Interdisciplinary Research Collaboration in Dependability of Computer-Based Systems

www.dirc.org.uk

DIRC's Vision

Build more dependable (computer-based) systems at lower cost

- Computer-based systems

$$\text{computer-}\textit{based}\text{ systems} = \frac{\text{computers} + \text{people}}{}$$

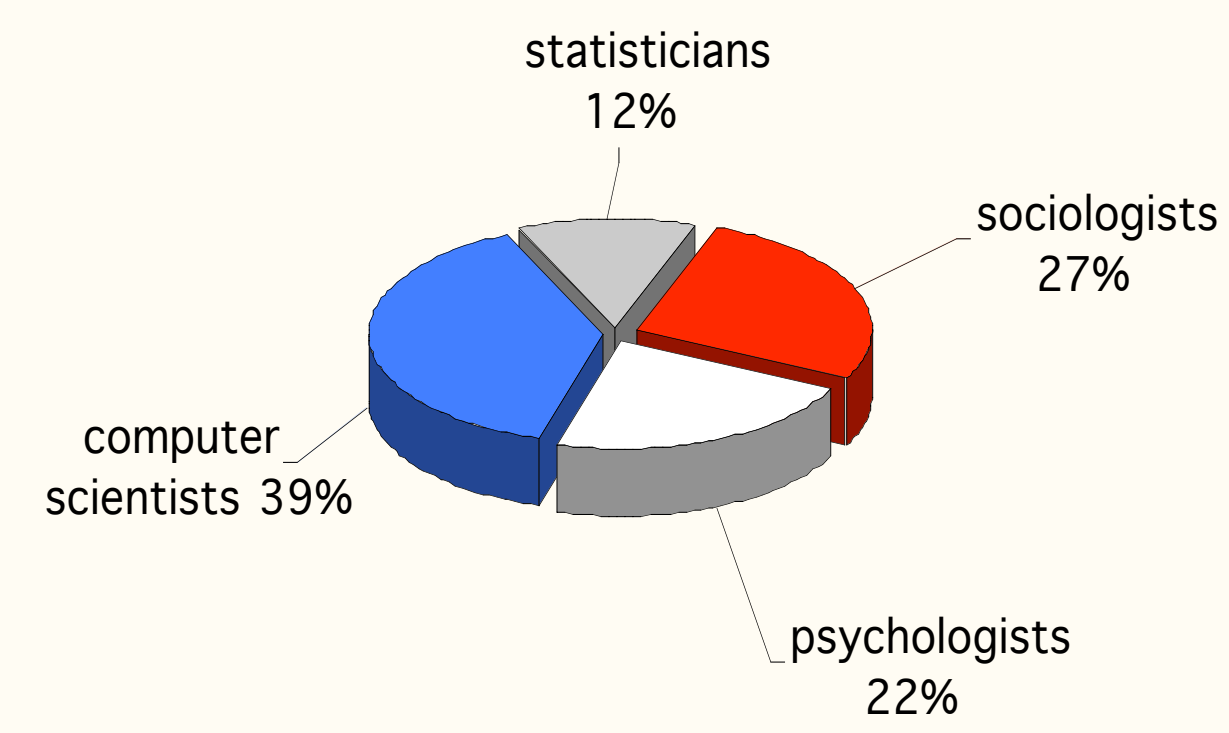
Computer-based systems
Pervasiveness of computers

- now
  - small, powerful
  - distributed
  - direct contact with large numbers of “users”
  - ubiquitous (most work now mediated by computer)
  - ca. 1M people creating “programs” in the UK alone
- 40 years ago
  - ...

Scale of DIRC

- funding ca 12M€ (EPSRC and DSTL)
- runs July 2000 – June 2006
- five UK universities
  - led by Newcastle
- 20-25 Research Associates
- more than 25 permanent staff involved
- 12 PhD students

Interdisciplinary mix



Steering Committee Members

- Martyn Thomas (Chair)
- Cliff Jones (*PD*)
- Robin Bloomfield (*ILD*)
- Rebecca Steliaros (EPSRC)
- Jon Warwick (*secretary*)
- Graham Button (Xerox)
- John Fox (Imperial Cancer)
- Tom McCutcheon (DSTL)
- Roger Needham
- Colin O'Halleron (Qinetiq)
- Fred Schneider (Cornell U.)
- Rob Witty (NATS)

Industrial Advisory Board

- Balance - sectors, size
  - Stephen Hale, NATS
  - Jim Horning, Network Associates Laboratories
  - Mel Jackson, Praxis Critical Systems
  - Bob Jennings, Health & Safety Executive, NSD
  - Frank van der Linden, Philips Medical Systems
  - Dave Lomet, Microsoft Research, Redmond
  - Paul Loveless, BACS
  - Patrice Nigon, Swiss Re
  - Lawrence Regan, Barclays Solutions
  - Iain Smith, Dependable Systems

Senior Visiting Fellows

Gregory Abowd (College of Computing, Georgia Institute of Technology), **Phil Agre** (Graduate School of Education and Information Studies, UCLA), **Stephen R. Barley** (Dept. of Managment Science and Engineering, Stanford University), **Jack Carroll** (Virginia Polytechnic Institute and State University), **Peter Galison** (Department of History of Science, Harvard University), **Michael Jackson** (Author and Consultant on System Design), **Gilles Kahn** (INRIA), **Jean-Claude Laprie** (LAAS-CNRS), **Bruno Latour** (Centre de Sociologie de l'Innovation, Ecole des Mines de Paris), **Nancy Leveson** (Aeronautics and Astronautics Dept., MIT), **Jessica Litman** (Professor of Law, Wayne State University), **John McCarthy** (Department of Applied Psychology, University College Cork), **Peter G. Neumann** (Principal Scientist, SRI), **Charles Perrow** (Department of Sociology, Yale University), **John Rushby** (Computer Science Laboratory, SRI), **Scott Sagan** (Center for International Security and Arms Control, Stanford University), **Susan Leigh Star** (Dept of Communication, UCSD), **Diane Vaughan** (Sociology Department, Boston College), **Pierre-Jacques Courtois** (Département d'Ingénierie Informatique, Université catholique de Louvain), **Ian Hayes** (School of Information Technology and Electrical Engineering, University of Queensland), **Tom Lincoln** (Private Consultant - ex Rand), **Kristen Nygaard †**

DIRC's Initial 2-D Structure

- Research Themes
  - cut across disciplines
  - intended to last throughout DIRC
  - relationships to computer systems are interestingly different from their relationships to the surrounding environment of people and organisations
- Project Activities
  - (relatively) short-term – ca. 3 years
  - each interdisciplinary
    - ... and multi-site
  - focus of DIRC's main deliverables
  - medium of interaction with "industry"
    - throughout, "industry" includes ...

Project Activities

Human interaction in real-time systems

Organisational culture and trust

Deployment and evolution

Decision support for dependability

Open-Source software

Security and privacy

Dependable ubiquitous computing in the home

Effective collaboration in design

Dependable service-centric Grid computing: QoS

Some technical pointers

- determining specifications of control systems
- role of “classification”
- notion of “process”
- doubts on “advisory systems”
- “patterns” of ethnographies
- “micro-worlds” for timing experiments
- programmer ability vs. MBTI

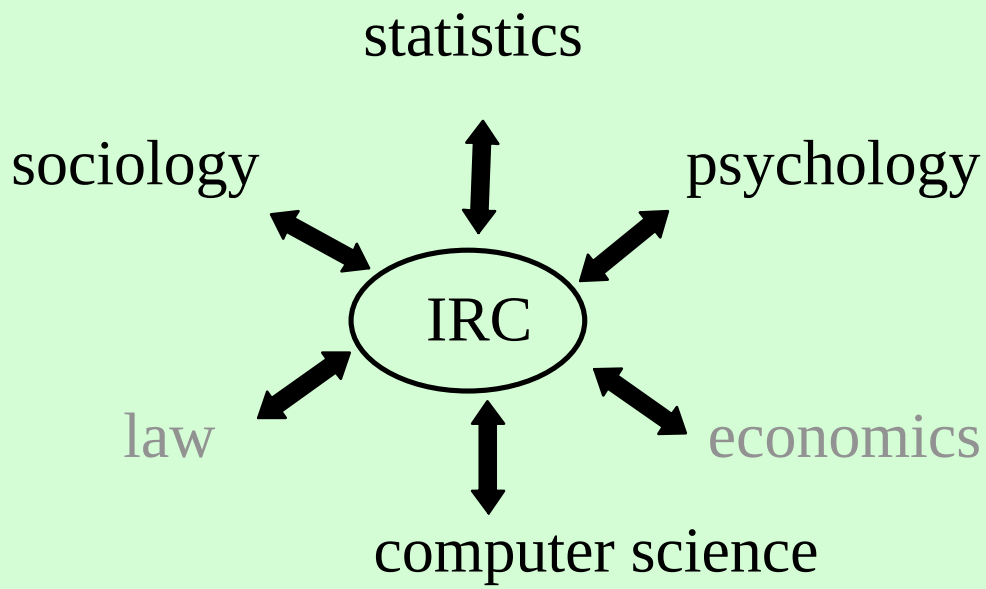
Some more pointers

- 200+ publications and reports
  - differences in forms of publication
- Donald MacKenzie's book

  Mechanizing Proof: Computing, Risk, and Trust
  - RKM Prize of American Sociological Association
    - (plus ESRC Research Professorship)
- "Trust in Technology" book

Research themes: computer systems *and* people

- risk
- timeliness
- diversity
- responsibility
- structure



Progress – Research Themes

- essential property: two way look at theme
- long-term
  - even beyond lifetime of DIRC
- act as “conscience”
- main objectives
  - gather “wisdom” of theme from PAs
  - write book(s) – integrate knowledge

Reasons for recent DIRC restructuring

- need to increase focus on Research Themes
- replace “Project” by “Targetted” Activities
- 3-12 months duration, rather than 2-3 years
- always interdisciplinary, normally multi-site
- many *targetted* topics coming up
  - tools
  - (interventionist) case studies
  - dependability syllabus
  - ...
- flexibility!

Targetted Activities - *examples*

- "Trust in Technology" book
- "GOLD" project
- mammography case study
- Chaum (e-voting) case study
- NATS
- ...
- dependability syllabus
- psychology of programming experiments

DIRC Workshops (external)

- Dependability in Healthcare
  - Edinburgh March 2001
- Open Source Software
  - Newcastle Feb 2002
- ACM SAC'2002 Interdisciplinary Track
  - Madrid 2002
- (with AMASE) Ethnography, ...
  - Lancaster 2002
- Dependability/Components
  - Schloß Dagstuhl November 2002
- SAFECOMP in Edinburgh

Workshops (cont)

- Health Record
  - Edinburgh December 2003
- Legal aspects workshop
  - Gray's Inn, London, Feb 2004
- Identity cards briefing – with
  - with RAEng, Feb 2004
- HEAT (ex PA7)
  - York March 2004
- Atomicity
  - Schloß Dagstuhl April 2004
- ...
- Workshop on *interdisciplinarity* (with AKT)

“Mid-term review” in 2003

- super, interdisciplinary, team built
  - trust between, understanding over, disciplines
- real collaboration
  - between disciplines
  - across sites
- conclusions
  - “DIRC is redefining the agenda for Dependability”
  - “exceeded all expectations”
  - must find ways to continue beyond 6 years

Things we have learned

- IR is (even) hard(er)
  - John Goddard's warnings
    - words/numbers (symbols) distinction
    - observe/change split
  - it's *not* terminology so much as *values*
- without IR we would have got nowhere
  - CSc as bridge!?
  - OR-like attacks beneficial
  - achieved: mutual respect

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