# Standardised tactical vignettes to enhance international Defence studies

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## Abstract

Vignettes are plausible snapshots of discrete actions that may occur within a campaign. Unlike scenarios, which are often specific, abstract and classified, vignettes usefully represent common actions where issues of procedural change or equipment acquisition can be tested. Standardising these vignettes would enhance international collaboration through access to a corpus of studies, while alternative models, wargames and simulations can be compared.

A dataset was derived from 33 recent DSTO Army-focussed studies through characterisation by such elements as the environment (eg rural or urban), the level of blue/red forces (eg company v platoon), the type of Army activity (eg assault) and the tactical tasks (eg patrol) involved. Analysis showed that there was an uneven distribution of tactical tasks with some being overrepresented, often in similar combinations, with other aspects such as stability operations not being addressed. This implies that the tactical task may not be the best choice as a basic building unit to design a vignette set.

We discuss construction of a hierarchy of vignettes and consider the trade-off between flexibility in wargames, "fitness for purpose" and the ability for international comparison.

## 1. Introduction

Analysis of military campaigns can be described as containing three broad levels of detail. At the highest is the scenario (Pincombe *et al*, 2012) which provides a strategic context for capability development planning. Typically these are highly classified, specific and are subject to changes according to strategic policy and altered circumstances. While useful for identifying broad guidelines, the abstract nature of policy-directed scenarios tends to provide little in the way of guidance as to how specific elements of a campaign should be carried out. The classification and high level of abstraction mean that there is little scope for exchange of these between analysts.

At the lowest level are those features that are well described as tactics, techniques and procedures (TTPs). These are generally moderately classified and provide detail of the principles of how an action may be carried out. The actual conduct of an action will however depend on the local circumstances at the time. Thus they would be scenario independent. While the classification will not preclude exchange, they are likely to be too numerous for effective exchange and collaboration between analysts.

In between is the subject of this paper: the vignette (Mitchell, 2002). These are discrete purposeful actions that can occur during a scenario and which, almost certainly, comprise combinations of tactical events, ie TTPs). The analyst would typically conduct a sponsored study on a vignette to provide insights into such things as equipment acquisition or usage. Thus vignettes typically contain a combination of a credible context, a well formulated military action and the ability to test variations.

Implicit to being useful is the notion that vignettes are a combination of rigidity to objective but freedom of action of how this is achieved. This combination of generality implies that formulation of vignettes will be largely unclassified and this then becomes an opportunity for standardisation and exchange. We propose the following to show the analytical value of a standardised set of international Defence vignettes:

- They represent a sound list of use cases for testing new TTPs, organisations or technical insertions
- They provide a set of test cases to audit analytic capability
- They can be used as external references to compare wargames and simulations (including updates)
- They introduce a common feature so that studies from allied nations can be exchanged and compared, thus leading to a corpus of reference material and interoperability of analysis
- Reduced development time if a vignette already exists and is documented
- Accreditation of fitness for purpose to explore specific items

It is important to recognise the direction of the influences here – vignettes should not be seen as naturally deducible from the scenario but should be viewed for plausibility and consistency, particularly with respect to the goals of the analysis (Vandepeer *et al*, (in press)). The relationship of the vignette with the TTP is more equivocal however. Our experience has been that sponsored studies are directed towards an analytical question and thus the pertinent TTPs are included as a consequence. However, there is no reason why TTPs cannot be used to generate sensible combinations and thus as a means to develop vignettes.

In this paper we describe our initial efforts at deriving a set of vignettes. In particular, we look at the essential features of vignettes, how they can be constructed, the level of detail and how they might be described. The proposed, longer-term end state is a library of vignettes that fulfils these characteristics:

- Encompasses many, if not all, military actions likely to be of interest to the analyst
- Is of manageable length
- Contains enough detail to be able to compare studies
- Contains enough flexibility to allow changes in TTPs, equipment and environment
- Is compatible with possible wargaming/simulations formats
- Uses language that is compatible with both the analyst and Defence user community

As this is a pilot study we have concentrated on infantry activities in the first instance.

## 2. Possible approaches

Key to identification of the vignettes was the selection of a set of descriptors for classification of infantry actions ((Bowley *et al*, 1998) for a compendium). There are a number of ways to do this (eg (Bowley *et al*, 1998) (Sheehan *et al*, 2004), but for the purposes of this exercise we decided to concentrate on concrete actions (such as assault) as they were more akin to the goals of the analysis. Thus other approaches such as those based on objects (the units involved), generic skills (eg defeat) or characteristics (eg firepower) were not followed.

We felt that *actions*, *environment* and *force size* was the minimum set of descriptors required to classify infantry actions. Of these, the force size was less likely to be the major component and thus we concentrated on actions and environment.

There are pros and cons of deciding to use the action or the environment (eg terrain) as the lead term. As an example: if the vignette involves (say) a vehicle check point (VCP) in a town

centre, which is the lead classifier – the vehicle check point or the close urban terrain? One could be the fixed parameter and the other the variable. For instance the vignette could be based on a VCP with variables being given by the environment, in this case close urban but with possibility of extension to additional terrains such as open urban and rural, or variations in force size or intent of the red force. Such an approach would allow a focus on the measures of effectiveness for the action and, importantly, would be in a form familiar to any military clients of the study.

There are some advantages to choosing the environment as the primary term particularly from the wargamers' point of view. If all vignettes based on close urban terrain use a common terrain, overheads would be substantially reduced. It would also allow some introspection on military actions. For instance it may be possible to determine many common features in say a VCP or an observation post and thus to identify if the two actions are distinct in doctrine, or variations on a theme. This has the potential to greatly reduce the number of vignettes though probably at the cost of loss of detail.

We also considered how the vignettes could be discovered. Again, there are likely to be two routes – through *ab initio* study building up on combinations of constituent elements, or through examination of a body of work to show what has previously been studied (ie use cases). Again the VCP can be used as an example. While it may seem a reasonable item to put on the list, examination of the constituent elements may reveal that is similar to other actions such as the observation post. Indeed, when examined in detail all the individual characteristics may be dominated by another vignette and thus no learning benefits accrue. On the other hand, using existing studies has the advantage that the vignette list would encompass the issues of interest, would be presented in terms familiar to the client and would comprise a credible combination of elements. A negative would be that it may leave us underprepared for any new analytical areas. The *ab initio* route may be all encompassing though it may include far more than is required. However, some of these combinations can be removed as being unreasonable or unlikely to occur.

| Environment based<br>*Ab initio* selected | Action based<br>*Ab initio* selected |
|---|---|
| Environment based<br>Usage selected | Action based<br>Usage selected |

Figure 1: Carroll diagram of approaches to formulating vignettes

Figure 1 shows a simple arrangement of these two choices. The present work is part of ongoing research in DSTO and, for instance, in a parallel study with non-lethal weapons we have examined different ways to classify vignettes. We have successfully applied a top down grouping of an existing use case derived vignette set (Krysiak *et al*, 2013) using the environment as the primary classifier (bottom left hand quadrant in Figure 1) in this.

To expand our understanding of the analytical space, we chose to explore a classification system based on the action rather than the environment. Again, we selected use cases as the source material. In part, this was because we were unsure of the exact nature of the constituent elements that would be required for an *ab initio* approach, but also we had an

extensive set of previous studies carried out in Land Operations Division (LOD). Our feeling was that we might be able to use the current study to define the *ab initio* terms. We also used Army doctrinal material as a secondary data source to test its usefulness in this regard. The present work thus represents the bottom right hand side of Figure 1.

In passing, we note that the analysis proposed in Figure 1 can be approached in two ways: in an open or closed manner. Both the current work and the top down reduction of the non-lethal weapon vignette mentioned above are open ended in that the list is as long as the number of useful vignettes. Nevertheless the list can become unmanageable though at what length this occurs needs to be determined. An alternative that has been less explored (The Technical Cooperation Program, 2012) is the notion that a set number of vignettes can be logically deduced by defining some axes and allowed combinations (eg two terrain types, two levels of intensity and two broad types of action gives a maximum of 8 combinations).

## 3. Materials, Procedure and Results

We had available approximately 20 years of analytical studies relating to Army actions conducted within Land Operations Division (LOD) and proposed that these could be treated as vignettes as they fulfilled the criteria of discreteness, adequate documentation and complexity. These studies addressed some combination of concept exploration, equipment insertion, force organisation and tactics through testing the ability of a given force to achieve a specific mission. The methods used to do this ranged from agent based distillations (MANA) through human in the loop wargames (CAEn/oneSAF) and computer assisted wargames (jSWAT) to live exercises. In total 56 unclassified vignettes can be identified in 33 reports of which 43 relate to infantry actions (see reference list).

It was decided to modify existing coding from previous theming analysis (see below) to classify these vignettes. This saved time and improved the consistency of the codes with the literature at the expense of making them less specific to these texts. Codes were required for three areas: the environment in which the vignette was set; the force sizes involved in the vignette; and the actions of the blue force that were tested by the vignette. The first two of these were much easier to code than the third.

Environment was classified by: open rural (OR), close rural (CR), low density urban (ULD) and high density urban (UHD).

Force size was based on the unit: Section (S), Platoon (P), Company (C) or Battalion (B), and where these basic unit sizes were augmented by a small number of additional forces the symbols S+, P+, C+ and B+ were used.

We chose two methods to code the blue force actions: one from DSTO (and directed towards analysis), based on "activities" (Hobbs and Curtis, 2011); and one from Army, based on training and doctrine, (LWD). In the first of these cases the activities identified for Soldier Modernisation (Curtis, 2000) were used as codes: plan (PL), operational move (MO), tactical move (MT), cordon and search (CS), observation post (OP), vehicle check point (CP), fire support (FS), assault (AS), ambush (AM), defence (DE), crowd control (CC), occupy defensive position (DP) and administration (AD). As these may have been too generic to discriminate between vignettes we also used a second coding method based on the modified version of the infantry Tactical Tasks (TT), sourced from the Land Warfare Doctrine 3.3 series of manuals used by the Australian Army. For the purposes of this paper we only considered those TT related to infantry actions. The TT were further refined through combining some extremely specific items to attain a consistent level of granularity, particularly for those areas relating to stability operations which have been in doctrine for far less time than offensive and defensive tasks. In total we used 20 offensive (O) TT, 18 defensive (D) TT and 22 stability (S) TT (Annex A).

Very early in this compilation it became clear that the TT fell into two overlapping groups: those based on more generic actions (which we called Tactical Actions) and specific items (Tactical Techniques). This reflects the different levels at which infantry actions may be conducted and practiced. We retained this distinction so some aspects of the blue force may be coded both to a tactical action *and* to a tactical technique. This helped to resolve any coding differences by the analysts, even if it meant that some vignettes had many TTs associated with them, possibly referring to the same items.

Two of the authors (IJM and BMP) independently coded the full vignettes on activity, environment, force size, tactical actions and tactical techniques (see Example). When these codes were compared there was only a 73% rate of coding agreement. Therefore, the two coders presented their codes to each other and explained the reasons for their coding choices and then independently recoded the entire set. This increased the rate of coding agreement to 97%. The differences were argued until the coders agreed and a consensus extract describing the vignettes was developed as a summary of the summaries (Annex B).

> *Summary: A Blue Motorised Rifle Company (of about 100 soldiers) is tasked to clear and capture a segment of the Tennant Creek township occupied by a Red Strike Platoon (of about 30 soldiers).*
> - *Both forces are able to draw on their Battalion support elements.*
> - *Blue force starts from a defensive position outside town.*
> - *Buildings in town will be methodically cleared and seized.*

> *Coding:*
> > *Tactical tasks: Deliberate Attack (O4), Attack By Fires (O9), Support By Fires (O17), Sweep (O18), Seize Locations (O19), Surveillance (D18)*
> > *Environment: low density urban (ULD)*
> > *Forces: C+ (blue) P+ (red)*
> > *Activities: Fire support (FS), Assault (AS)*

Example: Indicative first round summary and coding.

Inspection of Annex B reveals that only 40 of the 60 tactical tasks were represented along with 10 of the 13 activities: 19 AS (19 occurrences); FS (16); PL (6); AM (6); MO (4); MT (4); OP (2); CP (1); DE (1); and DP (1). While 17 of the 20 offensive tasks were present, only 11 of 18 defensive tasks and 12 of 22 stability tasks appeared (Figure 2). We note that offensive codes appeared 118 times over the entire set but defensive codes only 36 times and stability codes only 26 times.

Eleven of the 43 vignettes with infantry TTs identified in them could be matched to a tactical action. The most frequent offensive tactical actions were 14 Deliberate Attacks (O4), nine Quick Attacks (O3), six Advances to Contact (O1) giving 29 of the 29 offensive tactical actions between them. For defensive tactical actions all six cases were represented by the two Area Defences (D1), two Mobile Defences (D2) and two Withdrawals (D4). Five of the six stability tactical actions occurred more than once: three Controls (S1); and two cases of Restore (S3).

Only one of the 43 vignettes with infantry TTs identified in them could not be matched to a tactical technique but could be allocated to a tactical action. For the offensive tactical techniques 53 of the 87 unique occurrences were accounted for by the high frequency 19 Support By Fires (O17), 13 Attack By Fires (O9), 13 Seize Locations (O19) and 9 Sweeps (O18). The higher frequency 11 Patrols (D17), six Surveillances (D18), five Route Securities (D15) and four cases of Defend in Sector (D13) made up 26 of the 31 defensive tactical techniques. Only the seven cases of Population Interaction (S22) were high frequency

amongst the 19 occurrences of stability tactical techniques: possibly indicating a concerted effort to cover the stability related tactical techniques at least once but not much more than that.
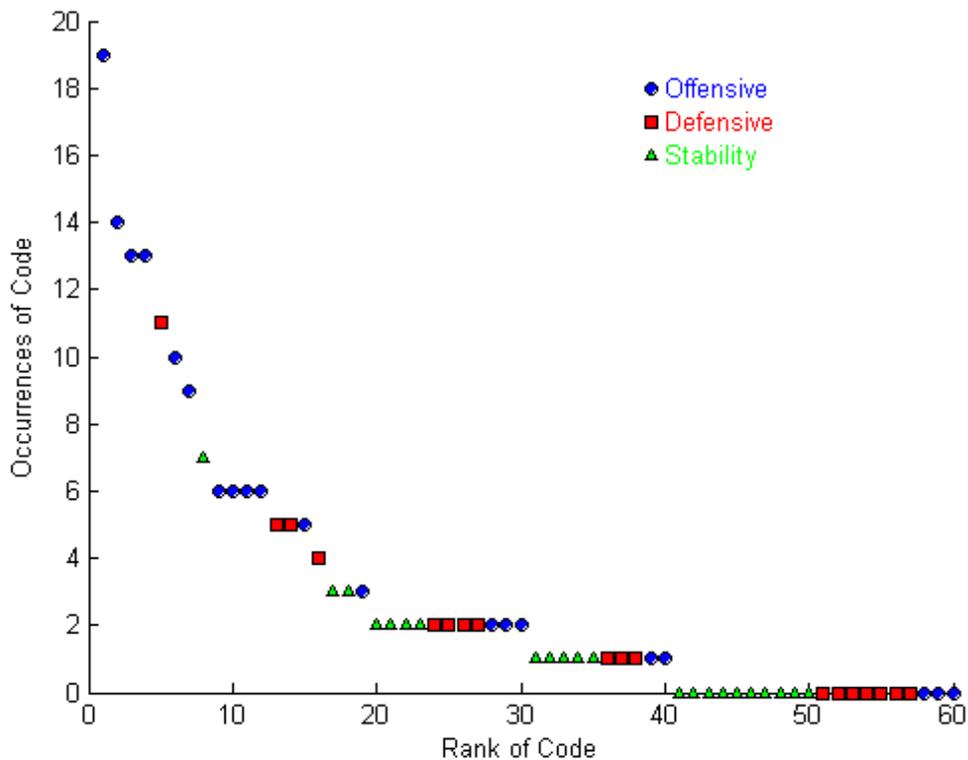


Figure 2: The frequency of appearance of the 60 codes in the 43 infantry vignettes (offensive actions in blue circles, defensive in red squares and stability in green triangles).

There is a strong overrepresentation of the most common four activities with 19 assaults, 16 fire supports, 6 ambushes and 4 tactical moves but none of the other activities appearing in more than two vignettes. Not all of the vignettes could be matched to the activity list and this may need to be extended to include (for instance) building clearances.

Open rural and urban low density terrains appeared to be overrepresented with 26 of the former and 16 of the latter compared to 6 closed rural and 4 urban high density.

There was a reasonably even distribution of force sizes with 9 company size actions, 8 battalion sized actions, 8 platoon sized actions and 6 section sized actions.

The six TTs that occurred 10 or more times were examined to see if any correlations occurred. These results are shown in Table 1 and the outstanding correlations are that of O4 and O19, O18 and O19, O17 and O19, O4 and O17, O9 and O17 and O17 and O18. These all make sense. That a deliberate attack is often aimed at seizing locations is not surprising. Seizing locations in a sweep is also not unexpected. Using support by fires during an operation to seize locations is not extraordinary, nor is using support by fires in a deliberate attack. Grouping attack by fires with support by fires simply represents the doctrinal conviction, born of mass casualties in real Australian attacks without support by fires, that attacks cannot succeed without suppressive fires. Using support by fires during a sweep is also not remarkable. Interestingly, none of the commonly occurring offensive actions correlate in any way with the defensive task of patrol.

Table 1: Correlations amongst the six major Tactical Tasks

| | O4 | O9 | O17 | O18 | O19 | D17 |
|---|---|---|---|---|---|---|
| O4: Deliberate Attack | 1 | 0.2599 | 0.5375 | 0.4795 | 0.6553 | -0.1943 |
| O9: Attack by Fires | 0.2599 | 1 | 0.4921 | 0.0661 | 0.1895 | -0.0697 |
| O17: Support by Fires | 0.5375 | 0.4921 | 1 | 0.4474 | 0.5828 | -0.0838 |
| O18: Sweep | 0.4795 | 0.0061 | 0.4474 | 1 | 0.6236 | -0.0044 |
| O19: Seize Locations | 0.6553 | 0.1895 | 0.5828 | 0.6236 | 1 | -0.1773 |
| D17: Patrol | -0.1943 | -0.0697 | -0.0838 | -0.0044 | -0.1773 | 1 |

## 4. An initial vignette list

An important aim of this process was to develop a small set of vignettes retaining a maximal fraction of the complexity seen in the entire set. There are many methods to do this but we chose a greedy algorithm to arrive at an "optimally" spanning set of vignettes. This algorithm started with the vignette with the largest number of TT codes. In this case there were two such vignettes, TR-1672 and TN-0634(2), each with eleven codes – so the first in the list, TR-1672, was chosen as the first vignette. The codes represented in TR-1672 were then removed from the remaining vignettes and the vignette with the most unrepresented codes was chosen as the second vignette in the series. This process was repeated until all codes were represented (Figure 3). Only eleven of the 43 vignettes were required to represent all 40 TT codes at least once while 4 vignettes covered 30 of the 40 TT found and 6 covered 34.
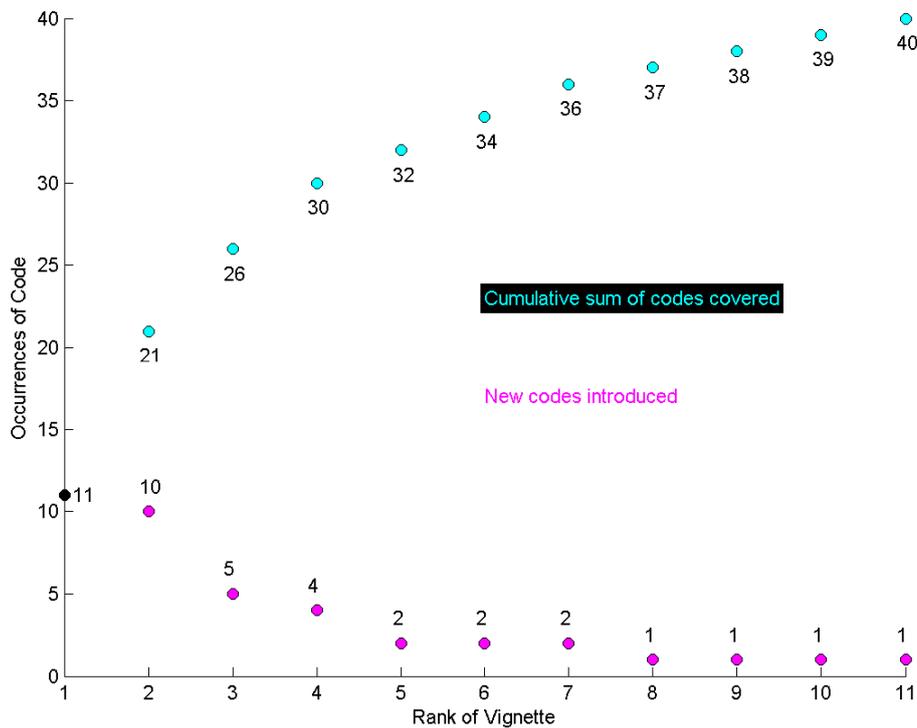


Figure 3: Plot showing how progressively adding a vignette increases the total number of represented Tactical Tasks (TT). The upper line shows the number of cumulative TT with the lower showing the number of TT added at each stage.

The appropriateness of this algorithm is reinforced by the robustness of overall order to alterations in the order in which ties are resolved. The first place a tie occurs is with the first vignette. Were TN-0634(2) chosen first instead of TR-1672 the only changes would be that

the second vignette, GD-0169, would introduce 9 new codes rather than 10 and that TR-1672 would be in third place rather than TN-0634(2) and would introduce 6 rather than 5 new codes. Changes in the way ties are resolved also make the order of the 5th, 6th and 7th ranked vignettes change and the order of the 8th, 9th, 10th and 11th also change but no other vignettes enter the set under any circumstances. Of course there are other algorithms to perform this ranking, but this lack of sensitivity makes this algorithm one of the good choices. It is important to note that in both cases cited here, 11 vignettes were needed to cover the TT list and that the lower ranked vignettes only contributed one extra TT each.

In many cases it may be impractical to work with eleven vignettes so in Table 2 we present the top six vignettes, as found by our greedy algorithm, to maximise the combined number of unique TT codes, in more detail. Six is in many ways an arbitrary number as there is no clear break point evident in Figure 3 but the notion can be used to illustrate the point of striking a balance between length and completeness. Table 2 shows that the top six vignettes (using the Figure 3 data) introduce: thirty-four of the forty TTs found in the entire set; seven of the nine tactical actions; seven of the ten activities represented in the entire set; and cover two of the four environments with no closed rural or urban high density terrains represented. Reference to Annex B gives a short description of the study that can be used to define the vignette. For instance, TR-1672 refers to "Conduct a joint airborne & amphibious landing and seize air and sea points of departure" with additional detail on the force sizes. Finally, we note that these vignettes span the range of 6 to 11 TTs and that to some extent they are of approximately equal complexity.

Table 2: Tactical Tasks included in the top 6 vignettes, first occurrences appear in bold

| | Tactical action | Tactical Technique | Activity | Environment |
|---|---|---|---|---|
| TR-1672 | O3 | 8 Offensive: **O6, O8, O9, O13, O17, O18, O19, O20**<br>2 Defensive: **D6, D13** | **MO; FS; AS** | **Open rural** |
| GD-0169 | D1 | 1 Offensive: **O16**<br>4 Defensive: **D12, D15, D17, D18**<br>4 Stability: **S5, S6, S11, S22** | **OP; CP; AM** | Open rural |
| TN-0634(2) | O1, O4 | 6 Offensive: **O11**, O13, O17, O18, O19, O20<br>3 Stability: S11, **S13, S20** | FS; AS | **Urban low density** |
| TR-1977 | S1, S3 | 3 Offensive: O6, O8, O19<br>2 Stability: **S8, S12** | MO; **DE;** FS; AS | Open rural; Urban low density |
| TR-1267 | O4, **D4** | 1 Offensive: O9<br>3 Defensive: **D11**, D13, D18 | FS; AM | Open rural |
| RR-0277(1) | D2 | 4 Offensive: O6, **O7**, O9, O17<br>1 Defensive: D13 | AM | Open rural |

## 5. Comments on the procedure

The vignettes used in this study were sourced from unclassified sections of LOD reports which were sponsored by the Australian Army. This introduces an additional three possible sources of concern. First, the sample size was modest, though still encompassed 43 infantry related studies. Second, we only considered unclassified vignettes. A wider study comprising classified and overseas vignettes will help to show the scope of the space. Third, there may also be a systemic bias in the types of studies that the Australian Army sponsors, which would largely focus on equipment acquisition or TTP development. Thus, it may not be surprising that only 40 of the 60 TTs were identified in these studies rather than any inherent problem with sample size. Indeed, it may be that some actions are dominated by others and, for

instance, stability TTs, may be expected to be achieved using existing equipment. Thus, they would not be the subject of a sponsored study.

Next we found that the approach of taking existing use cases (the studies) and classifying according to a secondary set of descriptors was practicable but suffered from some problems in application. The TTs themselves need some modification to be able to be used in this fashion. These comments should not be seen as criticism of doctrine. The TTs were developed for another purpose, not for the convenience of the analyst, but can form the basis of a revised list. For instance, some studies could not be classified readily and there was ambiguity between selection of tactical actions and tactical tasks. Several actions also usually occurred together and these observations would help if a revised set, akin to the TTs, was developed. We note that the initial work may have suffered from the relative sizes of the study library (43) as opposed to the TT list (60). With some refining, the differences in interpretation observed by the two analysts will also be reduced. Finally, we note that this was a useful learning exercise as it is clear that the TTs would not have been suitable as the *ab initio* terms on which to build up a vignette list (as would be the case for the top right of Figure 1).

## 6. Discussion

Six goals were identified in the Introduction, repeated below, and addressed in turn.

- Encompasses many, if not all, military actions likely to be of interest to the analyst
- Is of manageable length
- Contains enough detail to be able to compare studies
- Contains enough flexibility to allow changes in TTPs, equipment and environment
- Is compatible with possible wargaming/simulations formats
- Uses language that is compatible with both the analyst and Defence user community

As was seen in Figure 3, 6 vignettes covered 34 of the 60 TTs while 11 covered 40. These achieve the criteria of the length of the list but the coverage is open for debate. It can be noted that the first 6 vignettes include 85% of those TTs that were of interest in the last 20 years of studies – a far more impressive statistic. As described above, more work will be needed to determine the real scope of the vignettes.

Ascribing codes to vignettes and then ranking these vignettes with a greedy algorithm is only one way of developing a reduced set of vignettes but it is a flexible way of doing so. In this case the full complexity of all forty-three vignettes, as measured by the number of activity codes present, was represented in a subset of only eleven vignettes. Three-quarters of the total complexity is present in a set of just four vignettes and over half in just two. The method gave an ordered list of vignettes that allowed decision makers to choose their trade-off between the number of vignettes and the degree of complexity represented. Nevertheless, it may be possible to reduce the vignette list length by another mechanism. We also note that a more extensive vignette list may also lead to a greater coverage of the TTs within a shorter vignette list, or more being included within an arbitrary number (eg 6).

Next we believe that the short summaries described in Annex B can be used to provide an initial scan of the content of a vignette to allow comparison with other nations' studies. There will however need to be some standardisation of level of detail and a common terminology. This could lead to some interoperability between the analyst communities as described in the Introduction, thus leading to resource savings and greater confidence in results.

Ideally, vignettes included in a reference set would have maximal flexibility, where flexibility is determined by ability to change inputs and alter the number of degrees of freedom. Such vignettes require the capacity to easily accommodate changes in inputs including force

structure, force capability, equipment, force size, rate of supply and critically, tactics. The vignettes we used comprise concise and specific exercises or tasks, which can easily accommodate changes in such inputs, this requirement is achieved. An additional benefit of the ability to change inputs into the set of vignettes is that this allows the results from different studies to be compared because vignettes that are essentially the same can be used across multiple studies. As a further requirement of product flexibility, it is important that the degrees of freedom can be increased or decreased. This enables the level of detail of the vignette set to be adjusted so that it correlates with the level of detail contained within the study question.

We have not addressed the issue of wargaming/simulation formats in this work. All of the studies were conducted using one form of wargaming/simulation or another, though an important question to consider is if a particular vignette can be readily translated across several formats. A side issue to this, and one based on the opposite goal to flexibility, is that of mathematical comparison and calibration. For instance, if a rigidly defined vignette could be described in two different wargames, would similar results be obtained?

Finally, we propose that the goal of a language common to both the analysts and Defence stakeholder is likely to be met by this approach.

## 7. Conclusion

This initial study has shown that an unclassified, international set of vignettes is a tractable goal but that considerable work will be needed to achieve this. The aspects that need to be developed include:

- Revision of the Tactical Tasks (or similar items) to identify the fundamental units of classification, possibly through combinations and identification of dominations and redundancies
- Expansion of the data set to include more vignettes through examination of individual nations' study sets and (within reason) classified studies, and to see if a "better" list of vignettes emerges that covers more fundamental actions and combinations
- Exploration of different means to reduce the vignette list length, other than the greedy algorithm
- Examine the revised list of Tactical Tasks to investigate the *ab initio* method of building up feasible combinations as an alternative method of generating vignettes while still retaining analytic usefulness and client familiarity
- Re-examine the environment-led approach possibly leading to fitting within a logically limited number of combinations

## References

(a) Cited articles

Bowley DK, Gaertner PS, Curtis NJ and Scutter MD (1998). *Frameworks for the Analysis of Overall Combat Effectiveness*. In: 24th meeting of QWG Army Operational Research. Australia.
Curtis NJ (2000). *Planning for the Next Generation of Soldier Modernisation*. In: Puri V, Filippidis D and Hurcum G (eds) Land Warfare Conference. Defence Science and Technology Organisation: Melbourne, Australia. pp p314-327

Hobbs W and Curtis NJ (2011). Perceptual Positions in the Analysis of Military Operations: Theory and Application to Army Field Experiments. *Journal of the Operational Research Society* 62**:** 1753-64

Krysiak KK, DJBowden F, Curtis NJ, John M and Williams P (2013). *Reduction of Vignette Sets for Studying Non-Lethal Weapons* DSTO Report TR-xxxx

Mitchell IM (2002). *Analytical LEGO - Vignettes as the Building Bricks for Studies of Compliance and Peace Building Scenarios*. In: Cornwallis Group VII: Analysis for Compliance and Peace Building. Canadian Peacekeeping Press: Ottawa

Pincombe B, Blunden S, Pincombe A and Dexter P (2012). Ascertaining a hierarchy of dimensions from time-poor experts: Linking tactical vignettes to strategic scenarios. *Technological Forecasting and Social Change* Advanced on line publication

Sheehan JH, Deitz PH, Bray BE, Harris BA and Wong ABH (2004). *The Military Missions and Means Framework*, AMSAA Technical Report TR-756

The Technical Cooperation Program (2012). *Towards Vignettes for Analysis of Non-Lethal Weapons*, TR-LND-TP4-01-2012

Vandepeer C, Moon T and De Visser G ((in press)). Linking missions to scenarios for analysis of military macro-systems. *OR Insight*

(b) Bibliography of the DSTO reports used in this study

DSTO-TR-0983 Lovaszy S, Tailby D, Stanford C and Brewer S (2000). CASTFOREM Modelling of the RTA Motorised Company.

DSTO-TR-1267 Tailby D, Stanford C, Cause R, Pash K and Jose A (2002). CASTFOREM Modelling of the Restructuring the Army Phase 2 Enhanced Combat Force.

DSTO-TR-1378 Gill AW, Egudo RR, Dortmans PJ and Grieger D (2002). Using Agent Based Distillations in Support of the Army Capability Development Process - A Case Study.

DSTO-TR-1628 Guille MC and French HT (2004). Toward a Methodology for Evaluating the Impact of Technologies on Infantry Situation Awareness.

DSTO-TR-1659 Wheeler S and White G (2004). The Use of Agent-Based Distillations and Linear Programming for the Modelling of Offensive Support Elements.

DSTO-TR-1672 Wheeler S, Coombs G and Goodman G (2005). Evaluation of Land ISTAR Capabilities.

DSTO-TR-1687 Stanners M and French HT (2005). An Empirical Study of the Relationship Between Situation Awareness and Decision Making.

DSTO-TR-1813 Tomecko N, Sands D and Wheeler S (2005). Alternative Force Structures for Offensive Support and their Impact on Command and Control in a Networked Environment.

DSTO-TR-1857 Nunes-Vaz R, Vaughan J, Pratt J, Tregenza M, French K, Menadue I, Williams P, Ferris B, Aidman E, Fowler G, Boyd P, Roszkowski M, Balin M, Bottger M and Pietsch B (2006). The Peregrine Rise Experiment, May 2003.

DSTO-TR-1902 Williams P, Manning C, Dexter R and Bowden FDJ (2006). M113/Bushmaster Mechanised Infantry Fleet Mix Study.

DSTO-TR-1927 Haub J and Harvey S (2006). Systems Analysis in Support of RRAMCC: Paper 2, Baseline Systems Analysis.

DSTO-TR-1943 Bender A, Bowden FDJ, Gaertner P, Kempt N, Tregenza M and Williams P (2006). Land Based Offensive Support Systems Analysis.

DSTO-TR-1977 Egudo R, Boland N and Gan H (2007). Force Optimisation Tool for Allocation of Land Forces to Objectives.

DSTO-TR-2142 Coutts A, Dexter R, Sanderson D, Shine D and Finlay L (2008). Micro Combat Team 2012 Experiment 1 – Platoon Operations in a Complex Urban Environment.

DSTO-TR-2398 Williams P, Bender A and Bowden F (2010). Effects-Based Capability Analysis of the JP2048 Phase 4A&B First Pass Option Set.

DSTO-GD-0169 Bowley DK (1999). Restructuring of the Army Task Force Trials Scientific Framework Paper.

DSTO-GD-0179 Chalmers GJ and Hobbs WSR (1998). Field Study Instructions for the Soldier Combat System Trial: Townsville 1998.

DSTO-GD-0352 Kardos M and Chapman T (2003). Constrained Planning and Wargame Performance in Military and Civilian Teams.

DSTO-GD-0361 Brennan M and Fisher J (2003). Summary Analysis Report for Headline Experiment 2000.

DSTO-GD-0407 Ciuk J, Curtis NJ and Kardos M (2004). Insights from Exercise RAW HORIZON.

DSTO-RR-0277 Gaertner PS (2004). Mission Area Analysis: Army's Amphibious System Requirements to Conduct Entry from Air and Sea.

DSTO-TN-0242 Lovaszy S, Tailby D, Stanford C and Brewer S (1999). Algorithms and Data Used in the CASTFOREM Modelling of the RTA Motorised Company.

DSTO-TN-0485 Millikan JA, Castles TD and Brennan MJ (2003). Close Action Environment Modelling of a Combined Arms Sub-Unit in an Urban Environment.

DSTO-TN-0499 Davy J and Demczuk V (2003). Human Factors Aspects of Hard Target Weapon Systems.

DSTO-TN-0509 Dortmans PJ, Jones IE and Garside D (2003). Scenario, Capability Requirement and Strategic Linkage: Supporting Effects-based Planning for the Land Force.

DSTO-TN-0623 Wheeler S (2005). On the Suitability of NetLogo for the Modelling of Civilian Assistance and Guerrilla Warfare.

DSTO-TN-0634 Rees L, Stanton B and Bowley D (2005). Analysis Report for Exercise HOLDFAST.

DSTO-TN-0817 Coutts AW and Dexter RM (2008). Limits of Employment of a Light Infantry Micro Combat Team in Urban Combat.

DSTO-TN-0833 Shine D, Coutts A and Dexter R (2008). Micro Combat Team Campaign - Objective Force Experiment 1 - Sep 2006.

DSTO-TN-0835 Dexter RM, Coutts A amd Neal D (2008). Hardened and Networked Army Micro Combat Teams – The Impact of Tactical Methods on Combat Performance in a Complex Environment.

DSTO-TN-0890 Finlay L, Sanderson D, Dexter RM, Hemming DB, Shine D, Coutts AW and Kosowski L (2009). Micro Combat Team Campaign - Objective Force Experiment 2 - July 2007.

The terminology is such that TR-1977 (1) refers to the first action described in the report.

Annex A: List of tactical tasks used in this study

| Tactical Tasks | | | |
|---|---|---|---|
| | **Offensive** | **Defensive** | **Stability** |
| **Tactical Actions** | Advance to Contact (O1) | Area Defence (D1) | Control (S1) |
| | Advance in Contact (O2) | Mobile Defence (D2) | Reform (S2) |
| | Quick Attack (O3) | Delay (D3) | Restore (S3) |
| | Deliberate Attack (O4) | Withdrawal (D4) | Assist (S4) |
| | Pursuit (O5) | | |
| **Tactical Techniques** | Airborne (O6) | Battle Handover (D5) | Noncombatant Evacuation and Refugee and Internally Displaced Persons Movement (S5) |
| | Ambush (O7) | Deliberate Break-out from Encirclement (D6) | Recovery of Personnel and Equipment (S6) |
| | Amphibious (O8) | Break-out by Stealth from Encirclement (D7) | Traffic Control Posts and Vehicle Checkpoints, Curfew and Enforcement of Out-of-bounds Areas (S7) |
| | Attack By Fires (O9) | Convoy Escort (D8) | Conflict Containment, Separation of Hostile Forces and Supervision of Ceasefire (S8) |
| | Cordon (O10) | Counterattack (D9) | Crowd Control (S9) |
| | Corridor Thrust (O11) | Counter-penetration (D10) | Internment and Detention (S10) |
| | Coup de Main (O12) | Defend a Battle Position (D11) | Key Point Protection (S11) |
| | Diversionary Attack (O13) | Defend a Strongpoint (D12) | Population Protection and Support to Rule of Law (S12) |
| | Raid (O14) | Defend in Sector (D13) | Allocation and Control of Equipment and Infrastructure (S13) |
| | Reconnaissance in Force (O15) | Reserved Demolition (D14) | Disarmament, Demobilisation and Reintegration (S14) |
| | Search (O16) | Route Security (D15) | Selection and Recruitment of Future Security Forces (S15) |
| | Support By Fires (O17) | Spoiling Attack (D16) | Training, Mentoring and the Transfer of Responsibility (S16) |
| | Sweep (O18) | Patrol (D17) | Immediate Health Assistance (S17) |
| | Seize Locations (O19) | Surveillance (D18) | Restoration (S18) |
| | Secure (O20) | | Support to Elections (S19) |
| | | | Enabling Humanitarian Assistance (S20) |
| | | | Provide Environmental Assistance (S21) |
| | | | Population Interaction/Intelligence Gathering (S22) |

Annex B. Initial examination of the previous studies

| Study number | Activity | Environment | Force Size | Extract | Tactical Task | |
|---|---|---|---|---|---|---|
| | | | | | Actions | Techniques |
| TR-0983 | FS; AS | OR | C+ vs. P+ | Can a motorised company succeed in an assault on a platoon supported by ATMs and indirect fire? | O1; O4 | O15; O17; O18; O19; D17 |
| TR-1267 | FS; AS | OR | B+ vs. B+ | Can the future mechanised brigade beat a Soviet mechanised brigade in a meeting engagement? | O4; D4 | O9; D11; D13; D18 |
| TR-1378 | FS | OR | C vs. B | Does EXFOR's manoeuvre concept allow it to win against enemy who attack with unsupported armour with poor sensors? | | D18 |
| TR-1628 | AS | OR | S vs. S | Do radios help a section patrol and attack? | O3 | O17; D17 |
| TR-1672 | MO; FS; AS | OR | 3B+ vs. 2B | Conduct a joint airborne & amphibious landing and seize air and sea points of departure. | O3 | O6; O8; O9; O13; O17; O18; O19; O20; D6; D13 |
| TR-1687 | OP | OR | 1 vs. B+ | How does situational awareness alter decision making? | -- | D18 |
| TR-1813 | FS | OR vs. ULD | ? vs. ? | How does fire support differ between rural and urban environments? | O4 | -- |
| TR-1902 | AM | OR | P vs. S | Mechanised platoon ambushed by squad and withdraws. | D4 | D8 |
| TR-1927(1) | MT | OR & ULD | -- | Clear mines from a 120km main supply route in 8 hours and keep it clear. | -- | D15 |
| TR-1927(2) | MT | OR | -- | Clear mines from a 60,000 m$^2$ area in 6 hours. | -- | D15 |
| TR-1927(3) | MT; AM | OR | -- | Clear mines from a 60km secondary supply route in 4 hours and keep it clear. | -- | D15 |
| TR-1927(4) | MT | OR & ULD | -- | Clear mines from a 31 km route in 4 hours and keep it clear. | -- | D15 |
| TR-1943(1) | AS | OR | B+ vs. C+ | Assault a river crossing with 2 well supported tank coys and 1 mech inf coy against 1 mech inf coy and a tank pl. | O4 | O9; O11; O17; O19 |
| TR-1943(2) | DE | OR | C++ vs. C+ | Block enemy mech inf coy movement through an area with supported infantry coy. | D1 | O6; O9; D11 |
| TR-1943(3) | AS | OR | 2C+ vs. C+ | Seize a bridge with 2 well supported infantry coys against a mech. inf. coy. | O4 | O12 |
| TR-1943(4) | AS | OR | B+ vs. C+ | Deliberate attack by 2 mech. inf. coys and a tank coy on a prepared OPFOR mech. inf. coy and tank pl. | O4 | O17; O19 |
| TR-1977 | MO; DP; AS; FS | OR & ULD | 2B+ vs. 2C+ | Secure a SPOD and APOD with a tank BG, ARH Sqn and airborne bn vs. mech. BG (a tank coy, AD pl. and motorised coy) at landing site and motorised BG nearby town with APOD and SPOD. | S1; S3 | O6; O8; O19; S8; S12 |
| TR-2142(1) | -- | UHD | P+ vs. 2P | Counter insurgency patrol through dense and populated urban space to seek contact with enemy then destroy them . | O1; O3; S1 | O16; O18; D17; S22 |
| TR-2142(2) | -- | UHD | P+ vs. 2P | Clear enemy from a building with no external threat while minimising | O3 | O17 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | own force and civilian casualties. | | |
| TR-2142(3) | -- | UHD | P+ vs. 2P | Clear insurgents from a building where some enemy are an external threat providing supporting fire while minimising own force and civilian casualties. | O3 | O17 |
| GD-0169 | OP; CP; AM | OR | 3B+ vs. 2B+ | Neutralise enemy special forces incursions into the east Kimberly region. | D1 | O16; D12; D15; D17; D18; S5; S6; S11; S22 |
| GD-0179(1) | -- | OR | S vs. -- | Can a rural patrol without state of emergency powers detect 16-18 targets? | -- | D17 |
| GD-0179(2) | -- | ULD | S vs. ½S | Determine difference between two types of infantry sections in room clearance in presence of enemy and civilians. | O3 | O19 |
| GD-0179(3) | -- | ULD | P vs. -- | Determine difference between baseline and enhanced infantry sections in patrolling a small built up area. | | D17 |
| GD-0179(4) | AS | ULD | S vs. ½S | How does fatigue and grenade usage impact engagement of fighting and fleeing enemy? | O3 | O9; O17 |
| GD-0179(5) | AM | CR | S vs. ½S | What are the differences in day and night ambush? | | O7 |
| GD-0179(6) | AS | OR | S vs. ½S | How to move from patrol to section attack? | O3 | D17; O9; O17 |
| GD-0352(1) | AS; FS | CR & ULD | C vs, C | Use 4 tanks, 4 IFVs, 2 SPH and 2 ARH to capture a small town from 6 tanks, 6 IFVs, 3 SPAA and 2 SPH. | O4 | O9; O17; O19 |
| GD-0352(2) | AS; FS | CR | C vs, C | Use 4 tanks, 4 IFVs, 2 SPH and 2 ARH to destroy a blocking force composed of 6 tanks, 6 IFVs, 3 SPAA and 2 SPH. | O1; O3 | O15 |
| RR-0277(1) | AM | OR | C+ vs. ? | Light infantry coy conducts deep defence and ambushes red counter lodgement offensive. | D2 | O6; O7; O9; O17; D13 |
| RR-0277(2) | AM | CR | C+ vs. ? | Light infantry coy conducts deep defence and ambushes red counter lodgement offensive. | D2 | O6; O7; O9; O17; D13 |
| TN-0242 | AS; FS | OR | C+ vs. P+ | See how performance changes when a motorised coy deliberate attack is supported by an AGS or an ARH in open country. | O4 | O9; O17 |
| TN-0485 | AS; FS | ULD | C+ vs. P+ | Supported motorised coy assaults small low density town in open rural area held by a supported platoon. | O4 | O9; O17; O18; O19; D18 |
| TN-0499(1) | -- | OR | -- | How much can a soldier carry on a 20km patrol followed by a 600m run and still engage the enemy? | O1 | D17; O9 |
| TN-0499(2) | -- | OR | -- | Can a 2-man team carry a radar 10km and set it up? | -- | D17; D18 |
| TN-0623 | | ULD | ? vs. ? | Peacekeepers patrol, interact with civilians and respond to ambush. | S1 | O16; D17; S12; S22 |
| TN-0634(1) | AS; FS | CR | B+ vs. C+ | Conduct a breaching operation with a HNA BG against a reinforced Red coy conducting area defence and use Blue tanks to envelop and destroy with fires fleeing Reds. | O1; O4: | O9; O10; O11; O17; O18; O19; O20 |
| TN-0634(2) | | ULD | B+ vs. C- | Conduct an assault against an urban area with a HNA BG to seize it from an irregular force of | O1; O4: | O11; O13; O17; O18; O19; O20; |

| | | | | | | |
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| | | | | roughly coy size. Use a tank feint, penetrate the town with infantry and conduct a deliberate attack on the main Red supply dump. | | S11 S13; S20 |
| TN-0634(3) | | ULD & CR | -- | Conduct engineering, transition and stabilisation operations with particular consideration to mapping, construction and combat engineering to support the HNA BG, restoration of civilian essential services, civil military cooperation and employment of local civilian contractors. | S3; S4 | S11; S13; S20; S21 |
| TN-0817 | -- | ULD & UHD | ? vs. P | Compare unspecified force doing unspecified things in low and high density urban terrain against a platoon sized insurgent adversary. | -- | D17; S22 |
| TN-0833 | AS; FS | OR & ULD | P+ vs. P | Can 3 infantry sections supported by 2 tanks, a support section, 3 howitzers, 2 ARH and a fire control team defeat an insurgent platoon in a small village at minimal civilian cost? | O4 | O11; O16; O17; O18; O19; O20; S22 |
| TN-0835 | AS; FS | OR & ULD | P+ vs. P | Can 3 infantry sections supported by 2 tanks, a support section, 3 howitzers, 2 ARH and a fire control team defeat an insurgent platoon in a small village at minimal civilian cost? [same *vignette* as DSTO-TN-0833 – different tool] | O4 | O11; O16; O17; O18; O19; O20; S22 |
| TN-0890 | AS; FS | OR & ULD | P+ vs. P | What happens if the 2 M1A1 tanks in DSTO-TN-0833 & DSTO-TN-0835 are replaced by the CV90-35 or CV90-120? | O4 | O11; O16; O17; O18; O19; O20; S22 |