

Participating public research institutes:

- VTT Technical Research Centre of Finland, Oulu, Finland: one research team
- Centre National de la Recherche Scientifique (CNRS), Grenoble, France: one research team
- Commissariat à l'Energie Atomique (CEA), Grenoble, France: one research team

Participating business companies:

- Ellipse Oy, Vantaa, Finland: one research team
- Jaakko Pöyry Consulting Oy, Vantaa, Finland: one research team
- Nokia Private Radio Networks, Helsinki, Finland: one research team
- France Telecom R&D, Grenoble, France: one research team
- St Microelectronics, Grenoble, France: one research team

- Thales Communications, Colombes, France: one research team
- Xerox Research Centre Grenoble, Meylan, France: one research team

The Academy and Tekes funded the Finnish partners, Tekes focusing on Finnish business companies and one academic research team. The MRNT through its National Network for Software Technology (RNTL) provided funding for the French partners, both academic and public research institutions and business companies.

2 Evaluation procedure

The evaluation took place during a three-day meeting in Helsinki on 14–16 June 2006. The first two days were dedicated to discussions with representatives from the consortia and the individual projects and with members from the Steering Group. The discussions focused on what the groups considered to be their main achievements in the programme, on the programme as a whole and on how the groups would continue their research in proactive computing. On the third day, Programme Coordinator Greger Lindén and Programme Manager Heikki Mannila for Helsinki Institute for Information Technology HIIT were heard.

In addition to the information from the hearings and discussions, the members of the Evaluation Panel had received and analysed the following information on paper and in electronic format before the meeting.

General material

- Description of Academy of Finland Research Programmes

Planning and launching

- Application call (aka Programme Memorandum)
- Application evaluations
- Funding decisions
- Funding cooperation agreement: Memorandum of Understanding
- Steering Group meeting minutes

Follow-up and implementation

- List and materials of events related to the programme (agendas and in some cases proceedings)
- Copies of PROACT News – bimonthly news emails of PROACT

Evaluation

- Academy of Finland guidelines for the evaluation of research programmes
- Example evaluation reports
- Instructions to the projects

- PROACT evaluation plan (report)

Coordination

- Application and plan
- Coordination reports 2003–2005 and assessment report 2002
- Publications
- Self-evaluation

Projects

- Applications
- Final reports (1/project)
- Self-evaluation reports (1/project partner)
- Publications (full list and copies of max. 10 publications)
- Other project-related material (e.g. videos, websites, interviews, popularising articles)
- Press releases
- Site visit summaries

Programme website

- www.aka.fi/proact

Most of the material was made available on an internal evaluation website, which was also used as a communication tool by the Evaluation Panel to share drafts and other material presented and produced during the evaluation process.

The Evaluation Panel produced this report as a result of the programme evaluation.

3 General evaluation

3.1 Scientific quality, innovativeness and interdisciplinarity

The PROACT programme attracted considerable interest among Finnish research teams active in diverse areas such as theoretical computer science, software engineering, machine learning, computer vision, signal processing, physiology, psychology, sociology, design, media, electrical engineering, electronics, wireless communication, clothing and fashion, and biomedical disciplines. Only about one-third of the proposals could be supported and the budgets of these proposals were cut, some of them quite severely. An international team of experts conducted the selection process. This process guaranteed that all the projects that received funding were of the highest scientific and technical quality.

The 14 approved PROACT projects varied widely in their areas of work and in their approach to proactive computing. The basic technologies included middleware, data logging and retrieval, various sensor and interface technologies (incl. vision, brain

computer interface, eye tracking, wireless physiological sensing and haptic interfaces). The proactive research involved tracking routine behaviour and the focus of attention, understanding and measuring context, predicting exploration, search and relevance of information, suggesting actions or questions, and studies of user acceptance. The domains included emergency management, sports, rehabilitation, education for disabled students, classroom learning and distance education, mobile services, smart rooms, objects, furniture, and robots. Some projects examined the integration of technology into different cultural contexts and product concepts. The research also contributed to theory in areas such as peer-to-peer and ad hoc networking, as well as energy management in wireless ad hoc and sensor networks.

As a whole, the Evaluation Panel was impressed by PROACT. The scientific outcomes were, on the whole, very good. The projects resulted in publications in well-recognised journals and conferences. Some of the projects had considerable impact internationally. The projects focused on design and human-computer interaction (HCI) were imitated internationally and promoted a new human-centred "Finnish" approach to design research, in particular. Many projects led to new areas of research, new forums, improved methods for conducting research and new areas of application.

The Evaluation Panel did not find as much proactive computing in the PROACT projects as it expected. Certain expected areas of work and topics were missing; in particular, the Panel expected more focus on AI, speech and nonverbal behaviour, energy management, security and privacy, HCI, and robustness. The Panel was also surprised at a lack of projects emphasising a "systems approach". Many projects suffered from a lack of open platforms and tools for rapid prototyping in proactive computing. Shared efforts to build common tools and installations, such as smart rooms or software tools for new user interfaces, support for context awareness, or processing, storing and sharing large amounts of semi-structured data, would considerably increase the synergies within an interdisciplinary programme such as PROACT. This gap, perhaps, arose from the absence of emphasis on systems-oriented approaches in the call for proposals, and from the limited time, flexibility and resources available to develop and test systems.

PROACT was without doubt an interdisciplinary programme. In some cases, collaborations between different institutions that were geographically dispersed encountered difficulty in coordinating their work. Some teams would have benefited from better communication and cooperation across disciplines. However, other project teams represented new multidisciplinary collaborations, and some productive cross-fertilisation between disciplines was evident.

3.2 Educational aspects

PROACT projects supported PhD students at the level of approximately one PhD student per faculty member. Some Master's theses were supported as well. The quality of these students was quite high. Many of them published in leading conferences and journals, and those who completed their work obtained good posts. Some of the graduate students initiated workshops, encouraged by the Programme Coordinator. The Programme Coordinator also arranged two PROACT seminars for graduate students, and these seminars were widely praised. They fostered networking among

the students, and allowed them to give and get useful feedback and practice presenting their work in a professional atmosphere.

Because the projects lasted only three years and budgets could not be stretched over additional years, faculty had to find other funds to support the completion of PhD dissertations. In a few cases, PhD work was interrupted and has not been resumed, particularly in the less well-established labs or areas that typically receive less funding, such as sociology. This outcome seems troubling.

3.3 Cooperation inside and outside the research programme

Teams from all over of Finland took part in the PROACT programme. The programme brought together scientists and engineers from small university teams and large, well-established research institutes and university labs. In addition, three projects formed part of a larger collaboration with French research teams. The French teams had more industry participation. PROACT projects, with one exception, did not get funds (e.g. from Tekes) to involve industry in the research.

The Programme Coordinator and Programme Manager fostered awareness among the different PROACT projects through an initial seminar for lead investigators and a final seminar, and through site visits where visitors could mention related projects. Many project leaders mentioned that the initial seminar and suggestions during site visits were useful in order to learn about other projects, but this effort, as well as the project resources, were too limited to prompt deeper collaborations and more interdisciplinarity. It is evident that interdisciplinary cooperation is much easier within a single project than between projects. This should be taken into account already at the programme planning stage. The objectives of interdisciplinarity should be clear from the start.

3.4 Socio-economic impact

Some PROACT projects continued previous work of established researchers, whereas other projects represented new research activities. Several PROACT projects from both of these groups will be followed up on or continued, and have the potential of ultimately producing practical or commercial Finnish products and services. Examples include “smart” fabrics, new mobile applications and services for individuals and communities, and medical services (e.g. remote monitoring of cardiovascular status). Other projects, such as those focusing on design, HCI, medical care and disability, if the collaborations can be continued, could positively impact Finnish design and consumer products, education and health care, and the quality of life and well-being.

3.5 Shaping the Finnish Research Area

Planning for the PROACT programme began in 1999, following an approximately four-year cycle. The programme was announced and proposals were evaluated during a four-month period, in 2002. The programme itself ran for three years. The Evaluation Panel believes this schedule was inefficient in that too much time was spent defining a theme and too little time was left for researchers to develop proposals

and collaborations, and then to conduct the research. This is important especially in new, interdisciplinary fields, where new combinations and synergies between researches are sought. The Academy of Finland may require considerable time to consider totally new, emerging fields of research it wishes to advance, but much less time should be needed to target specific themes, such as proactive computing.

The PROACT programme, in an important respect, was an investment in new, interdisciplinary collaborations to advance innovation and new knowledge in proactive computing. These new collaborations sometimes entailed cooperation across institutions (sometimes at a considerable distance), and they took time to develop. They also entailed costs, such as time for travel and meetings. New collaborations are comparatively fragile and require leadership, including explicit decisions to meet regularly, to hold joint workshops, to publish jointly, or to exchange graduate students. Distance was a barrier to success. However, when successful, the new collaborations led to new areas of research and new frameworks for thinking about proactive computing and/or to new skills or methods. PhD students and faculty learned from the cross-fertilisation of ideas.

These collaborations constitute a costly and significant scientific human resource. The Academy does not have an exit strategy for what to do with new collaborations coming out of PROACT. At least in written documents and in the interviews carried out by the Evaluation Panel, the Academy seems not to have considered that interdisciplinary collaborations are a valuable but fragile resource that must be nourished if such collaborations are to be sustained.

3.6 Activities and coordination

The PROACT programme's attempt to foster and legerage (with limited funds) a wide range of research activities into a single programme focused on proactive computing represented a special challenge and risk. The Evaluation Panel felt that progress was made towards the goals that had been set out at the beginning of the programme.

The participating research teams started out each with their own goals and their own culture of doing things. The coordination activities in the programme made the teams conscious of questions asked and techniques applied in other fields. These activities were a useful learning experience for everyone, in particular for the young people involved in the programme. On balance, coordination and programme management was appropriately light and non-bureaucratic, but in the future more opportunities to interact with other projects could be offered.

The rules for research expenditures in areas of basic research should be changed to allow for more flexibility. The policy allowing so-called no-cost extensions in the USA has been extremely beneficial to research projects. These extensions are allowed with no questions asked for one year and they are often allowed, with permission, for a second year, as well. Flexible arrangements have many advantages without requiring larger budgets. They allow researchers to spend more money in later years as they learn to build on their best work. They allow researchers to invest in riskier work over a longer time period. They allow students and faculty to explore opportunities (or to respond to unforeseen exigencies such as pregnancy) without the pressure of having to spend project money within a specific time frame.

3.7 Conclusion

The PROACT programme had ambitious goals to foster research in a new, interdisciplinary field. It was able to catalyse new cooperation between teams working wide apart both geographically and mentally. Some already established areas were well presented, but some essential areas were practically non-existent. However, projects ranging from focused, high-quality, low-risk endeavours to interdisciplinary, large-consortium, high-risk attempts produced both interesting explorations in new areas of proactive computing, and some high-quality scientific results. As a whole, Finnish research in this area stands with the best of research internationally. In spite of its heterogeneous project portfolio, the PROACT programme contributed well to maintaining and strengthening this excellence.

4 Statistics

The programme employed a total of 178 researchers for longer or shorter terms corresponding to a total of 162 full time equivalents (FTEs or person-years). However, these researchers usually worked closely together with other researchers in the same research teams, thereby increasing the total number of researchers somehow involved in proactive research to over 250 (according to returned information). The programme produced 320 publications, out of which 279 were refereed (journal or conference articles, monographs (excluding theses) or book chapters) and 41 other publications (non-refereed and popularising articles or technical reports). The projects also reported another 108 publications (93 refereed) on proactive computing but not funded by PROACT.

The programme contributed to researcher training: 14 PhD degrees and 23 MSc degrees were awarded, related to the programme and at least to some extent funded by the programme. Another 45 PhDs were planned by the projects (not completed by the end of the project).

The following table contains the information returned by the projects. It is unfortunately incomplete in some cases and the numbers on the summary line are probably larger in reality.

Project	Persons	FTEs	Refereed publications
ADAMOS	25	25	9
AMPROS	16	13	24
BEACON	12	3	14
CONTACT	14	8	23
CONTEXT	10	15	42
MEMOGA	9	12	16
MORPHOME	8	12	12
NAPS	19	11	25
ONLINE AD BCI	5	4	6
PRIMA	14	16	30
PROAGENTS	8	10	7
PROHEMON	10	9	22
PROVISION	14	7	22
WPTC	14	17	27
Total	178	162	279

In addition to refereed publications, the projects were very active both in writing popularising articles and technical reports, as well as in giving interviews to newspapers and magazines. The projects have filed for at least two patents, appeared seven times on TV and four times on the radio in Finland and France. They have received at least eight awards for best papers in conferences or best theses (MSc or PhD) at their universities. Two projects also made videos to disseminate their research.

5 Individual evaluations

Adaptive Mobile Services – Design Parameters and User Experience Factors (ADAMOS)
Professor Kari Kuutti, University of Oulu, consortium leader
Professor Heikki Ailisto, VTT

Researcher Michel Ida, CEA
Researcher Patrice Senn, France Telecom
Researcher Laurent Jamet, ST Microelectronics
Professor Jean Caelen, Université J. Fourier
Researcher Philippe Mallein, CNRS

Funding: Academy of Finland 480,000 euros
French funding 1,000,000 euros

ADAMOS was a joint project with partners from Finnish and French universities, research institutes and industry. There were two laboratories involved in Finland and five institutions in France. The expertise involved was mainly non-technical (sociology, psychology), but also technical (user interface, prototyping). The budget supported two PhD students in Finland and three in France.

The overall aim of the research in ADAMOS was to design guidelines for future proactive services that could do context switching. The research aimed at identifying an approach for exploring future services and the cultural context that would affect how the services would be used. The researchers started working with PDAs but then moved to mobile phones. They worked on three main tasks. The first task was to develop a prototype device that could change its interface depending on the location and needs of the user. After tests in the laboratory, a second prototype was developed for field testing. The prototype device could modify its menu depending on the location of the user. The second task was to decide, based on user data, how proactive services could be adapted to people's routines in different contexts, such as work or home, and how we can solve the conflict between a proactive service that acts on behalf of a person and the person's wish to control what the device does. To answer these questions, one of the PhD students studied user responses to the prototype device in a field test at a very large health fair. The results of this test are being analysed. The third main task involved explorations into future proactive services. The team created a 10-minute video, showing a scenario of the future. The video was shown to comparative focus groups, two in France and two in Finland. The team then carried out further interviews with consumers. One example result is that the researchers observed that Finnish women were much more positive about proactive services than French women were.

This PROACT project helped advance the cooperation between France and Finland, and the team plans to request future funding from the Academy of Finland and the EU. The project also supported the studies of five students. People cannot accurately assess their future responses to new technologies (a phenomenon well known through past studies of cell phones, ATMs, and telephone answering systems). Thus, projects such as this have to choose a strategy for assessing future demand for applications and their requirements. One strategy is to build a prototype that works and test the new service in the lab and then in a field setting. Another strategy, and the one that the ADAMOS project adopted, is to create scenarios of future use and to encourage people's imaginative exploration of new services by, for example, using videos or animations. Whether or not this strategy can work is a matter of some debate in the research community. The strategy seems especially risky when the testing is done with a small sample – four focus groups (in which a single outspoken person can influence the entire group) and few follow-up interviews. This research team has done a nice job of identifying key issues, such as the importance of studying cultural differences in different contexts of everyday life. However, whether the future-oriented user research is really predictive remains to be seen. PROACT might have had more traction by supporting field research on a prototype context-switching service based on previous user research. The research could compare different dimensions of context sensitivity (e.g. a location sensitive service vs. a service detecting other aspects of life, such as who is present, or attentional resources). The

conflict between user control and proactive services will be unresolved without specific information on how proactivity uses contextual information.

Adaptive Middleware Platform for Proactive Reconfigurable Systems (AMPROS)
Professor Juha Tuominen, Helsinki University of Technology
Dr Tapio Mäkinen, Nokia Private Radio Networks

Professor Guy Bernard, INT
Researcher Jean-Pierre Germain, Thales Communications

Funding: Academy of Finland 420,000 euros
French funding: 460,000 euros

The project brought together one French and one Finnish academic team and one industrial partner from France and one from Finland. The objectives of the project were to specify, design and prototype a generic middleware platform for distributed applications dedicated to emergency teams. The applications are targeted to support secured and robust communication, monitoring, coordination and management of different rescue teams such as police, fire brigade and paramedics teams cooperating using mobile terminals in rapidly changing, potentially dangerous environments without any stabile, established infrastructure. This project was integrative, in the spirit of the PROACT programme. The project teams had worked together before.

The practical work was based on iterative development using frequent communication between the teams using in particular virtual meetings via extensive video conferencing. The emergency rescue communities, government bodies and other stakeholders including industry took part in these meetings to discuss and set the requirement through relevant use cases and demonstration scenarios. Several technologies like TETRA, ad hoc networking, CORBA, Java and SOAP were tried and used in building prototypes. The results consist of detailed requirements, software architecture and open source implementation of a middleware supporting context sensitive deployment of software components, dynamic reconfiguration of the systems during execution as well as management of system and data consistency in a faulty and temporarily disconnected environment. All these were separately demonstrated, including integration of TETRA-networking with IP-technology.

Most of the goals were met, but since the Finnish industrial partner had to withdraw early from the project due to business reasons, the consortium was considerably weakened. It was not possible to carry out a comprehensive integration and demonstration of the results. As with many exploratory systems projects, it could be said that AMPROS was simply ahead of its time. The potential user communities seem to lack the necessary resources to overcome the usual normal inertia to test and apply the new technology. The project should have had more early emphasis on this, in order to gain more attention, trust and acceptance. The educational goals were met. Many publications were produced, especially on the French side, and several PhD theses were completed. However, it is not quite obvious to what extent the project was able to contribute to the more general software technology domain with solutions or components that could be applied elsewhere.

In this type of exploratory research the early involvement of user communities is essential. Naturally, the gathering of real data from rescue operations in real time and on the spot is not easy, but would have been beneficial. Focusing on some limited use cases and a few key technologies would have helped in getting more concrete results. Unfortunately, the project suffered from external risks, which realised during the project. Although the overall impression about AMPROS is mixed, the conclusion should be that the Academy of Finland should support this kind of exploratory systems research also in the future.

Behavioral Modelling in Context-Aware Systems (Beacon)
Professor Röning Juha, University of Oulu

Funding: Academy of Finland 180,000 euros

The project concentrated on the development of methods for learning behavioural models. The general context was population ageing. The project invested in and used a smart room of about 100 square metres, equipped with a number of sensors. For example, the floor was instrumented with Electro Mechanical Film (EMFi), which makes it possible to get signals from people or objects walking or moving around in the room.

The project was divided into 4 working packages: detection tracking and identification from the movement of walkers sensed by EMFi; users' routine behaviour learning; distributed software architecture; and mini-robots (just started). In the first package, the system was eventually able to individually recognise persons from a group, based on their style of walking and shape of footsteps. In the second package, important locations for the users were identified, which could be used to teach a mobile device to provide services according to them. The third work package developed a middleware infrastructure from scratch, called Property Service architecture, the initial CORBA implementation being unsatisfactory. It made it possible to build experiments much easier and faster. This development also intended to experiment on swarms of mini-robots. The design of mini-robots was achieved in the last package, but experimentation remained in an initial phase within the project.

The Beacon project made it possible to support part of a wider activity at the University of Oulu, funded by the University and by grants from Tekes, from various business companies and from the EU. A whole set of experimental facilities, in particular the room, and research activities are being accumulated, following a lab research strategy, which are funded by an assemblage of grants. This seems in particular to explain how the project could tackle four different topics with relatively little funding.

The project provided a basis for investigating individual users' behaviour beyond what was done on routine learning. For example, it would be possible to detect someone falling down on the floor. Several applications are pending at the EU level following this line.

The project was successful, and well integrated into a wider set of activities in the laboratory. Twenty publications are mentioned in the final report, related to the four topics of the project. However, it could turn out to be useful to consider sharing or borrowing some technological bricks with/from other teams, as it seems that this

project has a main integrative objective and at the same time develops all the necessary bricks. However, the overall opinion is very positive.

Context Management for Pro-Active Computing (ContAct)
Dr Petri Vasara, Jaakko Pöyry Consulting Oy, consortium leader
Researcher Markus Siponen, Ellipse Oy
Professor Olli Simula, Helsinki University of Technology

Researcher Christer Fernström, Xerox
Professor James Crowley, INPG

Funding: Tekes
French funding: 380,000 euros

ContAct was a French-Finnish consortium consisting of JP Management Consulting (Europe), Ellipse, HUT, INPG and Xerox Research Centre Europe. The two last partners are located in Grenoble, France. The consortium also included, as partners in its second work phase, visualisation experts Kevin Gagnon and Mark Bernstein from Eastgate Systems and hypertext analyser Martin Dodge from Crystal Technologies. The coordinator was Director Petri Vasara, Jaakko Pöyry Consulting Oy. The project concentrated on two different issues. In the first phase, the focus was mainly on tracking and tracing the movements of individuals in office environments including privacy concerns, whereas the scope during the second part was concentrated on developing ubiquitous presentation solutions for enterprise use. On the Finnish side, funding came from Tekes.

Research goals included tracking people in a space and determining where their attention is focused; finding and validating a set of aesthetic criteria that can be used to assess document layouts and in which circumstances these criteria apply; analysing documents and people's preferences to learn a model that can map static profile and activity information to layout criteria; training a machine learning system to apply the learned aesthetic criteria to produce a well laid out document; and, finally, constructing a corpus of good (and bad) documents in a particular domain (e.g. PowerPoint presentations).

The following software tools were developed during the project: Ubi framework, Interactive Pie Chart using Ubi framework, Contact slide generator methodology, Corpus, Slide evaluator software and results, Neural networks engine, Slide generator design specs, and Contact system in action.

Several different types of new applications were developed and tested. One PhD and one MSc thesis were finalised in close connection to the research carried out. Also, several new ideas rose during the project which will be further elaborated in upcoming research projects. Moreover, the project opened doors between the research communities in both countries and made proof of the fact that it is possible to carry out consortium projects with international partners. Some extra constraints in cooperation were experienced caused by complicated NDA and IPR issues. The business companies already utilise the results of the project in their R&D towards products. On the Finnish side, this line of research continues under the Fenix

programme by Tekes. PROACT was considered important for fostering the French-Finnish connections and providing new partners and contacts to the business companies involved through the publicity and profile given by the programme. Therefore, the overall conclusion is very positive.

Context Recognition by User Situation Data Analysis (CONTEXT)
Professor Martti Mäntylä, HIIT
Professor Hannu Toivonen, University of Helsinki

Funding: Academy of Finland 620,000 euros

The CONTEXT project was carried out at HIIT under the leadership of professors Martti Mäntylä and Hannu Toivonen. The overall goal was to explore how the emerging paradigm of context-awareness could be used to provide proactive applications in the field of mobile communication. More specifically: 1) how qualitative descriptions of user situations can be utilized in developing context-aware mobile applications, 2) new in situ online algorithms to analyse and characterise context information for proactive applications, 3) models for context aware HCI and their verification, and 4) prototyping and experimenting with context-aware mobile messaging.

The project contributed to very different fields, including empirical user studies and HCI, axiomatic construction of algorithms and building relevant software prototypes on a smartphone platform. Collaboration between HCI and computer science research resulted in software components for prototype applications used in field research. Studies on basic and constructive human factors have provided motivation, evaluation and grounding for the development of computational methods. Many publications on prestigious forums were published on context descriptions, data analysis, privacy management and ContextPhone, an open source context-aware application toolkit running on a Nokia Series 60 Smartphone platform. Several interesting mobile applications were prototyped on it, including data gathering, media capturing and a form of dynamic phonebook sharing the context information between groups of trusted users. Many of these tangible results attracted interest and turned out to be useful in getting into direct cooperation with institutions doing exploratory research such as MIT Media Lab, UCB SIMS and University of Art and Design Helsinki.

The project has been successful and highly productive. It has already produced three PhD theses and several others are in progress. A number of publications have been published on high-quality forums on various fields of interests to the project. The prototypes have caused wide interest outside the research community. The work continues with new funding from the Academy of Finland and from other sources. Although the team itself considered PROACT primarily as a “harmless” funding opportunity, it fits very well in with the programme theme with respect to its nature, methods and results produced. Because of its many dimensions, CONTEXT could be considered as a kind of benchmark for a prototypical proactive computing project.

Living in Metamorphosis: Control and Awareness in a Proactive Home Environment (Morphome)

Professor Frans Mäyrä, University of Tampere
Professor Ilpo Koskinen, University of Art and Design Helsinki
Professor Jukka Vanhala, Tampere University of Technology

Funding: Academy of Finland 400,000 euros

The Morphome project was a three-university consortium led by Frans Mäyrä, Hypermedia Laboratory, University of Tampere; Ilpo Koskinen, Department of Product and Strategic Design, University of Art and Design Helsinki; and Jukka Vanhala, Institute of Electronics, Tampere University of Technology. These researchers represent three disciplines – cultural studies, design research and electronics technology. The project was supported with 400,000 euros, approximately equally divided among the three units. The budget supported (approx.) two doctoral candidates and several assistants for three years.

The project was principally a design research project whose initial aim was to develop design principles for how proactive technologies should be built and implemented in people's homes. Because human beings are unable to imagine and report on technologies they have never seen, designers studying these new technologies need to invent new methods for creating environments in which they can simulate and study the new technologies in their context of use. Homes are a particularly challenging environment because they are so deeply involved in people's daily routines, and in their personal and emotional lives. The project team developed and tested a prototype design of smart objects including a "smart pillow" – a new and more natural form factor for ubiquitous, unobtrusive, acceptable proactive computing in homes.

At the time, the researchers' approach was innovative and inspired projects elsewhere, including the Hug and Sensing Chair projects at Carnegie Mellon, and a similar emotionally-responsive pillow project at MIT Media Lab. They published articles and a book, led workshops, sent a postdoctoral researcher abroad, and received much press attention. One of the doctoral students completed her PhD and landed a key research post at an elite US firm. Unfortunately, the good collaboration has not continued due to insufficient funding for basic design research (moreover, a longer time period might have enabled the other PhD student to finish the dissertation). The project gave status to design research, enabled the researchers to do a more basic project than they usually do with industry design research funding, and the freedom to develop their approach without a specific product or product framework in mind. As computers move into every product, design is going to play a key role in future technology. To move the field more effectively, design research should be a key aspect of human-centred computing research and involved in the development of new kinds of technology-supported interactions. Thus, the kinds of work represented by this project should be supported in the future. During their brief project, the team became a leader in this regard. The Academy of Finland should consider supporting this and like-minded projects in the future at levels appropriate for sustained work.

Machine Vision for Sensing and Understanding Human Actions (Provision)
Professor Matti Pietikäinen, University of Oulu

Funding: Academy of Finland 300,000 euros

This PROACT project was a single university activity at the University of Oulu led by Professor Matti Pietikäinen, whose field is computer vision. The budget supported two doctoral candidates.

The general goals were to investigate the capabilities of machine vision in proactive computing and to develop solutions needed for building emerging applications. A novel framework for proactive machine vision was proposed and various machine vision applications, in terms of vision modules, were developed. The results of the project can be summarised by the following applications studied: skin and face detection, people detection, event recognition, detection and tracking of skin areas, detection and recognition of human faces, recognition of facial expressions, recognition of human activities, recognition of dynamic textures, and tracking motion of articulated objects. Perhaps the most important result of the project was the use of the local binary pattern texture operator (LBP) for face recognition. These works have been widely cited and led to many other teams around the world investigating the approach. The work on the Distance Education Assistant was also very interesting. The development of an automated system that does both the selection and switching of the video source in a distance education situation in a real lecture room was novel. The stimulus for changing the source is obtained directly from video cameras, and no other sensors are needed. For instance, if a teacher uses the document camera, the system recognises this event and as a response it changes the source of the video feed to the document camera. Many papers in good journals and conferences were published as part of the Provision project, including a PAMI paper.

The University of Oulu Computer Vision Group has an outstanding international reputation and the results of this project continue to indicate this fact. The PROACT funding was only a small part of the overall support needed to fund the computer vision efforts at the University. The project was a success because the PROACT could be leveraged against other funds and projects at Oulu. This is both desirable and dangerous.

Methods and Models for Intelligent Garment Design (MeMoGa)
Professor Minna Uotila, University of Lapland, consortium leader
Professor Heikki Mattila, Tampere University of Technology
Professor Osmo Hänninen, University of Kuopio

Funding: Academy of Finland 500,000 euros

The MeMoGa project brought together three teams specialised in electronics, materials and research on clothing and dress, to ascertain in an industry-realistic way the potential of ubiquitous computing for *intelligent garments*. The project could in particular take advantage of the experience in the area of clothing of the University of Lapland team, from a sociological, design and industrial perspective. The project was

integrative, in the spirit of the PROACT programme. The project teams had not worked together before.

The project was divided into four phases: re-reading clothing and fashion theory, background research on intelligent garments, concept design, and knowledge building. Some prototypes – mainly concepts and virtual prototypes – were developed, some of which can not be described here, due to non-disclosure agreements with industrial companies interested in the project results. Many kinds of materials were considered in the study: chromic, conductive, auxetic, aerogels, state change materials and nano-applications in textiles. Electronics embedded in garments could measure various biosignals, in particular EMG for muscle activity.

The project was original and leading to potential innovation, in particular thanks to the presence of clothing companies in Finland for example in arctic sports, or medical equipment companies. Initial exploratory research had already been conducted at this time in several places around the world, and it was the right time to deepen this research using industry knowledge, brought by the consortium leader, the University of Lapland.

The results are very encouraging. However, much has yet to be experimented. The perspective of a "market burst" of demand for this kind of product is probably true, but it will probably be reached only if prototypes are developed with detailed attention paid to user requirements. In particular, if not already present among the people from clothing and design, sociologists and cognitive scientists should probably be added to the team competence.

The project was very successful. Prototypes presented seem to be at first sight well-designed and acceptable from a user perspective. Several applications have been declared to be already under development with industry. An international community is being organised around the project teams, in particular a new international conference, Ambience2005, organised in September 2005 in Tampere, bringing together 200 researchers from 24 countries on intelligent ambience, including intelligent textiles and garments. Nine publications are mentioned in the final report, several of them in new events fitting this new topic.

Networking and Architecture for Proactive Systems (NAPS)
Docent Patrik Floréen, HIIT, consortium leader
Professor Pekka Orponen, Helsinki University of Technology
Professor Jorma Virtamo, Helsinki University of Technology
Funding: Academy of Finland 390,000 euros

NAPS was carried out by a consortium of three teams led by Docent Patrik Floréen, University of Helsinki, and Professors Pekka Orponen and Jorma Virtamo, Helsinki University of Technology. The research topics focused on ad hoc and sensor networks, which provide a basic infrastructure for proactive systems. In particular, algorithms and computational complexity results were obtained for topology control, routing and node placement in energy-constrained networks.

The more detailed research goals included, among others, clustering as a means to control trade-offs between accuracy and efficiency of ad hoc network management, multiobjective and dynamic routing, to cope with different criteria such as energy,

QoS constraints like latencies and link quality, multiple routes to recover from failures and changes in topology etc. The traffic management sub-project studied the capacity vs. robustness of multihop ad hoc networks, accuracy vs. efficiency of mobility models as well as routing and problems of interference in wireless networks.

The work was primarily based on modern algorithmics and mathematical modelling and methods, including different combinatorial and stochastic approaches together with some simulations. Several PhD and MSc theses were finalised or got underway within the project and a considerable amount of high-quality publications were produced, especially on traffic management.

The teams had not worked together before, so PROACT offered them a concrete incentive to look for new synergies. Some cooperation took place in that people were able to exchange research ideas and method know-how between teams. A new joint application to get funding for the continuation of the research has also been prepared. PROACT was considered helpful also in making other contacts within the programme.

On-line Adaptive Brain-Computer Interface (OnlineBCI)
Professor Mikko Sams, Helsinki University of Technology

Funding: Academy of Finland 150,000 euros

This PROACT project was a single activity at the Helsinki University of Technology led by Academy Professor Mikko Sams. The budget supported one doctoral candidate.

The general goals were to investigate a Brain Computer Interface (BCI) system with novel features that can be successfully operated by tetraplegic subjects, and to keep the BCI constantly tuned to its user. Another important goal was to use both EEG and MEG to measure brain activity. The key concept was to define brain activity features and signal processing methods to conduct successful online measurements with tetraplegic subjects. One feature type was based on activity in the motor cortex before movement and another was based on sensorimotor synchronisation after the movement. Various classifiers were used to process the EEG and MEG signals. Modern particle filtering techniques were developed for various versions of the classifier. Key results included: features from low-frequency bands can be used successfully with tetraplegic subjects; dynamic classification yields better results than batch classification; the classification accuracy of MEG was comparable to that in previous EEG studies; and MEG provides another useful method to measure brain signals to be used in BCIs. Many papers in good journals and conferences were published as part of this project.

The HUT team has an outstanding international reputation in HCI and the results of this project continue to indicate this fact. The PROACT funding was only a very small part of the overall support needed to fund the HCI efforts at HUT. The project was successful because PROACT could be leveraged against other funds and projects at HUT.

Proactive Information Retrieval by Adaptive Models of Users' Attention and Interest (PRIMA)

Professor Samuel Kaski, Helsinki University of Technology, consortium leader
Professor Petri Myllymäki, University of Helsinki / HIIT
Researcher Ilpo Kojo, Helsinki School of Economics (HSE)

Funding: Academy of Finland 620,000 euros

The PRIMA project was a three-institution consortium led by Professor Samuel Kaski, Helsinki University of Technology, Professor Petri Myllymäki, University of Helsinki/HIIT, and Dr Ilpo Kojo, Helsinki School of Economics (vision systems). These researchers' labs represent two main disciplines (machine learning/computer science and visual systems/psychology). The budget supported three doctoral candidates and research assistants.

The initial goal of the project was to build probabilistic and neural computing-based models that would learn from the actions of people to model their information retrieval intentions and search strategies, and to use the models for disambiguating the user's vague commands and anticipating their expectations. The consortium considered this goal to require knowledge of human visual processes and attention in order to infer human intentions, methods for extracting information on human intentions from eye movement data, statistical or stochastic modelling, and analysis and computational modelling of the cognitive state of users. In some of the experimental studies, the researchers gave people search goals in various constrained environments, for example, tables of contents of documents. They used eye movement fixation and saccade tracking to gather data and then used data mining and statistical techniques to describe and predict different patterns of search. The vision group studied people's scrolling/cursor movements to understand people's cognitive states and intentions. The goal here was not just to anticipate search, but also to better understand cognitive and visual processes associated with search behaviour.

The two computer science teams had collaborated in the past, but they had never before worked with the psychologists at HSE. In many respects (empirical work), these two aspects of the project worked separately, but both focused on understanding search behaviour and used knowledge from one another. The project also interacted with the CONTEXT project, which looked at divided attention while using smart phones. A main result of the PRIMA project was in the development of an experimental method for generating and using eye movement data to predict search relevance. The project researchers showed that relevance could be predicted from eye movements. In related work, members of the project applied statistical models to domains such as chat logs and collaborative filtering. The project did address the problem of proactive computing in the sense of how to proactively help a user search. The main result of this work was to create experimental platforms for this purpose. The project published 30 papers in all and initiated conferences and workshops on using eye movement data in information retrieval. A broader outcome was the creation of a new area of research. It will be difficult to continue the collaboration, as there seems to be no mechanism for continuing the basic research and supporting the collaborative interdisciplinary aspects of the work.

Proactive Agents Supporting Children's Exploratory Learning (PROAGENTS)
Assistant Professor Marjatta Kangassalo, University of Tampere, consortium leader
Professor Roope Raisamo, University of Tampere

Funding: Academy of Finland 350,000 euros

This PROACT project was a single-university activity at the University of Tampere led by Assistant Professor (Research) Marjatta Kangassalo, whose field is early childhood education, and Professor Roope Raisamo, computer science and HCI. The budget supported several research assistants, a full-time researcher and two doctoral candidates.

The education-related goal of the research was to help visually impaired children learn about natural phenomena and astronomy through experience and exploration in a "micro-world". The researchers developed and studied a computer-based simulation environment with a multimodal interface to promote this learning. They developed agent-technology, multimodal software architecture, and an interface including visual, auditory and tactile feedback. The researchers involved pre-school and primary school children, including blind children, in iterative usability testing of the learning environment and the interface prototypes. The researchers also examined conceptual learning among the children who used the system. One dissertation examined how children's conceptual models of natural phenomena changed when they used the computer program; another focused on children's learning confidence as an aim to develop suitable research methods and to develop a theory in this area for the age group in question.

This well-rounded project supported the development and evaluation of an interesting new approach to education for visually-impaired (and normal) children, building on the previous work in exploratory learning of natural and astronomical phenomena by Assistant Professor Kangassalo. The project is a very good example of "human-centred computing", in that the technical development was aimed at supporting the needs of the human users (blind children, in this case). These needs include a learning environment that promotes exploration and motivation, and ways to substitute for the visual channel. The project activities included development of a learning environment that allowed visually impaired children to "wander" through the simulated 3-D environment of naturally behaving objects using a control stick and tactile and auditory feedback that could substitute for visual feedback. Although some aspects of the project (e.g. micro-worlds for children, exploratory conceptual learning) were not new, the researchers contributed a new design of a learning environment that would work for blind children. The proactive aspect of the project involved predicting children's exploratory responses so as to prompt them to explore further or to ask them questions about what they learned. The researchers had not worked together in the past, but for this project they met often, and successfully developed productive collaboration. These collaborators plan to work together also in the future; they have a spin-off project with EU funding. They also developed good relationships with a day care centre and a school for visually impaired children, whose students participated in the user tests and interviews.

The PROACT funding was only a small part of the overall support needed to make headway in this very important area of interdisciplinary education research, which has recently received a lot of attention and support in various countries, including the United States. In order to make substantial progress, a new programme could be focused on the science and applications of learning in exploratory environments, especially for disabled children. The PROACT funding for three years would not, by itself, have supported the two PhD students through their education.

Proactive Health Monitoring (ProHeMon)
Senior Researcher Alpo Värri, Tampere University of Technology, consortium leader
Professor Väinö Turjanmaa, University of Tampere

Funding: Academy of Finland 300,000 euros

The ProHeMon project was a two-university activity at the Tampere University of Technology and the University of Tampere, led by Senior Researcher Alpo Värri, whose field is signal processing, and Professor Väinö Turjanmaa, whose field is clinical physiology. The budget supported several graduate students and one doctoral candidate.

The general goals were to investigate and develop an easy, reliable and non-invasive method for studying respiratory and cardiovascular diseases, which could enable screening of sub-clinical diseases in a normal general practice and to design and build a working prototype of a measurement chair which could record and analyse the biomedical signals of a person sitting on it without the person even noticing that a measurement is being done. The ballistocardiogram (BCG) was the targeted signal to measure. The main results of the project included the use of the thin EMFi1 foil sensor to measure twelve channels of ECG and three channels of BCG; the development of a chair in which the sensor was installed; a wireless system for transmission of the signals to a base/analysis station; the development of unique wavelet-based analysis tools; and finally, the demonstration that the BCG signal and the analysis tools could be used to measure the physiological status of a person sitting in the chair. Eight groups of subjects were studied ranging in ages from 20 to 70 years and in varying degrees of health, and a protocol was established to acquire data from them. The results of the experiments indicate that the system was effective in that the BCG and the analysis tools were able to observe the physiological status and changes in physiological status in the test subjects. The investigators seemed very enthusiastic about the project and the results were very impressive. The investigators indicated that they had collaborated with other projects in PROACT, particularly with their wireless system. Several papers in good journals and conferences were published as part of the project.

The Tampere University of Technology's Institute of Signal Processing has an outstanding international reputation and the results of the ProHeMon project continue to indicate this fact. The University of Tampere is well-known internationally for its work in the medical and biomedical areas and the project reflects this very favourably. The project could have had a larger impact if the Academy of Finland had not cut one person-year in requested funding.

Wireless Technology and Psychophysiological Computing (WPTC)
Senior Researcher Veikko Surakka, University of Tampere, consortium leader
Professor Martti Juhola, University of Tampere
Professor Jari Hyttinen, Tampere University of Technology
Professor Jukka Lekkala, Tampere University of Technology

Funding: Academy of Finland 610,000 euros

WPTC was carried out by a consortium of four teams: two from the University of Tampere led by Senior Researcher Veikko Surakka (Psychophysiology) and Martti Juhola (Neural Computing), and two from the Tampere University of Technology led by Professor Jukka Lekkala (Wireless Sensors) and Jari Hyttinen (Biomedical Engineering) respectively. The objective was to apply wireless sensor technologies and signal processing to monitor facial muscle activity and combine and model the data in relation to human physiological and psychophysiological responses. Biomedical monitoring and new hands-free user interfaces were considered as potential applications. The teams had collaborated before.

The work was divided into several goals: 1) Development of wireless sensors and data links for non-intrusive close-to-body measurement of bioelectric signals, 2) Development of necessary signal processing methods, 3) Modelling the measurement and the physiological system to optimise sensor placement, and 4) Demonstrating and testing the whole set-up for health monitoring and hands-free HCI. Experiments with prototypes and/or user studies were made in all these areas. New constructions, models and methods were discovered and published for wireless sensing, bioeletronic signal modelling and related signal processing. Based on these, novel hands-free HCI prototypes could be constructed and experimented with extensive user studies, including tests with disabled people. The results are promising, although the acceptance of extra close-to-body sensors or devices by average consumers can always be questioned.

The consortium functioned very well and produced several results. Many co-authored papers were published and a few academic theses will ensue. It is clear that the teams of the consortium were able to take advantage of the synergies and produce shared and significant results. They explicitly attributed programmes such as PROACT to be essential in enabling this kind of cooperation. All the aims could not be achieved during the funding period, however, so the work of WPTC is continued and some new funding has been found for this purpose and new applications are planned to be submitted to EU sources and elsewhere.

6 General recommendations to the Academy of Finland

1 Technology and engineering research in Finland is excellent. The PROACT programme contributed to maintaining and strengthening this excellence. Proactive computing is an important area of interdisciplinary research and it will be increasingly important in the future.

Strong support for research areas covered by PROACT should continue.

2 The PROACT programme involved many research areas, disciplines and skills, and it took steps to integrate these areas and promote interdisciplinary research. The programme proved its ability to establish new, deep and long-term collaborations at the national, interdisciplinary, as well as bilateral levels.

The interdisciplinary approach and the French-Finnish- experimental joint call were very valuable, and should be considered as tools for preparing future programmes.

3 The PROACT programme involved little participation by Tekes. More participation might have allowed for more industry involvement, larger and longer projects to attain a critical mass, with higher budgets, as well as a systems approach. Alternatively, Tekes participation might have allowed for a second call for proposals to further develop the projects involved.

The coordinated support the Academy of Finland and Tekes have provided to some programmes could also serve as a model of support to fields such as proactive computing, in which scientific progress and technological innovations are closely coupled.

4 The PROACT programme did very well in choosing and supporting both well-established laboratories and new groups and collaborations. The programme reflected a healthy balance of the two.

The Academy of Finland should continue the processes it has in place to maintain a healthy balance between the utilisation of existing laboratories and the promotion of new, high-risk areas of work and younger less well-established researchers.

5 Four years is a long time for planning in areas of information technology. Proactive computing will be of interest for many years to come, but assumptions about what can be done technically and the context of use are evolving rapidly, as is the science of "proaction".

The Evaluation Panel recommends that the Academy speed up the planning cycle.

6 Researchers had only one month to write a letter of intent and two months to write a full proposal, from the time their proposal was approved at the first stage, putting new researchers at a particular disadvantage.

New procedures should be developed to allow for advance agreements among funding partners and international collaborators. More time should be permitted to allow for well-considered proposals, especially from new investigators, and for it collaborations.

7 PROACT grants were awarded for only three years, greatly restricting what could be done. Furthermore, the use of funding has had to follow strict rules that prevent researchers from using their funds efficiently and effectively.

The Academy of Finland, in concert with the Government, should develop rules for research that allow researchers more temporal control over the expenditure of their funds. Mechanisms such as the so-called no-cost extensions of projects in the United States should be created.

8 The PROACT coordination was universally recognised by researchers as "lightweight" and appropriate to basic research. The PROACT coordinator organised seminars at the beginning and end of the programme period, seminars for PhD students, site visits and encouraged special workshops.

The "lightweight" way of coordination as exercised in PROACT, focusing on support and communication, seems appropriate. One or two additional seminars during the course of the programme networking also the more senior researchers should be considered, in particular for project interaction.

9 The PROACT programme fostered deeper cooperation and cross-fertilisation of cognitive science, biomedical science, social sciences, design, and human-computer interaction with computer science and engineering. It represented an investment in new, interdisciplinary collaborations and the development of important scientific human capital, but there seems to be no exit strategy or mechanisms to sustain, let alone increase these collaborations, coordination and cross-fertilisation across fields.

Established new scientific connections should be considered as investments to be fostered with proper mechanisms (programmes or policies) so that they continue to be productive and bear fruit. The Academy of Finland should develop exit strategies to promote this kind of interaction across fields, sustain promising collaborations and foster interdisciplinary research towards new inventions and innovations.

Annex 1: The assignment

Evaluation of the Research Programme on Proactive Computing (PROACT)

The Academy of Finland has launched the evaluation process of the Research Programme on Proactive Computing (PROACT). The scientific evaluation of the programme will be carried out by an international evaluation panel. The members of the evaluation panel are Professor Edward Delp (Purdue University, USA), Software & Cognitive Systems Manager Jean-Luc-Dormoy (CEA – Commissariat à l'Energie Atomique, France), Professor Sara Kiesler (Carnegie-Mellon University) and Professor Heikki Saikkonen (Helsinki University of Technology and Nokia). With this assignment we, on behalf of the Academy of Finland, confirm your membership in the Evaluation Panel of the PROACT Research Programme.

The programme comprised 14 projects with altogether 41 partners from Finland and France. The programme started in 2002 and ended in December in 2005. The overall funding was about 8 million euros. The programme was organised in collaboration with Tekes, the National Agency of Technology (Finland) and the French Ministry of Research and New Technologies/French National Research Network for Software Technology (RNTL).

The objective of the evaluation is to estimate to which degree the PROACT research programme has succeeded in fulfilling the objectives originally set for it in its Programme Memorandum. Of specific interest are the programmatic approach, added value and programme impacts, interdisciplinarity, applicability of research, networking and dissemination of results.

In the evaluation report, the panel is expected to assess the programme as a whole and reflect especially the following issues:

1 Planning of the research programme
  – Preparation of the programme and planning of the contents of the programme
  – Research projects funded and funding decisions in creating the necessary preconditions for the programme

2 Scientific quality of PROACT
  – Scientific quality and innovativeness of the research
  – Scientific competence of the consortia/individual projects

3 Success of the implementation of the programme goals and objectives
  – Concordance with the objectives of the research programme
  – Functioning of the programme
  – Added value of the programme
  – Contribution to enhancing inter- and multidisciplinarity in research
  – Scientific and administrative coordination

4 Contribution to researcher and expert training

5 Collaboration and networking
   – Collaboration within the programme
   – Collaboration with other Finnish groups
   – International cooperation, especially between Finland and France
   – Collaboration with the end-users

6 Applicability of research and importance to the users
   – Contribution to promoting the applicability of research results
   – Relevance and importance to the users
   – National and international impact of the programme

7 Recommendations for the future (including the justification for the recommendations)

The main focus of the evaluation is on the scientific quality of the programme.

The schedule of the evaluation is as follows

December 2005	Appointment of the evaluators
December–March 2006	Data collection (self-evaluation reports and project descriptions)
April–June 2006	The evaluation panel analyses the data
14–16 June 2006	Meeting of the panel in Helsinki, interviews with project researchers and writing of the evaluation report
August 2006 (or later)	Publication of the evaluation report

The time and place for the panel meeting have been decided to be 14–16 June 2006 in Helsinki at the Academy of Finland, Vilhonvuorenkatu 6. The preliminary schedule for the panel is as follows:

13 June 2006	Arrival in Helsinki
13 June 2006	Get-together dinner at 7.30 pm
14–16 June 2006	Panel meeting at the Academy of Finland
16 June 2006	Departure from Helsinki -

The work will include examination of the reports, self-evaluation assessments, publications and other products of the programme and discussions with the Programme Steering Committee, key stakeholders, researchers, and programme coordination during the panel's meeting. There will also be periods reserved for the intensive work of the panel including the preparation and drafting of the evaluation report. Technical assistance will be provided during the visit.

An honorarium (EUR 1,600 to ordinary members, EUR 2,000 to the chairman of the panel; tax is deducted from these amounts) will be paid for the panel work. Also your

travel expenses (economy class) and accommodation in Helsinki will be reimbursed. For the travel arrangements you may wish to contact the coordinator, Greger Lindén, Greger.Linden@cs.helsinki.fi. The accommodation will be organised by the coordinator. Please, let us know your arrival and departure times as soon as possible, as well as if you have any special dietary requirements.

Further details of the meeting will be sent to you later.

Thanking you in advance for your cooperation.

Yours sincerely,

Ulla Ruotsalainen
Chairperson of the
PROACT Steering Group
Tampere University of Technology
Institute of Signal Processing

Heikki Mannila
PROACT programme Manager

Greger Lindén
PROACT Programme Coordinator

Helsinki Institute for Information Technology
HIIT

University of Helsinki and Helsinki University
of Technology

Annex 2: PROACT Steering Group

Steering Group 2001–2003

Professor Kari-Jouko Räihä (chair, University of Tampere, Academy of Finland Research Council for Natural Sciences and Engineering)

Research Professor Elina Hemminki (vice-chair, Stakes, Academy of Finland Research Council for Health)

Professor Markku Kivikoski (Tampere University of Technology, Academy of Finland Research Council for Natural Sciences and Engineering)

Professor Erno Lehtinen (University of Turku, Academy of Finland Research Council for Culture and Society)

Docent Kaisa Nyberg (Nokia, Academy of Finland Research Council for Natural Sciences and Engineering)

Docent Ulla Ruotsalainen (Tampere University of Technology, Academy of Finland Research Council for Natural Sciences and Engineering)

Marko Heikkinen (Tekes)

Pauli Kuosmanen (Elisa Communications)

Marko Turpeinen (Alma Media)

Steering Group 2004–2006

Professor Ulla Ruotsalainen (chair, Tampere University of Technology, Academy of Finland Research Council for Natural Sciences and Engineering)

Professor Arto Urtti, (vice-chair, University of Kuopio, Academy of Finland Research Council for Health)

Senior Technology Adviser Marko Heikkinen (Tekes)

Professor Krista Varantola (Academy of Finland Research Council for Culture and Society, until 8 November 2005)

Professor Urpo Nikanne (Åbo Akademi University, Academy of Finland Research Council for Culture and Society, from 8 November 2005)

Professor Kaisa Nyberg (Nokia)

Professor Kari-Jouko Räihä (University of Tampere)

Professor Kaisa Sere (Åbo Akademi University, Academy of Finland Research Council for Natural Sciences and Engineering)

Annex 3: PROACT research projects and their funding

Adaptive Mobile Services – Design Parameters and User Experience Factors (ADAMOS)
Professor Kari Kuutti, University of Oulu, consortium leader
Research Professor Heikki Ailisto, VTT Technical Research Centre of Finland

French partners:
Researcher Michel Ida, Commissariat à l'Energie Atomique CEA/Laboratoire d'Electronique, de Technologie de l'Information Leti, Grenoble
Researcher Patrice Senn, France Telecom R&D, Grenoble
Researcher Laurent Jamet, ST Microelectronics, Grenoble
Professor Jean Caelen, Université J. Fourier, Grenoble
Researcher Philippe Mallein, Centre National de la Recherche Scientifique CNRS

Funding: Academy of Finland 480,000 euros
French funding: 1,000,000 euros

Adaptive Middleware Platform for Proactive Reconfigurable Systems (AMPROS)
Professor Juha Tuominen, Helsinki University of Technology

Other Finnish partners:
Dr Tapio Mäkinen, Nokia Private Radio Networks

French partners:
Professor Guy Bernard, Institut National des Télécommunication, Évry
Researcher Jean-Pierre Germain, Thales Communications, Colombes

Funding: Academy of Finland 420,000 euros
French funding: 460,000 euros

Behavioral Modelling in Context-Aware Systems (Beacon)
Professor Röning Juha, University of Oulu

Funding: Academy of Finland 180,000 euros

Context Management for Pro-Active Computing (ContAct)
Dr Petri Vasara, Jaakko Pöyry Consulting Oy, consortium leader
Researcher Markus Siponen, Ellipse Oy

Professor Olli Simula, Helsinki University of Technology

French partners:
Researcher Christer Fernström, Xerox Research Centre Grenoble, Meylan
Professor James Crowley, Institut National Polytechnique de Grenoble INPG

Funding: Tekes

French Funding: 380,000 euros

Context Recognition by User Situation Data Analysis (CONTEXT)
Research Director Martti Mäntylä, Helsinki Institute for Information Technology (HIIT),
Helsinki University of Technology
Professor Hannu Toivonen, University of Helsinki

Funding: Academy of Finland 620,000 euros

Living in Metamorphosis: Control and Awareness in a Proactive Home Environment (Morphome)
Professor Frans Mäyrä, University of Tampere
Professor Ilpo Koskinen, University of Art and Design Helsinki
Professor Jukka Vanhala, Tampere University of Technology

Funding: Academy of Finland 400,000 euros

Machine Vision for Sensing and Understanding Human Actions (Provision)
Professor Matti Pietikäinen, University of Oulu
Professor Olli Silvén, University of Oulu

Funding: Academy of Finland 300,000 euros

Methods and Models for Intelligent Garment Design (MeMoGa)
Professor Minna Uotila, University of Lapland, consortium leader
Professor Heikki Mattila, Tampere University of Technology
Professor Osmo Hänninen, University of Kuopio

Funding: Academy of Finland 500,000 euros

Networking and Architecture for Proactive Systems (NAPS)
Senior Research Scientist Patrik Floréen, HIIT, consortium leader
Professor Pekka Orponen, Helsinki University of Technology
Professor Jorma Virtamo, Helsinki University of Technology

Funding: Academy of Finland 390,000 euros

On-line Adaptive Brain-Computer Interface (OnlineBCI)
Professor Mikko Sams, Helsinki University of Technology

Funding: Academy of Finland 150,000 euros

Proactive Information Retrieval by Adaptive Models of Users' Attention and Interest (PRIMA)
Professor Samuel Kaski, Helsinki University of Technology, consortium leader
Academy Research Fellow Petri Myllymäki, HIIT
Team Leader Ilpo Kojo, Helsinki School of Economics

Funding: Academy of Finland 620,000 euros

Proactive Agents Supporting Children's Exploratory Learning (PROAGENTS)
Assistant Professor Marjatta Kangassalo, University of Tampere, consortium leader
Professor Roope Raisamo, University of Tampere

Funding: Academy of Finland 350,000 euros

Proactive Health Monitoring (ProHeMon)
Senior Researcher Alpo Värri, Tampere University of Technology, consortium leader
Professor Väinö Turjanmaa, University of Tampere

Funding: Academy of Finland 300,000 euros

Wireless Technology and Psychophysiological Computing (WPTC)
Assistant Professor Veikko Surakka, University of Tampere, consortium leader
Professor Martti Juhola, University of Tampere
Professor Jari Hyttinen, Tampere University of Technology
Professor Jukka Lekkala, Tampere University of Technology

Funding: Academy of Finland 610,000 euros

Annex 4: PROACT research programme evaluation form

Please fill in one form for each PROACT project partner (i.e. each consortium partner) and return by 28 February 2006 to Greger.Linden@cs.helsinki.fi

We encourage you to use text fields (wherever available) for further explanations and clarifications!

A) FIGURES AND FACTS

Table 1. General information

Name of the project (and web page) **http://**
Project leader (of the individual project or the partner of a consortium) and organisation
Organisation and project type ☐ **University** ☐ **Consortium** ☐ **Leader of the consortium** ☐ **Research institute** ☐ **Individual project** ☐ **Company**

Table 2. Research staff financed (fully/partly) by PROACT funds

Name	Position	Degree	Person months

Table 3. Staff closely related to the project (but on other funding)

Name	Position	Degree

Table 4. Visits (research visits by the project researchers to other institutions or visits from other institutions)

Name	To/from	Institution	Year	Days

Table 5. Degrees completed fully or partly funded by the project (including planned PhD degrees and expected year of completion)

Student name	Completed/planned degree (PhD, PhL, …)	Year	Degree of PROACT funding (%)

7. Funding

Do you have other funding for the proactive research area? From which funding organisations?

8. Other facts

Any other facts you want to add?

9. Appendices

Please provide as much material as possible in electronic format (Word/PDF/PS)
A. A full list of publications (underline those publications arising from PROACT research funding) and the number of publications in each category.

- Articles
  - refereed articles
  - other scientific articles
  - popular articles
  - submitted manuscripts
- Scientific reports
- Books or book chapters, edited conference proceedings
- Academic theses
- Patents
- Television and radio programmes
- Scientific awards
- Other professional documented activities

B. A list and electronic versions (or paper copy if no electronic version is available) of the most important published scientific papers (max 10 papers/project).

B) SELF-EVALUATION

Indicate your opinion also by marks.

1 = poor/little, 2 = satisfactory, 3 = good, 4 = excellent, 5 = outstanding/plenty

PROJECT

1. Objectives and results of the project (please specify)

- To what extent did you achieve your goals and objectives? **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐

- What have been the greatest obstacles in reaching your goals?

- What kind of changes of the research plan did you implement during the programme?

- Explain the scientific significance and innovativeness of the research carried out (theories, methodology, main approaches, **results**).

2. Goals and objectives of the PROACT Research Programme

- To develop new technological innovations in the field of proactive computing
- To promote multidisciplinary research within field
- To promote researcher training in the field
- To maintain the high international standard of information technology research in Finland and France
- To strengthen bilateral research cooperation between Finland and France and also other international cooperation
- To develop IT solutions that will help people, especially the elderly and disabled, in everyday life
- To strengthen funding cooperation between European funding organisations

	1	2	3	4	5
▪ To what extent did your project/activities contribute to the objectives of the Programme?	☐	☐	☐	☐	☐

3. Contribution to the society

	1	2	3	4	5
▪ Have the results from your project been popularised through media?	☐	☐	☐	☐	☐
Is there any potential for it?	☐	☐	☐	☐	☐

	1	2	3	4	5
▪ Potential economic impact of the results	☐	☐	☐	☐	☐
▪ Potential social impact of the results	☐	☐	☐	☐	☐
▪ Potential technology impacts of the results	☐	☐	☐	☐	☐

4. Promotion of research careers

	1	2	3	4	5
▪ Contribution to the postgraduate training	☐	☐	☐	☐	☐
▪ Promotion of young researchers (especially women) in their research careers	☐	☐	☐	☐	☐

5. National and international networking

	1	2	3	4	5
▪ French-Finnish collaboration	☐	☐	☐	☐	☐
▪ Other collaboration/networking	☐	☐	☐	☐	☐

6. Other activities (arranged conferences/important meetings, please explain)

CONSORTIUM

7. Added value of the consortium

	1	2	3	4	5
▪ Has working as a consortium advanced the research of your project? How?	☐	☐	☐	☐	☐
▪ How much of the research work has been carried out as team-work between the research groups (sub projects)?	☐	☐	☐	☐	☐

PROACT RESEARCH PROGRAMME

8. Added value of the programme **1 2 3 4 5**

- Have you benefited from being a part of the PROACT Programme regarding
  -scientific work? How? ☐ ☐ ☐ ☐ ☐
  -researcher training? How? ☐ ☐ ☐ ☐ ☐
  -economic or social utilisation? How? ☐ ☐ ☐ ☐ ☐

1 2 3 4 5

- Have you benefited from the coordination of the Programme? ☐ ☐ ☐ ☐ ☐
  What benefits have you had? How could the coordination have supported you more?

- What kind of added value did the programme bring to the research field?

9. Strengths and weaknesses of the programme?

10. Recommendations for the future

- Suggestions for new research programme topics/themes or other activities for supporting the research fields of the PROACT programme

- In what other ways could research conditions be improved?

- What are the greatest short-comings, problem areas and needs in your field?

- How would you raise the scientific level of your research area?

OTHER COMMENTS

11. Any other comments you want to add?

The Research Programme on Proactive Computing (PROACT) was established to support research on ways for computers to be proactive in providing users with the information and services needed. The three-year programme was funded by the Academy of Finland, the French Ministry of Research and New Technologies and Tekes – Finnish Funding Agency for Technology and Innovation.

This publication includes the findings of an international panel appointed to evaluate the PROACT programme. The panel assessed the programme as a whole, especially the success of the implementation of the programme goals and objectives. The report is particularly focused on the scientific quality of the projects, researcher and expert training, collaboration and networking as well as the applicability of research. It also presents recommendations to the Academy for future programmes.

ACADEMY OF FINLAND

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