



UK Research Grand Challenges

Joe Sventek
joe@dcs.gla.ac.uk



Outline



- A brief foray into relevant acronyms
- In the beginning ...
- What is a *Grand Challenge*?
- The current *GC* topics
- How are *GC*'s governed?
- How are *GC*'s financed?
- Current status



Acronyms



- EPSRC - Engineering and Physical Sciences Research Council - the funding body responsible for funding computer science research in the UK
- BCS - British Computer Society - a professional organization for British computer scientists
- IET - Institute of Engineering and Technology - formerly known as the IEE, a professional organization for engineers, including computer scientists; not strictly British, but primarily so
- CPHC - Council of Professors and Heads of Computing - a body with institutional members that is concerned with issues facing academic computer scientists
- UKCRC - UK Computer Research Committee - a body with elected individual members that acts as an expert panel for the BCS and the IET; one responsibility is to respond to relevant consultation requests issued by the UK government

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In the beginning ...



- 2001 international review of UK computer science initiated by the EPSRC, BCS and IET recommended large, thematic research funding programmes
- The UKCRC sponsored a workshop to assemble a collection of long-term grand challenges for Computer Science, which could contribute to the long-term advancement of the subject, and which could be selectively adopted as a basis for policy by the funding bodies.
- 100+ grand challenge submissions were received
- The workshop yielded broad grand challenge categories/clusters
- Members of each cluster were encouraged to work together to refine the cluster themes

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And then ...



- Grand Challenge conference held in 2004 to present the 7 GC topics to heads of computing; A. Bernat of the CRA participated in this meeting
- J. Sventek attended Snowbird 2004 to represent UKCRC and the grand challenge effort
- Grand Challenge conference held in 2006 to present progress to date, as well as to introduce new challenges that were beginning
- J. Sventek attended Snowbird 2006 to represent UKCRC and the grand challenge effort

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What is a Grand Challenge?



- A grand challenge should be defined as to have international scope, so that contributions by the UK to its achievement will raise the UK international profile.
- The ambition of a grand challenge must be far greater than what can be achieved by a single research team in the span of a single research grant.
- The grand challenge should be directed towards a revolutionary advance, rather than the evolutionary improvement of legacy products that is appropriate for industrial funding and support.
- The topic for a grand challenge should emerge from a consensus of the general scientific community, to serve as a focus for curiosity-driven research or engineering ambition, and to support activities in which they personally wish to engage, independent of funding policy or political considerations.

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The current GC topics ...



- In Vivo - In Silico
 - realise fully detailed, accurate and predictive computer embodiments of plants, animals and unicellular organisms
- Ubiquitous Computing: Experience, Design and Science
 - modeling, designing, implementing, integrating, managing and using the ever-burgeoning population of 'effectively invisible' computers around us, embedded in the fabric of our homes, shops, vehicles, farms and even in our bodies

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The current GC topics ... (2)



- Memories for Life
 - produce a shared understanding of what is common in memory systems and use that understanding to improve efficiency, recall and information management in an integrated way across various levels of human personal, social and work domains
- The Architecture of Brain and Mind
 - understand and model natural intelligence at various levels of abstraction, demonstrating results of our improved understanding in a succession of working robots

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The current GC topics ... (3)



- Dependable Systems Evolution
 - be able to build systems whose dependability can be justified, even in the face of the most extreme threats, to be able to put systems in inaccessible places, knowing that they will continue to work over decades
- Journeys in Nonclassical Computation
 - explore, generalise, and unify the many diverse non-classical computational paradigms and to produce a fully mature and rich science of all forms of computation that unifies the classical and non-classical (natural) computational paradigms

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The current GC topics ... (4)



- Learning for Life
 - develop new forms of e-learning environment and the effective use of new e-learning tools and facilities

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Governance



- Essential that the community feel that they own the activity
- Each GC selects a small committee of its members to provide administrative leadership for the activity
- This committee will be responsible for any external funding used to progress the work (see next slide)
- Any steering must be exactly that, influencing without power
- A steering committee was created to effect this gentle influence: the current members are W Hall, K Sparck-Jones, R Milner, A Bundy and J Sventek

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Governance (2)



- We attempt to bring some consistency to the web presence for the activity and are attempting to assess the maturity and viability of the current GC's
 - A GC Project should have a set of explicit aims, objectives by which those aims can be seen to have been achieved, and a road map for achieving them
 - A road map might consist of some of the following elements:
 - A nexus of collaborative research projects.
 - The building of an exemplar system.
 - A shared tool set.
 - A shared testbed and plans for regular evaluation of alternate approaches using this testbed.
 - Regular, but lightweight, progress reviews and reports
 - An outreach activity to engage the general public with the excitement of your grand challenge and the role of Computer Science research within it

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How are GC's financed?



- Initially, each GC topic requires funding to achieve cohesiveness among the participants and consensus on the key ideas and goals
- These can usually be best achieved through EPSRC funding of networks; such funding(£25-50k each) can be used to fund workshops at which the cohesiveness and consensus can be progressed
- Once a GC project has sufficiently matured, we hope to influence the EPSRC to create targeted funding programmes; for the Ubiquitous Computing GC the EPSRC has funded the WINES programme, initially committing £15M over 3 rounds; funding to date has been £15M over 2 rounds, funding 11 projects.

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Current status



- Starting to evaluate GC topics with regards to progression to project status
- One new research grand challenge topic has been added to the list and is going through formative stages (Bringing the Past to Life for the Citizen)
- We plan to upgrade the web presence over the next quarter by employing experts in art and visualisation http://www.ukcrc.org.uk/grand_challenges/index.cfm
- Every GC topic group is anxious to interact with like-minded individuals outside of the UK to make these truly international Grand Challenges

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