

## An American Foray Into Soft OR

A Report on the  
Conduct of a Case Study  
in Partial Fulfillment of the Requirements for a Ph.D. Program

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## Operations Research - Vision and Reality

- As envisioned:
  - A quantitative problem solving approach
  - Interdisciplinary teams
- Current reality:
  - Increasingly aligned to a handful of mathematically rigorous techniques
  - Limited recognition and acceptance of the social and behavioral sciences' contributions
  - Difficult to provide timely, useful solutions to real world problems that require both qualitative and quantitative techniques

## Purpose of the Case Study

- To effect change within the U.S. military OR profession by:
  - Introducing soft OR concepts and techniques
  - Highlighting where such methods are currently used

## Selected Vehicle for Effecting Change

- The Education and Professional Development Colloquium of the Military Operations Research Society (MORS)
- MORS is the premier professional association serving the U.S. military OR community
- Provides a professional forum for peer review of military OR studies and analyses
- Activities include symposia, workshops, publications, honoraria

## Selected Colloquium Theme

- Participation in the International Symposium of Military Operational Research held annually in the United Kingdom
- Presentations that discussed some of the changes and challenges facing the use of traditional quantitative OR techniques
- Increased use and integration of soft methods into the traditional analyst's toolkit

## Underlying Assumptions

- There is value in considering alternative approaches
- Soft methods might be useful if better understood
- Little education about soft OR is available
- Resistance to controversial theme anticipated
- Unbiased results required that the case study be conducted independently of the Colloquium

### Literature Review

- Soft OR
- Complementary integration of qualitative and quantitative methods
- Teaching approaches

### Definitions

- "Non-classical formal approaches for the support of managerial problem-management activities" that seek relevance of its theories, tools, and techniques to real world problems. (Ledington and Donaldson, 1997)
- Methods that help understand, clarify, and communicate the problem where individuals hold different views on what the problem may be. (Matthews and Bennett, 1986)
- Soft OR methods allow "small groups of people working together to structure issues and explore different ways of improving the situation". (Ormerod, 1996)
- Soft OR emphasizes problem structuring to understand the situation. (Jackson, 1991)

### Historical Foundations of Soft OR in the Literature

- Analysis is only useful if it provides insight and possible solutions to problems that are of interest to the decision maker. (Ackoff, 1979)
- Technology must incorporate nontraditional inputs, such as "subjective preferences, ethical positions, and aesthetic judgements". (Boland, Tenkasi, and Te'eni, 1996)
- It is a responsibility of the OR analyst to address in the analysis "nonquantitative aspects that may need consideration" by the decision maker. (Morse and Kimball, 1970)

### The Nature of OR as a Discipline

- Lack of involvement of OR in social problems and the absence of a working relationship with the social sciences (Dando and Bennett, 1981)
- Divergence of theoretical research and teaching from the needs of practical application (Checkland, 1983)

### Broadening the Analyst's Toolkit

- The OR community needs to redefine itself in light of a changing reality. (Ormerod, 1998)
- The current trend of defining OR in terms of its models [and its use of technology] has sacrificed both relevance and breadth. (Abbott, as cited in Ormerod, 1998)
- Nonquantitative methods may be used in OR to augment traditional quantitative methods. (Keys, 1989)
- Soft OR offers methods that aid in resolving social conflicts and structuring complex problems. (Rosenhead, 1986)

### Rationale Supporting Complementary Integration of Qualitative and Quantitative Methods

- Rossman and Wilson (as cited in Miles and Huberman, 1994)
  - Corroborate findings
  - Elaborate quantitative analyses
  - Examine unexpected findings
- Greene, Caracelli, and Graham (as cited in Creswell, 1994)
  - To achieve convergence of results
  - To identify overlapping facets that emerge upon closer inspection using multiple methods
  - To augment the information gained from the use of an initial approach
  - To identify and examine contradictions obtained from multiple sources
  - To add scope and breadth to a study

### Guidance for Integrating Qualitative and Quantitative Methods

- Complementary integration recognizes that sharing and overlap between qualitative and quantitative approaches can and do exist (Firestone, 1987)
- "Each approach adds to our body of knowledge by building on the information derived from the other approach" (Newman and Benz, 1998)
- An appropriate mix of both methods can be used for problem solving so that approaches and solutions are comprehensive and support a wider variety of problems (Jackson, 1991)
- Think creatively about the problem context before selecting a methodology to use in its solution. (Brocklesby, 1995)
- Operations research practitioners must be flexible in how analytic results are provided to their decision makers and use whatever methods best suit those decision makers. (O'Keefe, 1989)

### Teaching Literature

- Methods to conduct and assess the Colloquium
  - Critical thinking
  - Peer learning
  - Socratic discussion
  - Methods for eliciting balanced participation
  - Graphic representations
  - Kolb Learning Style Inventory

### Focus of Colloquium 2000

- The Colloquium was held on 4-5 April 2000; 44 participants representing all sectors of the U.S. military OR community
- The theme was:  
*Expanding the Sciences - The Interdisciplinarity of OR*
- The interdisciplinarity of interest was the application of soft OR methods to military OR
- The Colloquium addressed many of the soft OR methods that figured largely in the British OR literature

### Colloquium Emphases

- Soft OR methods can be used to **AUGMENT** traditional quantitative methods, but **DO NOT REPLACE** our traditional tools and techniques.
- The purpose of the Colloquium was to **EXPLORE** the applicability of soft OR methods for the practice of military OR, **not to advocate** their use.

### Colloquium Objectives

- Provide tutorials to enhance participants' knowledge of soft OR methods.
- Demonstrate opportunities for use of soft OR methods through Application presentations.
- Examine the potential for inclusion of soft OR methods in current military OR curricula.
- Hidden agenda - Conduct a case study to meet the program requirements of the Walden University Ph.D. program in Applied Management and Decision Science (Operations Research).

### The Importance of the Hidden Case Study

- Strong objections from one member of the organizing committee
- Vehement opposition to the Colloquium theme
- Reported volatile interactions with soft OR proponents in the past
- Would not be party to any event that effectively "diminished the heritage" of traditional OR
- Refused to participate in the Colloquium

## Summary of Colloquium Presentations

- Soft OR Methods Tutorials Session – Dr. Mark Youngren, Session Chair
  - Ms. Beth Polakoff and Ms. Donna Osborn, Novigen Sciences, Inc.  
Topic: Survey Research Methodologies
  - Mr. Jim Murphy, Dynamics Research Corporation  
Topic: Decision Making During Current Operations
- Soft OR Applications Session – COL Andrew Loerch, Session Chair
  - MAJ Bob Larsen, U.S. Army, George Mason University  
Topic: The Use of Case Study Analysis in Army Procurement Decisions
  - CDR Kevin Amos, U.S. Navy  
Topic: Squishy Operations Research
  - CAPT Michael F. Winthrop, U.S. Air Force, AFSAA  
Topic: CZISR Aircraft Investment and Organizational Solutions
  - Mr. John Holt, HVR Consulting, U.K.  
Topic: The Use of Soft OR Techniques in Defence Analysis in the U.K.
  - Dr. Brian G. McCue, USMC, Twenty Nine Palms, CA  
Topic: Soft OR Use in Marine Experimentation

## Summary of Colloquium Presentations (cont.)

- Soft OR Applications Session (cont.)
  - Dr. Alyson Wilson, Los Alamos National Laboratory  
Topic: Data, Information, and Knowledge Integration to Support Decision Making
  - LtCol Kirk Yost, U.S. Air Force, J-8  
Topic: Soft Analysis Techniques in Joint Analysis
- Military Operations Research Education Session – LTC Jack Kloeber, Session Chair
  - Dr. Dennis Buede, George Mason University  
Topic: Civilian Graduate OR
  - Mr. Jack Keene, JHUAPL  
Topic: The Naval Postgraduate School OR Program
  - LTC Jack Kloeber, AFIT  
Topic: Update on AF Graduate OR
  - Mr. Dennis Fuller, ALMC  
Topic: Update on Continuing Education Courses

## Key Colloquium Findings and Products

- Many real world problems require the use of soft OR methods to structure the problem, provide insights, and suggest solutions.
- The use of soft OR methods may require the involvement of multiple disciplines, which supports the historical interdisciplinarity of our profession.

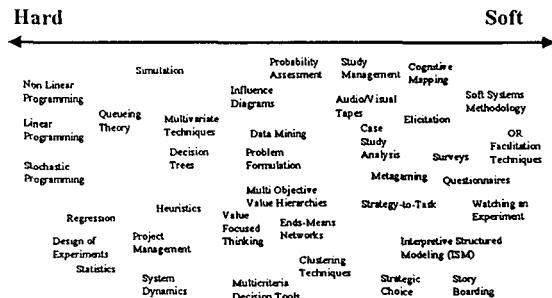
## Lessons Learned

- Soft OR methods are most useful during the early stages of problem definition and analysis. The analyst should transition to more rigorous/hard OR methods as the problem domain and context become more manageable and defined.
- Case studies, like other methods of analytic lessons learned, should be encouraged as part of a professional literature review for similar experience within a given problem domain.
- Applications increasingly rely on the observation of and elicitation of human perception and performance in a given context. These challenges require skills in survey design, interviewing techniques, and organizational design.
- In most soft OR examples, the utility to the decision maker was attributable to that portion of the effort known as "Understanding the Problem".
- In most soft OR techniques, a comprehensive exposure to the techniques and possible limitations in data and assumptions must be exposed to the decision maker as part of the presentation of results. This provides the decision maker with insight into the risk or confidence level associated with using that decision support information.

## Limitations of Soft OR Methods

- Inability to replicate results where human decisions and actions are involved.
- Ability of a single strong personality to influence the overall group's decisions.
- Difficulty in understanding and modeling human behavior.
- Variability in interpretations of soft OR results/qualitative responses.
- Dependence on the abilities of the facilitator.
- Tendency of subjects to think in terms of alternatives instead of values.

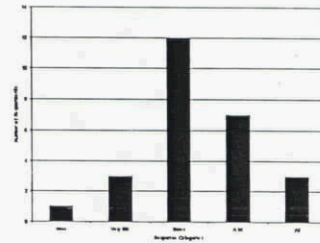
## A Nominal Continuum of OR Methods



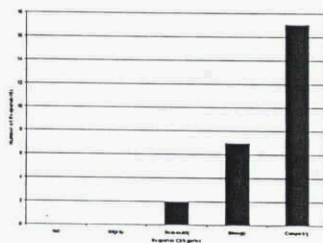
### Kolb Learning Style Inventory

- Used to assess whether the Colloquium participants acquired new learning about soft OR methods as a result of attending the Colloquium
- Sent via email immediately after the event
- Responses allowed via email, fax, in person
- 59% response rate (26 responses)

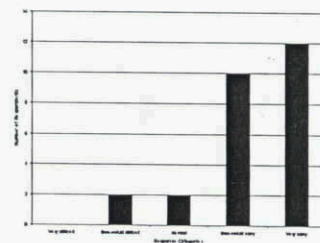
### Respondents' Reported Practical Experience Using Soft OR Methods



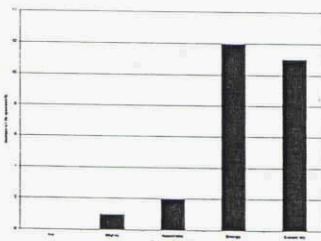
### Openness to Soft OR Methods During the Colloquium



### Ease with which Respondents Imagined Using Soft OR Methods



### Willingness to Use Soft OR Methods as a Result of the Colloquium



### Evaluation of the Change Strategy Used

- MORS Colloquium presented an ideal opportunity for conducting the required case study
- Change was successfully effected due to the strong support and participation of the MORS Sponsors, the MORS President, and the attendees
- New learning about soft OR was achieved at both the Colloquium and at the outbrief
- Change was directly effected as reported by one participant of the Colloquium outbrief

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