The 2010 Institution of Analysts and Programmers annual conference was held at the Magic Circle, London. David Morgan, the President of the IAP welcomed all the delegates and went on to introduce the first speaker, Peter McOwan, Professor of Computer Science and Director of Outreach in the School of Electronic Engineering and Computer Science at Queen Mary University of London.

Peter introduced LIREC, a European funded research project exploring how people would live with digital and interactive companions. He discussed the house of the future, considering human interactions focusing on assisted home help, office life, education and entertainment. He reviewed what people think about robots, how we react to them and how they should look, using several approaches including psychology (how should the robot act), computer science (programming robots) and engineering (building the right type of robot).

Most current robots are designed for factory use. Human-robot interaction is a relatively new field. We still don't know very much about what people want and expect from robots and new robots are being developed offering new problems and things to study. People can become quite attached to pet robots as seen from experience in Japan. Peter went on to discuss work carried out on a dog model, where personality is ranked by the looks of a dog. For example, English Setters are thought of as friendly, while a Doberman is seen as energetic.

Peter showed a video of the 'Spirit of the Building Showcase' at Herriot Watt University, which demonstrates living with robots and interactive companions. The video showed Sarah, a robot, greeting visitors to the building. She can guide people around it and provide information by, for instance, delivering printouts or responding to questions about the whereabouts and availability of staff.

A further demonstration included the iCat, the head of a robot cat that can play chess with children. However, the iCat is more than a simple chess program, becoming supportive and a tutor for the child. A lot of work has been carried out on expression recognition with adults, but children are different and pose more of a challenge. Pictures of children's expressions

were interpreted using a mouth tracker and the results shown as a probabilistic graph of the child smiling. The iCat can detect the child's reaction and respond accordingly. Also the system allows migration of chess games between the iCat and an android device and back, so that play can be carried on away from iCat, and then resumed later.

Peter summarised with a few thoughts. Understanding bio-intelligence is useful, while socially aware robots are still challenging, as are questions of embodiment and migration. Ethical issues are thrown up by the prospect of humans blending their lives with robots.

Keith Errey of ISANSYS presented "Delivering the promise of wireless digital health care". He defined digital health care as "The convergence of biology and engineering turning health care into information engineering." Wireless digital health care is concerned with clinical data on the go, assisted self management, such as Bluetooth-enabled blood glucose meters, mobile messaging (data collection and reminders) and hospitals with electronic patient data I/O devices.

Keith went on to talk about the significance of medical metrics. He pointed out that their values aren't absolute. For instance, body temperature depends on the time of day (circadian cycles) and can change by 2^0C over the cycle. It can also change with age, exercise, where it is measured, and, for women, position within the menstrual cycle. So, if an understanding of a patient's physiology is needed, we require a detailed description of the conditions under which the measurements are taken. Another approach is to take continuous measurements and use these readings for comparisons.

He made the point that complexity of physiology degrades with ageing and pathology and health dynamics is poised between too much order and too much chaos, so the only equilibrium in life is death! He also laid out some paradoxes – physiological systems become more predictable with disease but the practice of medicine is not possible without such predictable behaviour – doctors need to look for characteristic patterns.

The physionome is the description of the physiological dynamics of the normal intact organism. The next frontier is defined by "proteonome" + "physionome". As a genome is unique to an individual, so too is the physionome. Keith quoted some startling annual figures. 200,000 people die unexpectedly in hospitals in the USA and 150,000 people in the UK suffer

from cardiac arrest, less than half surviving. Thus to improve outcomes, provide for ageing populations and to save lives, better and more frequent physiological data is required.

Keith outlined his recommendations, which included more frequent monitoring of patients and individual monitoring plans including methods to correlate data from several biometrics to provide early warning indicators. Effective prediction will save lives and money. This can be done by using dynamic relationships between multiple vital signs. A 'Wellness Number' can be derived from combinations such as respiration rate, SpO_2, heart rate, pulse, temperature, blood pressure and physical activity.

Keeping people out of hospital as far as possible is the goal, both for their well-being and to minimise costs, which can reach $10,000 per day in the USA. To improve outcomes you need to determine who is most in need by predicting adverse events to allow timely interventions. By use of an algorithm using only 1 vital sign e.g. heart rate variability, it is possible to predict cardiac arrest. There is an iPhone app called ithlete that, with associated hardware, can tell you when to train and when to stop, preventing overexertion.

Similarly body worn monitoring devices, measuring heart rate variability, activity, temperature and skin conductance, can be used with an algorithm to determine a player's performance in professional football. State of mind, not just physical readiness can be deduced from physical vital sign data.

To be practical, there needs to be continuous monitoring, which must be unobtrusive. It must also be transparent to the user using wireless technology, for instance. Keith listed several different monitors and their technologies and finished with the promises of this field – systems to provide better health, the saving of lives, cost reduction, enhanced performance and a reduction in injuries.

The next speaker, Blay Whitby of the University of Sussex, spoke on "The ethical implications of caring technology (or would you choose to be cared for by a robot)".

Smart homes are ones that are highly automated with temperature monitoring and motion detectors involving some sort of biofeedback. They may feature CCTV, fridge content control and 24/7 auto-decision support. The ethical concerns include privacy, independence and legal competence. This raises questions such as "Is there a possibility of abuse?" and "Who is responsible

when something goes wrong"? There is also the question of the ethical supervisor as there are omissions in present codes of conduct. Also "How do they compare with existing arrangements?" as people can still be abused in ordinary homes.

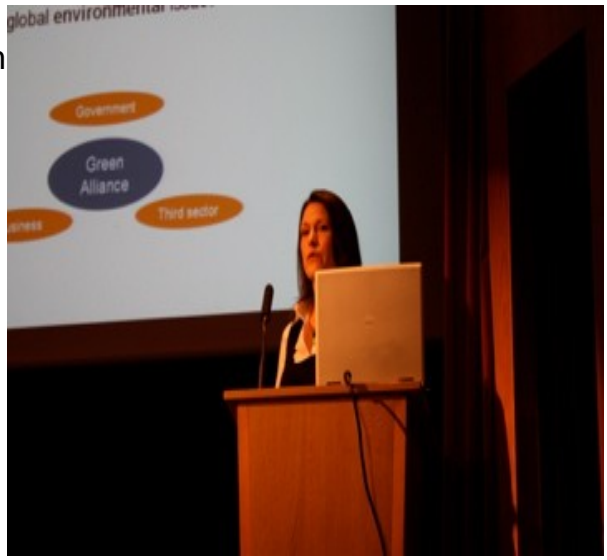
Further questions raised are, "Is it only for the rich?" and "Is there more profit in reducing social values"? Certainly, vulnerable users need to be protected. Codes of conduct should be extended from business users to vulnerable users.

Blay went on to discuss interfaces, programs and robots that pretend or explicitly claim to be either more human-like or more animal-like than they really are. Do people believe in computer systems? People can get intimate with a system and bond with it, maybe totally relying on it. He continued by discussing Frude's Dystopia (The Intimate Machine, 1983). Frude saw it as inevitable that computer companions will be preferred to human society. A number of present day technologies could combine to produce Frude's companions. Would this be a dystopia?

He then pointed out that the law may not be a guide, especially in areas involving new technology. However, this doesn't mean one can ignore it. It also doesn't mean that anything goes! Indeed, to behave ethically one often has to exceed the requirements of the law. To illustrate this, Blay gave an example from 100 years ago, listing excessive claims of technological brilliance – the Titanic! It was supposed to be the safest, fastest, biggest liner. As for lifeboats, the law demanded 16, but 20 were provided,a 25% excess. However, the maximum lifeboat capacity was 1178 while the ship's capacity was 3547 people. Alexander Carlisle, an engineer on the project, remarked at the subsequent Public Enquiry, "We spent 2 hours discussing carpets for cabins and 15 minutes on lifeboats".

Blay summarised with a call for action. Design, implementation, testing and use of all human-like interfaces should now be subject to ethical scrutiny. Interdisciplinary scientific research aimed at resolving some of the relevant ethical questions should be encouraged. The expression "vulnerable users" should enter our vocabulary and informed and rational public debate should be started on the social implications of various caring technologies.

Later, Blay's session generated a lot of discussion!



Rachel Cary, Senior Policy Advisor at the Green Alliance, presented an interesting talk entitled "Future Proof: an electricity network for the 21st Century". She started by laying out the purpose and history of the Green Alliance. It is an environmental think tank founded in 1979 with cross-party support. Its areas of work include designing out waste, climate and energy futures and political leadership.

Looking to the future in respect of climate and energy, the challenge is for a low-carbon infrastructure utilising carbon capture and storage, with special attention to transport and electricity networks. Rachel said that the old infrastructure consisted of large generators supporting a wide network. However, there are to be large changes in electricity generation and use (fossil fuel changes and demand changes). The conventional electricity meter is the point of contact with the end user. However, smart meters will change this by allowing different charge rates for different time periods. It also allow users to understand their usage. Hopefully, it will also help to change their usage patterns.

She went on to talk about what had been learned from producing the report "Future Proof" (see www.green-alliance.org.uk). This included six key principles to future-proof the network. The first was to work towards the future, deciding what is wanted, investing before the need and reforming the regulatory package. The next is to increase and maintain investment, playing catch up and acting early, as this saves money. Also planning and under grounding of networks, with offshore networks as a blank canvases.

Charges must be reviewed including location transmission charges, distributed generation and cost reflectivity. Demand must be made more flexible, looking at automation versus price signals and the differentiation between types of electricity. Some examples were given such as smart washing machines and dishwashers that will only start when electricity demand is low or the price drops below a pre-set threshold.

Preparation must be made for electric vehicles, heat pumps and distributed generation. In all these things, consideration must be given to the impact on the network. Finally, the networks must be made intelligent. The low carbon fund is a good start and with smart meters and a smart grid, hopefully this will lead to smart users!

The final speaker was Jon Bird, head of sustainability at CE Electric UK. Jon began by making a case for a smart electricity grid and outlining the current issues. The main problem is electricity-on-demand which we all take for granted to provide us with electricity where and when we want it. Generation has been run to match the loads demanded and the network has been designed to bring them both together. However, the low carbon agenda has changed this paradigm.

At the moment we have large power stations, offering flexibility in balancing supply and demand in real time, connecting via a distribution network to the end user. The first change, over the last 20 years, has been in distributed generation, such as small generators and smaller wind farms. As we move to the low carbon agenda, there will be less flexibility, with generators working at base loads. Wind farms only generate electricity when the wind blows! There are similar problems for solar and tidal generators.

Some customers are already using heat pumps. If all homes did this, the average power requirement would rise from 1.5Kw per dwelling to perhaps 5Kw. Electric vehicles need charging and each can create a demand of 7Kw. On the other hand, customers will also be generating electricity via photovoltaic cells and micro wind generators. Therefore we have to deal with a much more complex situation, with distribution becoming a two-way flow.

Active network management is a new skill that must be developed. Balancing supply and demand will become both more complex and more expensive. Ofgem's Project Discovery estimates that there will be a 14-25% increase in electricity bills by 2020, while the CBI forecasts a 30% increase by 2030. If the 'on demand' paradigm cannot be changed, prices will rise further.

Reflecting on Rachel's presentation, Jon suggested that the solution is to get smarter. We can't change the laws of physics, so generation needs to become more cost-effective and must occur where it is needed. So both active network management and active customer management is required. Improvements in energy efficiencies are essential, as is changing the demand envelope. Active micro-generation management is necessary too. However, there are still issues to be resolved. Should we use an engineer's optimisation exercise or give the choice to the customer? Should we be saving copper or carbon (i.e. use more cable to reduce power drain)? Should the system be

regulation or market driven? Who runs the virtual power plant (i.e. the thousands of individual generators)?

The level of smartness to be adopted is the customer's choice. For instance, we might use remotely read meters that give a real-time display to the user. We are fairly close to this now. A smarter system would use financial incentives using a feed-in tariff, renewable heat incentives and community energy saving programmes. It could also use 'time of use' cost-reflective tariffs enabled by smart meters. So informed users could modify their behaviour to minimise cost and carbon footprint. However it is a major communication task to deliver information to and from the customer for billing and system management.

To be smarter still, we need to move beyond the 'early adopters'. The package offered should be simple and trouble free. An analogy is Economy 7 – the package includes tariffs and equipment to offer a cheap deal to the customer.

Jon summed up by asking what happens next. Well, there is going to be a smart meter roll-out. A partnership of CE Electric, British Gas and the Low Carbon Network are to fund a bid to test the customer proposition.

The conference delegates were treated to a magic show and then a guided tour of the Magic Circle's museum. During a first class lunch, our magician entertained us with magic tricks, which were incredible even though he managed them at very close quarters!