

Military OR and ISMOR - a 30th Symposium Retrospect

30 ISMOR

29 July - 2 August 2013

Royal Holloway, University of London

Roger Forder

Gene Visco

Plan of action

- General trends and observations (and a few challenges for the future)
- Review of 10 to 28 ISMOR (evens)

The strategic backdrop

Three epochs and two turning-points

Epoch 1: 1984-1990

- The last years of the Cold War
- **Turning-point:** Fall of Berlin Wall, dissolution of USSR and WP

Epoch 2: 1991-2001

- Gulf War I
- The heyday of 'OOTW': Bosnia, Kosovo, Haiti, Sierra Leone, East Timor ...
- **Turning-point:** 9/11 attacks

Epoch 3: 2002-2013

- Counter-terrorism
- Afghanistan, Iraq, Afghanistan
- Regional intervention becomes hard going; counter-insurgency

Epoch 1: The last few Cold War years

- Anyone younger than about 45 missed analysing it!
- Essentially a single scenario - all-out conflict between NATO and Warsaw Pact (USSR and allies).
- Analysis dominated by use of combat simulations (often large and growing) and wargames
- ISMOR programmes dominated by models and studies related to combat, C3ISTAR, logistics and some human factors, mostly at mission or system level

Cold War ends. USSR and WP dissolved

```
graph TD; A[Cold War ends. USSR and WP dissolved] --> B[Single, determinant scenario disappears]; A --> C[Active operations become more frequent]; B --> D[Expanded scenario base for analysis  
Need to analyse new types of operation]; C --> D;
```

Single, determinant
scenario disappears

Active operations
become more
frequent

Expanded scenario base for analysis
Need to analyse new types of operation

Cold War ends. USSR and WP dissolved

```
graph TD; A[Cold War ends. USSR and WP dissolved] --> B[Single, determinant scenario disappears]; A --> C[Active operations become more frequent]; B --> D[Expanded scenario base for analysis  
Need to analyse new types of operation]; C --> D;
```

Single, determinant
scenario disappears

Active operations
become more
frequent

Expanded scenario base for analysis
Need to analyse new types of operation

Direct analytical support to operational commanders and planners

- No papers from 1984-1990. 18 in 1991, 5 in 1992. On average 1 or 2 papers every year since.
- **Gulf War I** Focus on combat and logistics
- **Remainder of Epoch 2** Major innovation: monitoring progress in peace-support operations.
- **Epoch 3** More sophisticated approaches to campaign monitoring (surveys, media monitoring). COIN also brings fresh challenges, greater urgency - new focus on support to intelligence with statistics, probabilistic modelling, social network analysis, etc.
- Work has also broadened to include advice on integrated use of all instruments of power
- More nations have become involved - Canada, Australia, Netherlands, Norway as well as US, UK and NATO commands

Operational data collection and analysis

(for model building and validation)

- Increased number of active operations seen as a great opportunity to put modelling on a firmer, more empirical basis
- Some early efforts reported
 - e.g. detailed reconstruction of 'Battle of 73 Easting' (Gulf War I) used to support both analytical models and training
- But, despite the mass of data in principle available from peace-support (Epoch 2) and nation-building / COIN (Epoch 3) operations, aspirations generally unrealised (fair?)
- Potentially the key to understanding the drivers of influence, perception and behaviour
 - Applegat & Cameron - *Best Practices for IW Data Quality Control* (2012)

Operational data collection and analysis (for model building and validation)

- Increased number of active operations seen as a great opportunity to put modelling on a firmer, more empirical basis
- Some early efforts reported
 - e.g. detailed reconstruction of 'Battle of 73 Easting' (Gulf War I) used to support both analytical models and training
- But, despite the mass of data in principle available from peace-support (Epoch 2) and nation-building / COIN (Epoch 3) operations, aspirations generally unrealised (why?)
- Potentially the key to understanding the driver of perception and behaviour
 - Appleget & Cameron - *Best Practices for IW Data Quality Control* (2012)



Challenge!

Other study areas (temporarily?) stimulated by active operations

- Casualty estimation and medical studies
- Fratricide and combat identification
- Assessing the cost of operations

Cold War ends. USSR and WP dissolved

```
graph TD; A[Cold War ends. USSR and WP dissolved] --> B[Single, determinant scenario disappears]; A --> C[Active operations become more frequent]; B --> D[Expanded scenario base for analysis  
Need to analyse new types of operation]; C --> D;
```

Single, determinant
scenario disappears

Active operations
become more
frequent

Expanded scenario base for analysis
Need to analyse new types of operation

Working with an expanded scenario base

- Scenarios - general issues
 - What's our philosophy?
 - How do we generate them?
 - How do we select them for particular studies?
 - Popular topic - symposium theme in 2002
 - Interesting area for comparison of differing national approaches
- Geopolitical analysis / forecasting
 - Identifying origins, locations and characteristics of future crises
 - Occasional papers since 1993 - wide variety of approaches
 - What level of genuine planning utility have we reached?
- Need structured ways of conducting analyses (force structures, system acquisition, etc) on a multi-scenario basis
 - Fairly regular topic

Modelling the new types of operation

Combat

- Needed more flexible models needed to represent a wider range of operational concepts (manoeuvrist, NCW/NEC, etc)
- Great stimulus given to better understanding and modelling of C2
- No shortage of computer power
- Successful developments during Epoch 2
- Now rarely on ISMOR agenda - are our models of traditional combat now good enough?

Modelling the new types of operation

OOTW / Irregular Warfare

- Starting from scratch! Early ambitions for models that paralleled those of traditional combat ('wind-up-and-go')
- Many approaches used - good work done - but ambitions not really achieved
- Key issue is understanding and modelling influence, perception and behaviour (social sciences)
- Focus in Epoch 3 has moved to increasingly well-established computer-assisted gaming methods ...
- ... but still need validation from operational data structured by appropriate theory

Modelling the new types of operation

OOTW / Irregular Warfare

- Starting from scratch! Early ambitions for models that paralleled those of traditional combat ('wind-up-and-go')
- Many approaches used - good work done - but ambitions not really achieved
- Key issue is understanding and modelling influence, perception and behaviour (social sciences)
- Focus in Epoch 3 has moved to increasingly well-established computer-assisted gaming methods ...
- ... but still need validation from operations and supported by appropriate theory



Challenge!

What other new topic areas have emerged?

New or improved frameworks / processes for analysis ...

- to support defence reviews (SDSR, QDR, etc) and other total-force analysis
- for capability measurement, capability-based planning, capability audit, capability management, capability portfolio analysis, ...
- to support concept development
- to address 'tricky' aspects of the defence and security space (C3, ISTAR, chem/bio, cyber ...)
- to address 'Defence Lines of Development' in an integrated way
- etc, etc

Compared with early ISMORs, fewer papers on specific types of mission / system or specific models

What other new topic areas have emerged?

- Peacetime management problems
 - Personnel planning
 - Training policy
 - Vehicle fleet management
 - Affordability and budgetary analysis
 - Acquisition management and behaviour
 - ...
- Green issues
- Engaging the decision-maker; the impact of OR

What other new topic areas have emerged?

- Peacetime management problems
 - Personnel planning
 - Training policy
 - Vehicle fleet management
 - Affordability and budgetary analysis
 - Acquisition management and behaviour
 - ...
- Green issues
- Engaging the decision-maker; the



Challenge!



Challenge!

Techniques over the years

- Rise and rise of spreadsheets and databases (with programming add-ons)
- Discrete-event simulation
 - Probably still in heavy use but ISMOR papers distinctly fewer
 - Have areas of modelling for which it is appropriate – combat, logistics processes, etc - reached maturity?
- Historical analysis
 - Shift in emphasis from detailed estimation of ‘stress of battle’ factors to broader issues

Techniques over the years

- Major increase in human-in-the-loop methods
 - Gaming - focus on influence, perception, behaviour in peace-support, nation-building, COIN
 - Synthetic environments and war-fighting experiments
 - Decision-support aids to present options, capture judgements, display deductions (traffic lights, dashboards ...)
 - Classic 'soft OR' - influence diagrams, cognitive maps, multi-criteria decision analysis, benefit chains, etc.
 - *Stimulated by complexity of current strategic / operational environment*
 - *Facilitated by ubiquity and power of desktop computing and software*

Techniques over the years

Other approaches prominent in recent years ...

- Agent-based simulation
- Network analysis methods
- System dynamics
- Statistics and probabilistic reasoning (support to operations)
- Ideas of complexity, chaos, self-organised criticality, etc

That's a quick survey of the general picture

Over to Gene!