Data Collection at Defence and National Security Exercises

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Abstract: Analysts use field events such as experiments, trials and exercises to meet a variety of data collection objectives. These may involve collection of data for determining the effectiveness of equipment or procedures, scoping future studies or informing model development. Over the last 18 years the authors have been engaged in a variety of field *exercises* and *experiments*. Unlike *experiments*, which are generally run by and for the analyst, *exercises* are run for the benefit of the exercising unit or to meet some higher level objectives. Consequently, analysts have limited control over events and often need to work with the exercise as given; significantly reducing data collection opportunities. Despite these difficulties exercises provide a higher degree of realism than staged experiments or trials.

Engagement in Defence and National Security experiments and exercises identified ten key differences that necessitate alternative approaches to data collection. Amongst these factors are the issue of experiment/exercise design and the impact on data collection opportunities as well as the various mechanisms by which the presence of an analyst can impact a free play activity compared with a controlled experiment. Several approaches have been employed to offset these issues and enhance the opportunity and value of data collection during exercises.

In previous work we observed that the concept of perceptual positions provides a useful framework for considering different forms of data collection. These perceptual positions include: 1st (self), 2nd (other) and 3rd (detached observer). When applied to data collection during field activities these respective positions generally relate to subjective (e.g., observations of participants of the activity gathered during interview), speculative (e.g., opinion or interpretation of actions by subject matter advisers) and objective (e.g., impartial observations including instrumented data collection). Together these three positions can be used to build up a more complete picture of the system under study.

Attendance at Army exercises during the early years of Australia's Soldier Modernisation program sought fundamental information on how the Army operated. Much of the information provided by subjects was a mixture of first-hand experience (1st position) and generalisation (2nd position). These were complemented by objective measurements made by the analyst (3rd position). Perceptual positions provided a framework that facilitated engagement with participants and subject matter advisors (SMA) by placing their "observations" into an appropriate context. Similarly, the study of a Police Operations Centre (POC) during National Security exercises demonstrated the benefit of the perceptual position approach. The objective (3rd position) video data of the activities of the POC commander was used to facilitate post exercise interview (1st position) and examine the differences between the two exercises investigated (2nd position). In both cases useful understanding of the system was developed in the absence of statistically valid volumes of data.

Pre-exercise planning and liaison is another mechanism by which analysts can significantly enhance the data collection opportunities associated with attendance at exercises. One specific example was a study of Army engineers. Pre-involvement of analysts with the exercising unit proved especially useful in gaining participation of the stakeholder group which contributed to the preparation of an IDEF0 diagram. Analyst/military teams were also utilised during this exercise which led to better integration of the analyst within the exercising unit. Providing the perceptual position framework to SMA also enabled them to act as surrogate analysts and helped in the planning and execution of data collection activities.

Our conclusion is that a combination of pre-planning and the application of the perceptual positions framework can overcome many of the issues associated with the collection of data during field exercises. Furthermore the consideration of data collection from different perceptual positions can facilitate improved preparation and planning of the exercise and supports the development of effective analyst/military teams. Under the right circumstances exercises become a shared activity between the analyst and the stakeholder community that provides a significant opportunity for the collection of realistic and meaningful data.

Keywords: *Data collection, exercises, experiments, perceptual positions*

1. INTRODUCTION

The analyst may attend a field event such as an experiment, trial or exercise for a number of reasons all of which refer to data collection in some form or another. This may refer to direct aspects such as low level measures of performance, usage of existing or new equipment, observation of procedures, identification of potential issues of concern or possible new uses of equipment or exploration of responses to changed context. More indirectly, the analyst may attend such events to be better prepared for the overall analytical strategy to support either a specific decision or to develop enabling capability to assist in further decision making. Population of wargames would fall into this category.

Whatever the reason, attendance at a field event provides a valuable opportunity for the analyst to gain data on Defence or National Security operations allowing exploration of revised tactics, techniques or procedures, take up and use of new materiel and to provide informed advice for acquisitions. In a previous paper (Hobbs and Curtis, 2011) the use of perceptual positions as a method to explore Army field experiments was described. The essence of this was the notion of different viewpoints based on the neurolinguistic programming literature (Knight, 1995), whereby the first position involved participation, the second speculation and exploration, and the third observation. In addition a fourth position gave holistic appraisal post-activity. Strengths, weaknesses and applicability for each of three first positions were examined and a protocol proposed to best capture available data and insights using these techniques. In summary, these perceptual positions could be described as follows.

- First position – to gain subjective data from participating subjects (usually carried out by the Army Practitioner but possibly by a skilled Analyst Observer).
- Second position – to explore new ways of doing things through speculation and extrapolation, and to comment on the generalisation of specific observations (the Subject Matter Adviser, SMA).
- Third position – to gain objective data through direct observation or monitoring of instruments (usually the Analyst Observer).

While we are confident that any approach based on these notions will work well for any *experiment*, significant adjustments must be made for an *exercise*. There are distinct features of a *user* owned and controlled exercise (Uchida, 2002) that lead to a very different approach to data collection to that of an *analyst* planned and directed experiment or trial (see below). In this paper we will refer to *field* experiments and exercises where the activity is carried out in a likely tactical setting with actual equipment. Of course this may be combined with simulations, such as weapons firing blanks, and placed within a narrative that provides a scripted enemy set of actions.

In this paper, we will describe the particular challenges of data collection during several Defence and National Security exercises. To some extent this has been a journey of exploration and we will share our early work relating to Soldier Modernisation and how this was modified to advise on National Security and Military Engineering exercises. These examples demonstrate how the use of the perceptual positions framework and pre-involvement of analysts in exercise planning and formation of analyst/military teams (Rees, Lush and Stanton, 2009) can be used to overcome some of the issues associated with data collection in this environment.

2. THE ANALYST AND EXERCISES

Exercises and experiments can be considered as points in a spectrum of military actions. Figure 1 shows that at one end there is specific skill training, such as marksmanship, and at the other, live action. In between, the level of realism increases while at the same time, the degree of control of the analyst falls. Thus while there is considerable ability to direct experiments or trials, the same is not found for exercises and this leads to subtly different approaches when the perceptual positions are applied. For us, the critical working difference between exercises and experiments is that in the latter case the analyst (who is the major beneficiary of the work) has control over the action, both in terms of what is actually done and in the mechanism of data collection and inference. In contrast, there is far less control of what can be changed in an exercise, though more positively, exercises are better attuned to actual practice.

While both experiments and exercises are potential sources of information for the analyst, they are generally treated differently by the Military Operations Research community (see (Uchida, 2002) for definitions).

These differences between the conduct of analysis of exercises and experiments can be summarised, as follows.

- **Perturbation of the activity:** The free play nature of an exercise increases the potential for an analyst's presence to interfere with the exercise and jeopardise data collection.
- **Number of analysts:** There is likely to be limitations on the number of analysts that can attend an exercise.
- **Ownership:** An exercise is not owned by the analyst and hence is not designed to meet their needs.
- **Duration of events:** Exercises can run from days to weeks with low incidents of "important" events
- **Number of events:** Specific events of interest may only happen once during the exercise.
- **Domain knowledge:** Where exercises are being attended for problem definition or other preliminary studies analysts may have limited knowledge of the "system" being studied.
- **Unexpected Events:** Uncontrolled or unexpected events are more likely to occur.
- **Umpire judgement:** Success of the exercise will be judged by military umpires.
- **Exercise control:** Exercises will vary in regards to the degree to which they are "stage managed' to ensure specific actions occur (e.g. contact with the enemy).
- **Training objectives:** An exercise may be conducted to provide specific training on an operation or system which impacts on the exercise design and control.

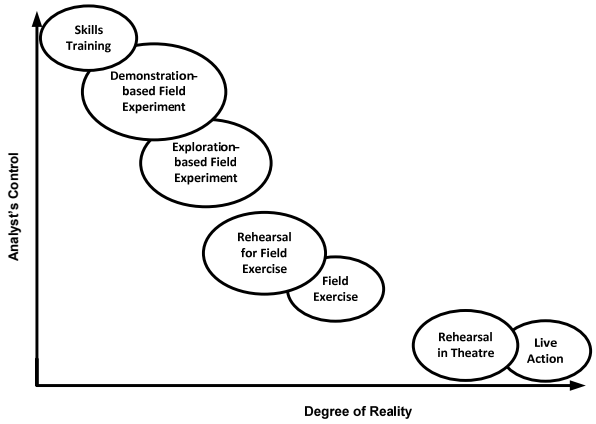

Figure 1: Relationship of realism and control for experiments, exercises and live actions (adapted from (Hobbs and Curtis, 1998)

The implications of this are the following for data collection during exercises.

- First position data gaining by after action review (questionnaire and interview) is likely to be less. available, and may occur significantly after the event, if at all.
- More reliance on second position material is likely.
- Third position "factual" material will be harder to plan for, and more difficult to obtain.

During our initial work attending field events (see below) these differences were not immediately apparent though with experience we began to note the distinct subtleties and were able to refine our data collection processes for application to both experiments and exercises. As will be seen the lessons learned meant that we were successfully able to transfer this expertise from an Army to a Police environment.

3. LESSONS FROM AN EARLY EXERCISE - KANGAROO 95

In the late 1990s and early 2000s many armies looked at exploiting newer technology such as through Soldier Modernisation programs (Hobbs, Goyne and Curtis, 2000). This work led to development of a methodology to support Army capability development based on a mix of paper studies; seminars, wargames and closed loop simulation; and field trials, experiments and exercises (van Antwerpen and Bowley, 2012). A key part of the study support was the notion of experiential learning by the analysts such as through attendance at field activities. For instance, two of the authors (NJC and WSRH) attended KANGAROO 95 to gain first-hand experience of dismounted infantry operations, to plan our analytic campaign, to model military actions, and

to gain numerical data to populate wargames and simulations. Material from specific Soldier Modernisation experiments and trials has been reported elsewhere (Hobbs and Curtis, 2011) but the following selected observations on data collection, made during a 3 week attachment around Katherine (Northern Territory) highlight some additional issues related to both field exercise attendance and the use of the three perceptual positions.

1. *Vehicle patrols*. The purpose of these was to exercise "quick response" to incidents and several patrols were undertaken to familiarise the soldiers to the routes, likely incident sites and potential situations. A limited amount of third position GPS data (Figure 2) was obtained providing the average speed on road (about 60 km/h) and dry dirt track (about 23 km/h). It was also observed that patrols were always ready to move in less than 5 minutes. However, there was little understanding by the analysts of the nature of potential incidents, how prepared the unit actually was, or the generalisability of observations. The input of an SMA (2nd position data) would have been valuable.

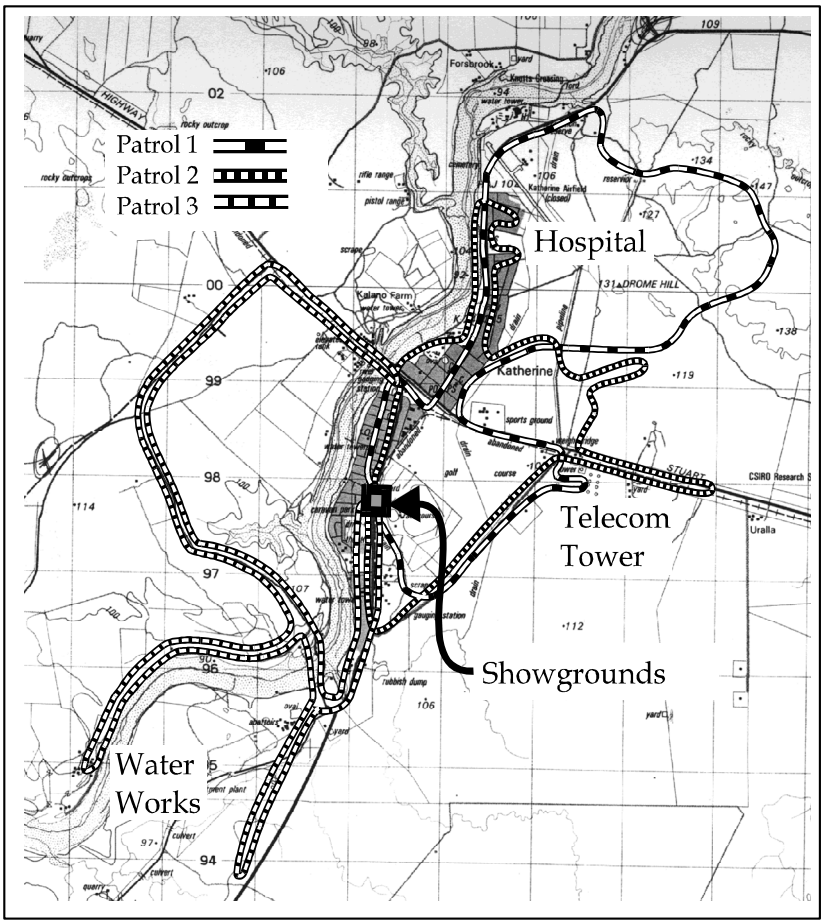

Figure 2: GPS tracking of a B-class vehicle patrolling an outback town from the base at the Showgrounds

2. *Scout missions*. In response to discovery of fresh footprints, a scout was sent to investigate. While the scout was able to provide a sketch of the scene, the analysts were excluded from observing the action owing to possible contamination of the site. A trained SMA may have been permitted to accompany the scout and provide useful information for analysis (2nd and 3rd position data).
3. *Clearance patrol*. This patrol comprised a grid search of an area near a creek bed. A schematic diagram (Figure 3) of a proposed patrol was prepared after the orders group and was used to provide context for the 3rd position data collection of the movement rate (about 2-2.5 km/h) and visibility (no more than 5m within the long grass). There were no enemy contacts made during this patrol or enemy 'signs' to be detected, thus it was not possible to obtain objective data on the effectiveness of the patrol. SMA insight could have provided such informed comment and also on the applicability of the measurements to other situations (2nd position data).

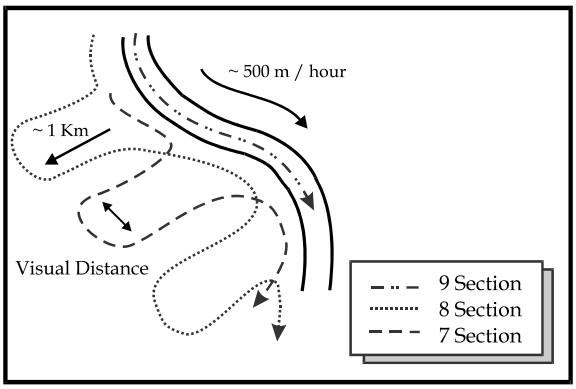

Figure 3: Schematic of grid search

4. *Load carriage*. Soldiers were weighed to determine loads for patrol order (operation from a fixed point) and marching order (changing location). Average figures were 16kg and 42kg respectively. This raw 3rd position data was supplemented through interview of the soldiers to identify what equipment they were carrying (1st position data) and what they would actually carry (or not) in a real conflict (2nd position data). While this could have been carried out anecdotally at a later date, actual measurements were felt to be of higher value, as some actions may be contrary to doctrine.

We also noted in hindsight, that it would have been worthwhile meeting the platoon lieutenant and sergeant before the exercise and briefing them on the aims of the analysts' involvement. The analysts did however attend the daily platoon orders group and gained knowledge of the operation, the reason behind it and the objectives. This provided context to the measurements made by the analysts and allowed some pre-planning of data collection. Interview with the platoon lieutenant (1st position data) provided information on the "platoon commander's day" though given operational constraints it was not verified by analyst observations (3rd position).

Attendance at KANGAROO 95 was a preliminary activity conducted as part of the structured analytical campaign for Project WUNDURRA, developed in concert with Army sponsors. In effect it helped inform the planning of future analysis through a process of exploration that included first, second and third position data. The key lessons from this (and other exercises at the same time) were:

- Analyst needs are not at the same level as the objectives of the military.
- Need for good liaison before the event.
- Collation and comparison of the 1st, 2nd and 3rd position could be improved.
- More data could have been collected but was not directly accessible by the analyst.
- Poor choice of analyst, bad presentation and "getting in the way" are all potential pitfalls.

4. DEVELOPING PROCESSES - APPLICATION TO A NATIONAL SECURITY OPERATION

There are obvious similarities in the conduct of National Security and Military command and control exercises and thus it seemed to us that our skills in exercise analysis would be readily applicable to the function of a Police Operations Centre (POC) during a counter terrorism exercise. Two opportunities arose to observe the conduct of the South Australian POC during the MERCURY series of exercises.

There were some notable differences in analysis of these exercises compared with KANGAROO 95:

- A POC is static allowing more instrumentation as the location and actors are fixed in place.
- An analyst (WSRH) was part of the exercise writing team (for the second event) and was thus able to influence its design.
- The analyst had discussed the aims and objectives of the analytical team with the exercise owner and the major players before each event.
- Exercise Control was located on an adjacent floor to the POC and access by analysis enabled data to be placed into context regarding the flow of the exercise.

The major data collection activity within the POC involved the use of a single pan-zoom-tilt (PZT) camera and transmitting microphone. The camera was located at the front of the POC and the Police Commander was fitted with the microphone. The same configuration was used to record activities in the POC during Mercury 04 and Mercury 05. An assumption was made that the majority of activities would occur within the POC and that the POC commander would be central to any activities. However, Digital Voice recorders were also used by analysts to record interviews with other personnel and notes on activities that occurred outside of the POC. Two four hour periods (0900 – 1300 and 1300 – 1700) where conducted for each day of exercise.

Analysis of the video/audio included five minute sampling of the POC commander's activities; providing roughly 100 "observations" each day. Seven broad categories of activity were used to classify the POC commander's actions. The average pattern of activity during selected periods of the exercise (i.e., those periods where the state was actively engaged in the exercise including the conduct of deliberate actions (DA)) is shown in Figure 4.

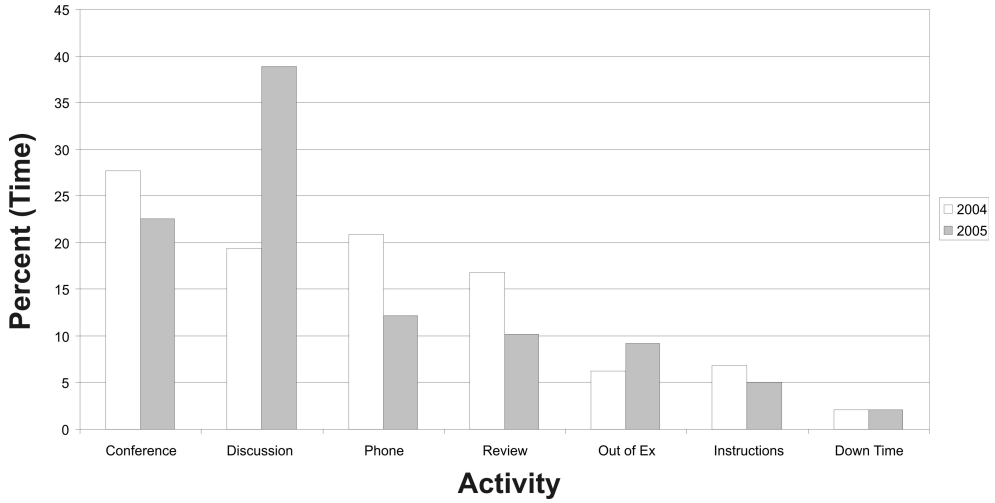

Figure 4: Classification of the Police Commander's activities during MERCURY 04 and 05

The data presented in Figure 4 shows some distinct differences between the two exercises. Whilst insufficient data is available to conduct statistical analysis the results do provide the analyst with some directions or prompts in regards to subsequent interviews with key players, in this case the Police Commander. For example, whilst it can be shown that the amount of time spent in discussion in 2005 was twice that of the 2004 exercise, we need to ascertain the implications of this observation. Was it related to differences in the exercise scenario, procedures in the POC or the commander's individual style? An answer to this question cannot be gained from the purely quantitative material in Figure 4, even if it was statistically valid.

Whilst there are differences in the scenario between the two exercises the general functions and operation of the POC, and relation to the State Crisis Centre (SCC) and State Emergency Operations Centre (SEOC), were the same (Figure 5). In the 2004 exercise the POC Commander commented on the need to brief the SCC and State Controller (Commissioner of Police) separately during the exercise as information was not being related and the State Controller was not physically located within the SCC or the SEOC. This double briefing resulted in a significant amount of wasted time on the phone.

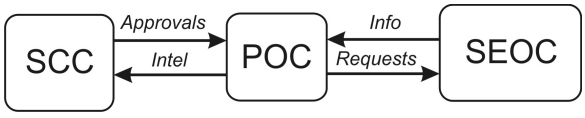

Figure 5: Relationship between the POC and the SEOC, SCC and State Controller (Commissioner)

During the 2005 exercise the State Controller relocated to an office adjacent to the POC and SEOC; a position from which he would be more immediately aware of activities as they occurred. An interview with the POC Commander identified the following issues:

- The location of the State Controller (i.e., Commissioner of Police) was a distraction as he engaged with the POC outside of formal briefings.
- All courses of action were reviewed by the State Controller with a subsequent reduction in the POC Commander's authority.
- Whilst time spent conducting phone briefings (i.e., to the SCC and State Controller) was reduced, the basic issue of multiple briefings had not been resolved.
- Less time to review relevant background documents and relevant intelligence material was noticeable.

A further review of the video footage confirmed that a significant amount of discussion time was spent in talks with the State Controller which supported the POC Commander's observations. He also offered the opinion that by moving closer to the POC he had confused the role and function of the SCC which was still receiving briefings but had no authority. He also commented that in a larger exercise or emergency this model would be even less efficient as the State Controller would have a broader range of issues to consider than the actions of the POC. In addition, for an emergency other than terrorism the State Controller may not be the Commissioner of Police and that a consistent model of operation was required.

The activity demonstrated how quantitative 3rd position data (i.e., video analysis of the POC Commander's activities) supported the interview process and provided support to 1st position observations made by the Commander. When considering the implications of these observations the POC Commander speculated (2nd position) in regards to the impact this would have in future events and the operation of the SCC. Together the combined 1st, 2nd and 3rd position views provide a richer picture of the operation of the POC than such views considered individually or in isolation.

Given the resources required to conduct activities of this scale, controlled experimentation is unlikely, hence the greatest possible value needs to be extracted from participation in National Security exercises. From a data collection perspective the key lessons from the Mercury experience included:

- Engagement in exercise planning and access to Exercise Control can offset some of the issues associated with observation of a "free play" exercise.
- As Defence employees' working in a civilian environment non-intrusive monitoring is essential.
- Good liaison with participants and "buy-in" to the objectives of the analysis were essential in fostering cooperation with subjects during the exercise.
- With limited "instrumentation" a combination of 1st, 2nd and 3rd position data is essential to build a complete picture of the event.

5. REFLECTIONS AND A REVISED PROCEDURE FOR EXERCISES

The landscape of Army operations is vast (Hossain, Moon and Curtis, 2013). For any given activity, not only is there variability caused by recent actions, terrain, conditions and the nature of the enemy, but each commander is likely to approach each situation in a different way to others. For the analyst, there are some clear challenges. For instance, if the study is at an early stage, without defined objectives, attendance at the exercise may in fact be part of the problem structuring phase. In this case, data collection may be limited to modelling of actions. For more mature studies, a detailed plan for data collection may be made but this needs to be done with care, particularly in terms of the use made of the material. We note that data collected from an exercise is likely to be "one-off", situation specific and thus unlikely to meet any criteria for statistical credibility. Instead different paradigms should be used: consistency and adherence to process. To some extent consistency arises when the full range of perceptual positions is used, and such triangulation may also be used to assess and discard anomalous results. Expert use of a body of data will also build a landscape of plausible results that emphasises a breadth of knowledge rather than an in depth appreciation of a specific item. The use of the SMA is key here to fill in the gaps.

Taken together we believe that a sound process is encapsulated by following these guidelines, which emphasise involvement, flexibility and preparedness:

- Early engagement of the problem owner to define the study scope and data requirements such as through the use of the System Instantiation Comparison Method (Rees and Bowden, 2007).
- Discuss the notion of the use of the perceptual positions with the problem owner as a means to maximise potential data collection.
- Engagement with the actors (commanders in the field) to explain the likely actions of the analysts and to prearrange any interview or questionnaire requirements.

- Identification and liaison with a suitable SMA who will be present at the activity who will:
    - Provide informed comment of an specific action.
    - Identify if a specific action can be treated as a typical use case that can, with the associated data, be used for wargaming.
- Identification a preparation of a surrogate (military) analyst who can attend actions not normally accessible to the civilian analyst (Rees, Lush and Stanton, 2009).
- Embedding of the deploying analyst within the study team to ensure an understanding of the data requirements.
- Training of the analyst particularly for:
    - Behaviour in the field.
    - Ability to identify opportunities for 1st, 2nd and 3rd position data collection.

These learnings became apparent to us in the late 00's. We applied these principles to further exercises for which examples are given below.

6. APPLICATION OF THE REVISED PROCEDURE TO ENGINEERING EXERCISES

The activities of Combat Engineers, in this case to deploy to a location and provide construction material sourced from the local environment (i.e., quarrying), were also examined. This differed from the previous examples in that there was no opposing force; although one of the objectives was to build up a body of knowledge to identify vulnerabilities and potential interventions should quarrying be carried out in a hostile area. Part of the data collection was thus to observe and develop a model of quarrying as an agreed template to base future proposed changes. Additionally, while quarrying is not uniquely a military operation, its conduct within a military context leads to subtle changes in perspective. For example in a civilian organisation, the primary driver may be efficiency but within the military context additional note must be taken of effectiveness. Further information was gained by noting that the quarrying activity was carried out within a military command and control setting and thus there was opportunity to collect data on other aspects of Army exercises.

A key difference to the KANGAROO 95, but not to the MERCURY exercises, was that the objectives of the analyst involvement were directed towards improving procedures rather than technology insertion. Based on our previous learnings, the following major changes were adopted.

- There was extensive liaison of the analyst with the unit and sub-unit commanders before the event. The relationship between unit personnel can be a significant enabler in the data collection process. It often established the credibility of the researcher, which is paramount within the military paradigm.
- The data collection needs were discussed with the commander (the problem owner) before the exercise and agreement reached on the analyst's access to material and the format of the final product.
- The perceptual positions as aids to data collection were discussed with the units before the deployment with the notion that using the perceptual positions provides triangulation and credibility to the material collected.

We also took a wider picture of the system and considered higher level questions such as:

- What does the unit do?
- What are the potential problems?
- How might they do it better?

This laid the basis of a process model for the action which can be used to develop the analytical campaign (Rees and Curtis, 2013). Thus the derived IDEF0 diagram (Kappes, 1997) could be developed using the System Instantiation Comparison Method (SICM) (Rees and Bowden, 2007) to identify the "Critical Component" which can be equated to the functions in IDEF0 diagrams. The entry at the top of the box represent controls (limitations or "rules") the bottom show mechanisms (resources or "tools") with the line through the box as the input and output of the process undertaken within the box included by the "Critical Component". The selection of IDEF0 as the method of choice reflected the experience of the analysts and will also be affected by type of decision and resulting research questions to be addressed as part of the study.

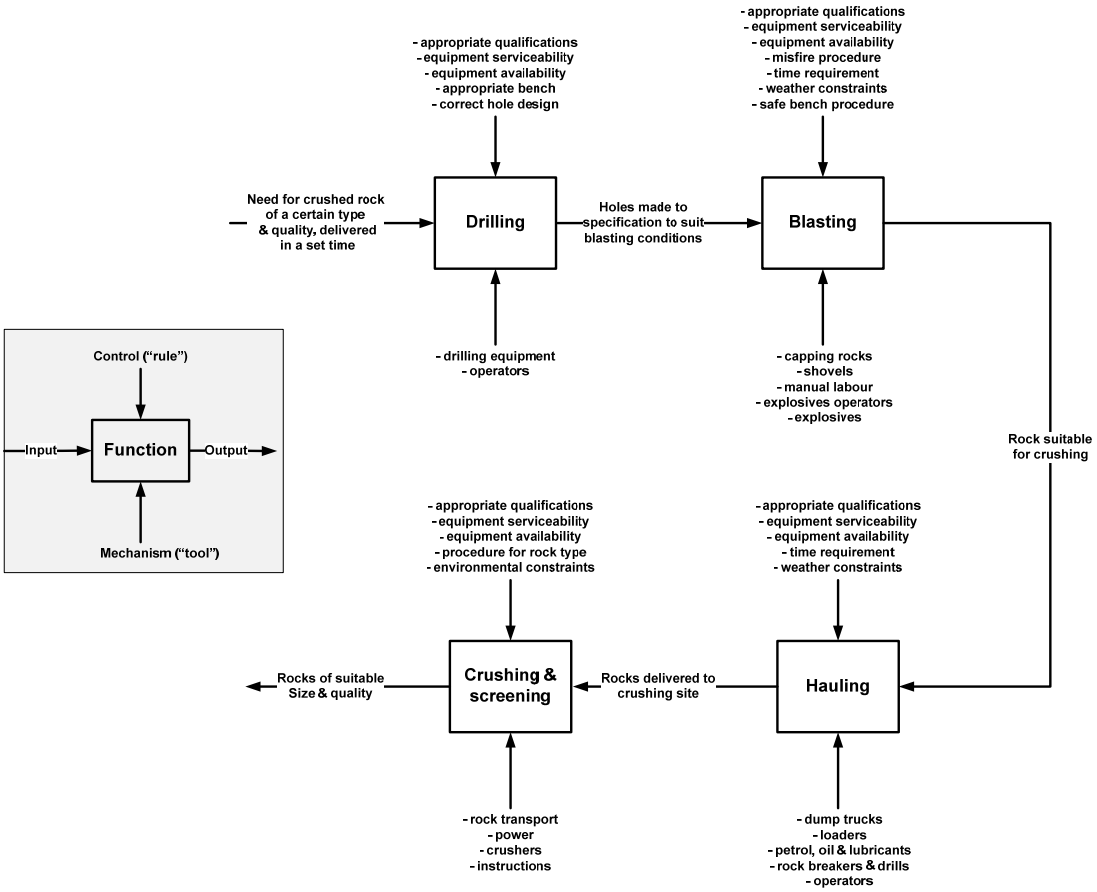

Figure 6: High level IDEF0 diagram of the quarrying functions

The significant findings were as follows.

- The simplicity of the IDEF0 diagram was well received by the unit participants and proved very valuable in generating a common picture of the issues. The diagram was refined at the exercise and this led to endorsement of the model. Critically, the end users of any analytical study now had ownership of the data collection and thus more confidence would be gained in the overall study.
- There were significant opportunities for interaction between users and analysts to elicit information appropriate for the decision under study. This was also seen as a learning exercise by the unit as it gave deep understanding of the processes and the skills necessary to perform the function. One of the units exercising was reservist and could contribute real-life experience from civilian life.
- The lack of prior knowledge of the activity was not an obstacle to data collection. In the quarrying study the analyst (LMLR) had no knowledge of this type of activity, but had extensive knowledge in the application of operations research tools within military domains.
- Considerable trust was built up through extensive discussions with the unit before the event. Trust is a key enabler in the data collection process. These discussions also provided awareness of unit Standard Operating Procedures, relevant military doctrine, and an initial understanding of acronyms and abbreviations that allows for a basic understanding of the system and relevant factors associated with its operation. This also gives confidence to the analyst that the results will be seen as credible.
- The notion of a paired analyst/SMA team appeared feasible and has been further explored in other exercises. SMAs are able to attend actions that are not accessible to the analyst.
- Figure 6 was verified at the exercise by feedback from participants (1st position) and direct observation by the analysts (3rd position). An Army SMA verified that the figure was in accord with military doctrine and civilian practice (2nd position).

Several implications for data collection were noted as follows. Firstly, we examined reference points for post-exercise analysis. We found that maps, decision points and timings are useful (Rees, Lush and Stanton, 2009), though it might be noted that most patrol members are not comfortable marking information on a map as they patrol as this goes against their training. Next we noted the value of rehearsals both for gathering of

data and also for the ability of the analysts to refine any models and thus direction of further measurement in trials. Thirdly we noted the positive effect of the analyst making an effort to be as unobtrusive and prepared as possible. Thus punctuality and being able to express to the unit (particularly the commander) the reasons for your involvement and the nature of the data that you are seeking are critical. Finally, it was noted that there was a genuine appreciation by the units of being involved in such activities, knowing that their inputs would contribute to any decision making that may occur downstream.

7. DISCUSSION

Overall, the perceptual position approach has been shown to be a useful framework for data collection in the *exercise* environment; with some changes both in planning and practice when compared with its application to *experiments*. We note that the spread of the exercises we attended was broad and this supports the general applicability of the approach. Differences between experiments and exercises have been identified and are listed in Table 1 along with potential mitigations suggested as a consequence of our engagement in Defence and National Security exercises.

Table 1: Some potential approaches to mitigating identified differences between experiments and exercises

Issue	Difference	Mitigation
Perturbation of the activity	Inexperienced Analyst Observers may interfere with the tactical aspects of an exercise. Includes reactivity effects due simply to awareness of the analyst (Adair, 1984).	Can be overcome by teaming of analysts and military staff (Rees, Lush and Stanton, 2009) as well as training and attendance at rehearsal activities.
Number of analysts	Inability to cover all events due to the number of analysts available. Safety concerns may also prevent analysts attending specific activities.	Post activity interview to gain 1st position data and use of SMAs as surrogate analysts.
Ownership	An exercise is not owned by the analyst and is not designed to meet their needs. An exercise will continue regardless of data collection issues.	Involvement and briefing of the exercising unit before the event to ensure joint ownership of the data collection
Duration of exercise	Experiments can be designed at an appropriate scale and time frame to maximise data quality and collection opportunities. By comparison, exercises require a greater commitment of time.	A symptom of the trade off between realism and control. Mitigated by remote data collection (Hobbs and Fowler, 1998) and use of SMAs.
Number of events	Despite the duration of an exercise there may be a low density of informative events and no ability to re run events. Analyst attendance only at significant times may alert subjects to impending action and should be avoided.	Post activity interviews with participants can draw on current experiences (1st position) as well as speculation (2nd position) regarding general trends.
Domain knowledge	Analysts will require a broader view of the complete system and operation rather than focussing on a narrow technical aspect.	Use OR tools to prepare models of the action before the event (Hobbs, Castles and Rogers, 2000). Paired analysts/SMAs also helps.
Unexpected events	Analysts may be affected by the same degree of uncertainty as exercise subjects with regards to where or when events will occur.	Understanding of the activity and pre-event preparation (e.g. modelling) is required. Cooperation with umpires and exercise control is important.
Umpire judgement	Umpires may be relied upon as data collectors in an exercise. Reports are often a mix of actual observations (3rd position), past experience (1st position) and generalisations (2nd position).	View data through the perceptual positions framework to provide appropriate context.
Exercise control	Exercises will vary in regards to the degree to which they are 'stage managed' to ensure specific actions occur (e.g., contact with the enemy)	Liaison with exercise control during the activity is required to separate real from artificial events.
Training Objective	An exercise is designed to maximise training opportunities and outcomes that may be at odds with analyst's objectives (e.g., access to soldiers for data collection).	Need to take a higher level perspective of the overall study question and be prepared to collect whatever data is possible.

While more work could be done to improve this framework, application of the strategies identified above will assist analysts in obtaining the most benefit from attendance at "one off" exercises. In any case, attendance at field activities should be guided by principles rather than strict procedures. Thus the essence of good data collection at exercises (and experiments) is of experience, planning, preparedness and flexibility. We also note that with the right units and circumstances that the exercise can become more a shared activity between the analyst and the stakeholder community. This is a lesson that should be applicable to trials and experiments.

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