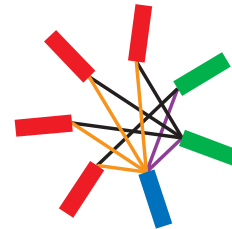


# New understanding to complex and costly problems



Dr John Galloway describes the science of his NetMapping invention and how it is assisting business to solve complex problems from governance to marketing

Australian software is being used around the world to discover hidden information in data – often in fraud detection, intelligence and policing applications – and it is now being applied to uncover commercial value in many varied business applications.

The power to untangle extremely complex webs of fraud spun by master criminals is being applied to solve equally complex business problems such as those that relate to growth in revenue or earnings before business and income tax – EBIT. Likewise research institutes in several countries working in the field of ‘complexity science’ are untangling massively complex models using the NetMap software.

Conventional analytical approaches often skip a step. Analyses of the way people or systems behave, typically produce as their main output ‘exception reports’ – e.g. in the context of fault detection in telecommunications data, fraud detection in insurance and retail environments, distinguishing customer behavioural patterns, detecting incidents

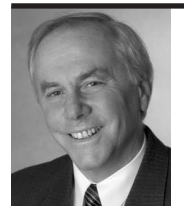
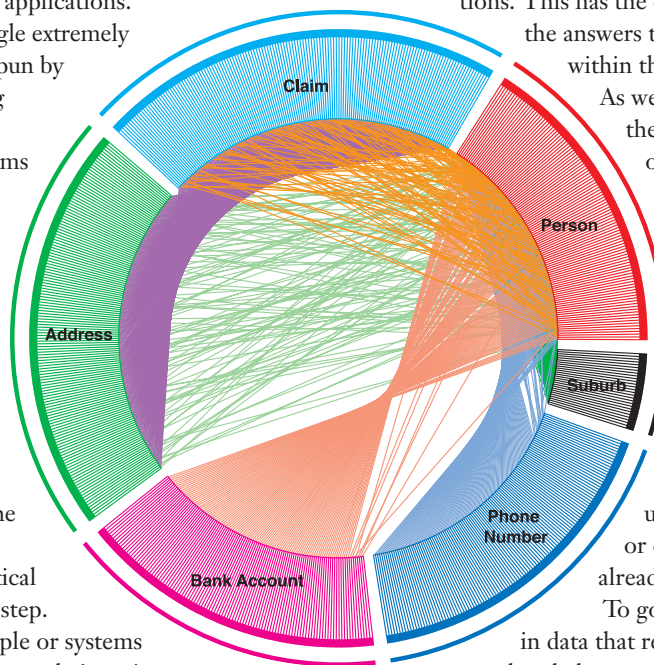
of inappropriate audit, or governance occurrences.

The problem is that exception reports imply that you know ahead of time what it is that you are looking for, and that means you need to specify rules or conditions. This has the effect of constraining the answers that can be found to lie within the parameters specified.

As well as this conundrum, there is the difficulty, more often impossibility, of knowing what are appropriate definitions and rules that will be used to constrain the answers. One simply does not know ahead of time what to ask of the data for most complex, non-linear and unpredictable problems, or else the problem would already have been solved.

To go looking for patterns in data that reflect exceptions to rules one already knows about misses the point – one needs a discovery step first of all to find out what constitutes ‘regular’ and ‘irregular’ behaviour, transactions, or whatever.

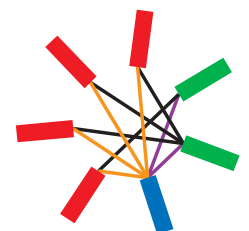
The human mind is a very powerful computer on



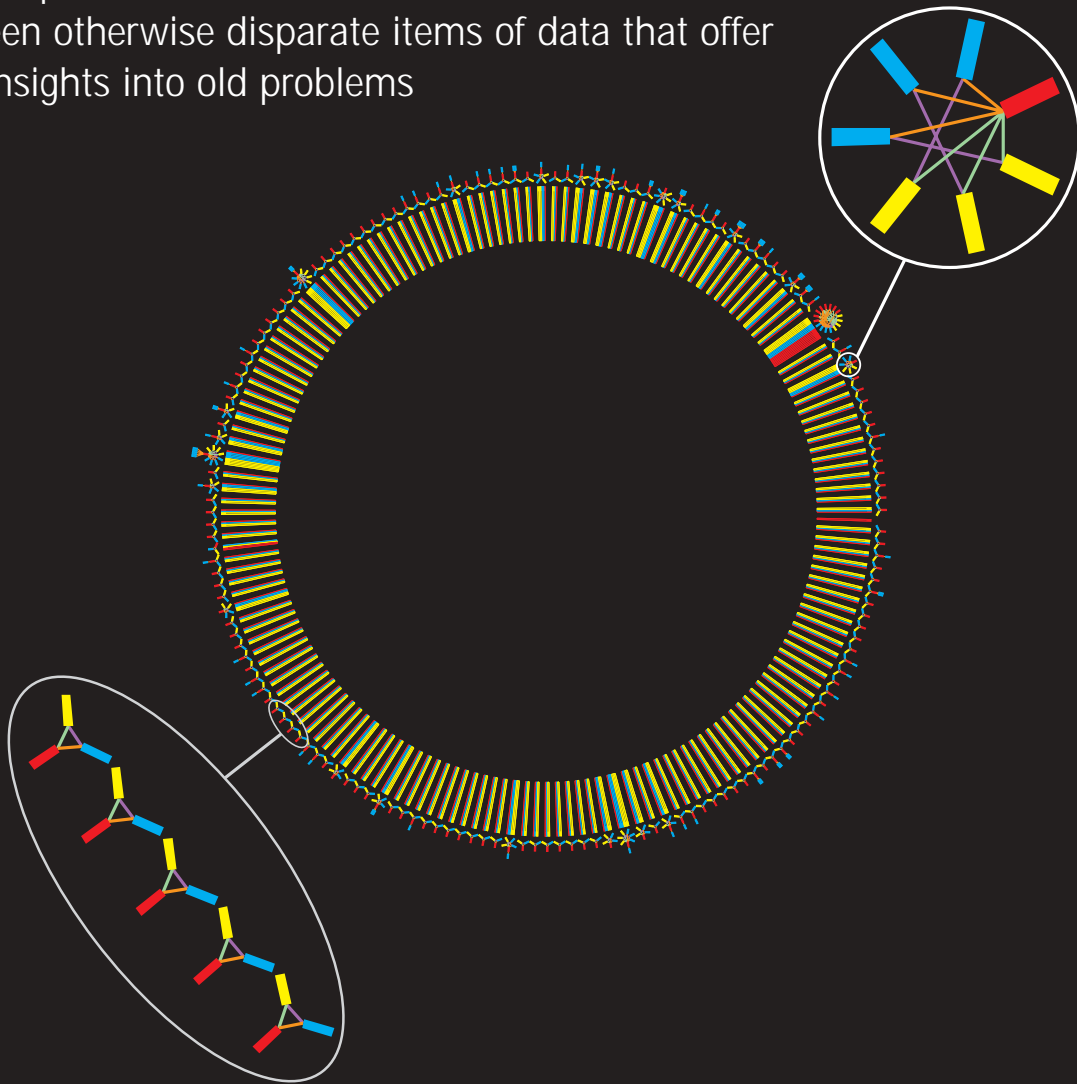
Dr John Galloway is chief scientist at NetMap Analytics Pty Ltd. He invented the NetMap software. Dr Galloway is adjunct professor of business intelligence and director of the Complex Systems Research Centre at the University of Technology, Sydney. E-mail: [jgalloway@netmap.com.au](mailto:jgalloway@netmap.com.au)

**CASE STUDY: BACKPACKER MURDERS CASE**

Australia’s most notorious serial murder case in which seven young people were abducted and murdered was solved with the assistance of NetMap. Working with the NSW Police, the NetMap software was applied with little preconception to vehicle registration records, gun licensing and internal police records. The list of suspects was progressively narrowed over four months from everyone in Australia to a short list of 230, and then a still shorter list of 32 suspects, which included Ivan Milat who was subsequently jailed for these crimes in July 1996.



It is the patterns of connections and inter-connections between otherwise disparate items of data that offer new insights into old problems



Above NetMap uniquely shows emergent patterns of strongly linked data items. Most groups appear as 'regular' – bottom left. They comprise one person (red), one address (yellow) and one insurance claim (blue) linked to each other. But some stand out as 'irregular' – top right.

the one hand and also a superb distinguisher of patterns that might be regular or irregular on the other hand – far more so than any electronic capability so far devised. When assisted by *unique algorithms* in NetMap, the analyst's intuitive powers are maximised so that they can see things in the data not otherwise possible.

#### Train-of-thought analysis

The contention in NetMap has long been that in order to distinguish between regular and irregular transactions or activities, there is a definitional problem, and by presenting data as colour-coded maps, the inquiring mind of an analyst can spot what seems to be unusual, irregular, or whatever, even though they might be hard pressed to say why, let alone write a rule that defines something exceptional. The analyst simply thinks: 'Those red links over there look a little unusual – they are all pointing to something. I wonder what they are connected to, and in turn what they are

connected to.' We call this train-of-thought analysis, which almost always enables NetMap to find answers to questions that one cannot figure out how to ask.

#### Connectivity

Another concept inherent in NetMap is that of connectivity. Connections between events or people are often more revealing than simply knowing how many events or people of one type there are versus how many of another type. Of course that can be useful, but it is a different type of information to a mapping based on specialised algorithms and colour-coded displays. A bar graph simply says what the number of occurrences are, but says nothing about the inter-relationships between occurrences. In our experience, it is the patterns of connections and inter-connections between otherwise disparate items of data that offer new insights into old problems. These occur often in the strangest ways in data, such that one could



**CASE STUDY: Airlines cost savings**

Qantas Airways had been experiencing cost overruns on 'special meals'. It was believed that travel agents were ordering the relatively expensive 'special meals' unnecessarily as a favour to clients. Qantas engaged a team of consultants from North America who spent nine weeks analysing the problem, unsuccessfully. NetMap was then engaged. The data preparation phase took three days. Then, within two hours, the NetMap software revealed that the problem had little to do with particular agents. Instead, on flights in and around SE Asia that coincided with Ramadan, passengers were ordering 'special meals' in order to obtain white meat that was not on the normal menu. By including white meat on normal menus for those flights for that time of the year, the company immediately saved \$250,000 per year.

field known as complexity theory or complex systems science. This examines the way small local actions can at times self-organise into larger patterns and also embraces chaos theory with its notion of prediction from seemingly random patterns of activity.

Complexity theory is a designated priority research area in many countries, including Australia, because it offers a conceptual framework for understanding many problems that have so far proven difficult or impossible to overcome. These tend to be characterised by many interacting components where the complexity of the interactivity and its inherent non-linearity makes it virtually impossible to manage or predict overall system behaviour. It can be said of a system that 'the whole is greater than the sum of its parts'.

In the past, science has focused on a reductionist approach. Its methods and assumptions have analysed the components of complex systems in detail. However, they have ignored the interactivity of the components and structure of that interactivity, which makes it difficult to understand the behaviour of systems as a whole. The field of complex systems focuses on the interactivity, and extends across many branches of science.

**Diverse applications**

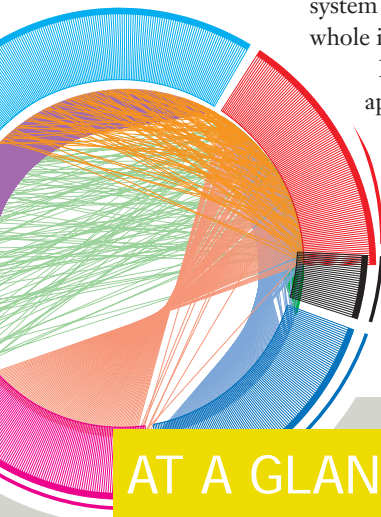
Now NetMap is being applied to more and more complex business problems, including interesting challenges such as:

- + Showing quantifiably how well an acquired company has been integrated into its new parent
- + Discovering market segments that self-define according to their attitudes to certain brands
- + Discovering where a database is losing data integrity and identifying all records that need correction

As a consequence of the solution's unique capabilities for understanding complex patterns of interaction, NetMap Analytics has secured collaborative research projects with such institutions as the London School of Economics, the Santa Fe Institute, UCLA, and the University of Technology, Sydney (UTS).

**Where to from here?**

Currently NetMap's research projects are varied and fascinating, with activity in many unexpected fields. The only certainty for the future is many more 'unexpected' projects that discover enormous value, and a good flow of patentable outputs.



**AT A GLANCE: NETMAP ANALYTICS PTY LTD**

**COMPANY NAME**

NetMap Analytics Pty Ltd

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**CHIEF SCIENTIST:** Dr John Galloway

**WEBSITE:** www.netmapanalytics.com.au

**STARTED:** 1991

**PRODUCTS:** NetMap software

**COMPANY LOCATION**

- + Head Office: Sydney, Australia
- + Partners in US, Europe, Middle East, Africa, New Zealand, Asia

**SECTORS OF APPLICATION**

- + Telecommunications
- + Financial services
- + Retail
- + Insurance
- + Government
- + Logistics
- + Law enforcement and security

**KEY USE**

- + Fraud detection, deterrence and security
- + Intelligence and policing
- + Network analysis
- + Marketing
- + M&A integration success
- + Financial and Process Audit
- + Organisation performance

**KEY MARKETS**

- + Australia, Asia Pacific, Europe, Middle East, Africa, North America, SE Asia