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Failure-driven reasoning about representational mismatch

- Grew out of work in the Mathematical Reasoning (DReaM) group. Has been a key focus of the group for more than 10 years.

- Key idea: *Failure of a reasoning process is often caused by inadequacies in the underlying representation. Analysing the causes of the failure can point to problems in this representation, and addressing these problems can lead to successful execution of the reasoning process.*

- Most of the work in this area led by Alan Bundy and/or Fiona McNeill.

- Many projects based on or incorporating these ideas have been carried out to date.

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Failure-driven reasoning about representational mismatch

- Applied in various areas:
  - Ontology mismatch and evolution in:
    - multi-agent systems*
    - physics
  - Service integration / choosing appropriate peers in a p2p network*
  - Guesstimation
  - Query matching in large data sources*
  - Reverse-engineering of secure devices*
  - Reasoned models

* Work primarily led by McNeill

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Data Sharing during an Emergency Response situation

- E-response situations characterised by:
  - many organisations coming together very quickly;
  - may be trusted partners; may be unknown;
  - large amounts of data available, much of it irrelevant;
  - pertinent data needs to be shared quickly and accurately.

- Automated data sharing depends on organisations being able to formulate appropriate queries, but these will usually be to data sources they don't know.

- We have developed the **CHAIn system** which uses **query failure** to reason about **schema- and data-level mismatch**, reformulate queries according to extracted matches and return appropriate responses despite mismatch.

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Data Sharing during an Emergency Response situation

- Current work jointly funded by
  - Dstl/EPSRC
  - ONR Global

- Current collaborating with SEPA (Scottish Environmental Protection Agency); many other collaborators lined up for later extension (Strathclyde Fire&Rescue; Scottish Resilience; Met Office).

- Current proof-of-concept system nearing completion; initially evaluation promising but much remains to be done.

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Data Sharing during an Emergency Response situation

- Future work will focus on:
  - Theoretical extensions;
  - A more complete picture of automated data sharing during e-response scenarios;
  - Integrating provenance information in returned results;
  - Effective interaction with users to develop optimal results;
  - Extensive simulation in collaboration with end-users to effectively evaluate the approach.