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Why Crew Resource Management needs to take resources seriously: a case study in
Human Terrain Mapping

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**Abstract**

Crew Resource Management (CRM) is concerned with optimising interpersonal behaviours in order to improve decision making and safety and has been applied in a wide range of safety-critical domains. CRM is a system which seeks to train practitioners to greater effectiveness within team working environments. A key aspect of making sense of a situation and taking decisions is the ability to recognise and utilise available resources. This often emphasises the notion that the 'crew' can be a 'resource' for the decision-maker (and the definition of 'crew' can be extended to any significant actor in the domain). From the perspective of Distributed Cognition, 'resources' can also include artefacts (physical objects and language). Distributed Cognition treats groups of individuals and artefacts engaged in the completion of a common task as a single cognitive entity. We contend that CRM, by its focus on interpersonal interactions, has tended to neglect this broader notion of resources and therefore provides an incomplete account of group information processing and decision making. In this paper, we discuss the role of artefacts as resources in CRM and illustrate our argument by applying this approach to the task of performing Human Terrain Mapping.

## 1    Introduction

*Military stabilisation and support operations*

Complex crises necessitate a coordinated approach, not only between the military forces of partner nations, but also across Other Government Departments (OGDs), Non-Governmental Organisations (NGOs), other International Organisations (IOs) and local populations (MoD, 2006). CIMIC (civil-military coordination) is *"The interaction between Alliance forces and the civil environment"* and comprises one part of the wider realm of civil-military interaction (NATO, 2003). CIMIC is conducted in support of the military mission and involves a number of activities with the intention of delivering a coherent response across the organisations mentioned above, including:

- Engagement with civil actors;
- Joint planning involving relevant civil authorities;
- Delivering civil effect on behalf of civil authorities in non-permissive environments;
- Continuous assessment of the local civil environment and the needs of locals;
- Coordination of the repair of critical infrastructure;
- Progression towards a smooth transition of civil responsibilities to the proper authorities;
- Advice to military commanders on civil-military matters.

(Adapted from NATO, 2003)

NATO AJP-9 (2003) also points out that in areas of instability few IOs or NGOs are able to operate, with the consequence that the military must step in to meet the needs of the local civilian population. In Helmand Province of Afghanistan, the stabilisation effort is coordinated through the Provisional Reconstruction Team (PRT). However, as a result of the difficulty and risk associated with operating on the ground in more remote areas of the province, delivery of stabilisation at the tactical level is undertaken by Military Stabilisation and Support Teams (MSSTs) - 6 person teams of experienced personnel drawn from the tri-services, who are given specialist training to deploy in to the field to coordinate local stabilisation efforts (MoD, 2009a). MSST training takes place over a 13 week period, which includes classroom training and scenario-based exercises covering a variety of aspects of civilian engagement, including: cultural briefings, communication, negotiation and analysis techniques, as well as preparation for operating in hostile environments (Figure 1, below). MSSTs seek to facilitate stabilisation and reconstruction projects with the consent of all relevant parties; in order to do this, it is crucial that the MSSTs have an accurate understanding of both key actors within the region and also the local population, in terms of their religion, culture and history, as well as their current concerns, priorities and attitudes towards ISAF and the Afghan Government (MoD, 2009b). The collection and analysis of this type of information has been termed Human Terrain Mapping (HTM).



**Figure 1**: One team member provides cover during the recovery of a civilian casualty – part of an MSST pre-deployment training exercise, January 2010.

*The Human Terrain*

HTM – 'understanding the human terrain' – is increasingly recognised as an essential component of modern military operations (MoD, 2009c); however, there are different interpretations of what it involves and how it may best be conducted. The British Army describes HTM as:

> *"…a broad and complex subject which brings together sociology, political science, geography, regional studies, linguistics and Intelligence. Its scope ranges from understanding individuals, particularly key leaders, through groups to societies and trans-national influences."*

> (MoD (2009) Army Field Manual, Vol 1(10) *Countering Insurgency*, p53)

The Army Field Manual goes on to describe HTM as having an understanding of the following elements of the human terrain:

- Language (basics of local language, effective use of interpreters).

- Political environment (political context of own campaign and aims, as well as insurgents' aims).

- Cultural environment (understand how the population will respond to actions).
    - Ideology and religion (knowledge of customs and avoidance of causing offence).
    - Differing cultures (tailoring messages to specific cultural groups).
    - Social structures (formal and informal institutions and organisations: importance of honour, the role of women, common courtesies and business practices – such as contracts and financial agreements).
    - Power and authority (the basis for power and authority within a society).
    - Interests (motivations behind behaviours: physical security, basic necessities, economic well-being, political participation and social identity).

- Time to develop understanding (development of comprehensive background knowledge, enabling the analysis of trends).

> (MoD, 2009c)

For the remainder of this paper, we will adopt this perspective of the human terrain during our discussions. Whilst this Army Field Manual description of HTM is from a counter insurgency perspective, there is a broad similarity in terms of the information required for CIMIC activity; 'NATO AJP-9 CIMIC Doctrine' includes similar components as required during CIMIC activity (NATO, 2003).

*'Doing' HTM*

Marr et al. (2008) describe their experiences of HTM in Iraq when their US Army Task Force was involved in a counterinsurgency effort during 'Operation Iraqi Freedom V' in 2007. Information was collected on religious boundaries, key economic structures, mosques and sheiks; this was done by cordoning off an area and then directly engaging with the local village elders and wider population, in order to gather data on the following information requirements:

- Local leaders (elders, officials, etc.)
- Cultural norms
- Local patterns of life
- Population trends
- Geographic area
- Mosques, markets, schools, medical centres, etc.
- ISAF locations and points of control
- Economic drivers / employment levels
- Access to essential services
- Coalition presence and activities
- Local population concerns / needs
- Biometric data collection

(Marr et al., 2008)

Hodge (2008a) describes similar census-taking activity carried out by US Marines in Afghanistan and how this information can be used to create map overlays that display social relations and tribal affiliations, poppy growing areas and attitudes towards ISAF (Hodge, 2008b). However, there is a question as to whether the use of such rapid data collection and presentation is fully able to elicit, capture and represent the complexities of the political and cultural environment that make up the human terrain. An alternative approach is to use specialist non-military teams to gather and report on human terrain information; in the US, the Human Terrain System (HTS) deploys anthropologists and social scientists to work alongside the military in Human Terrain Teams (HTTs). The argument for their use is that anthropologists (and related fields) are skilled in eliciting information on motivations, attitudes and values, and 'translating' this back into a perspective that Westerners can understand, rather than just asking a series of questions from a prompt card (McFate, 2005; Pryor, 2008). However, HTS has received strong criticism from within the anthropology community (c.f. AAA, 2007; González, 2009) and the US military (Connable, 2009).

## 2    Aims and Approach of the research

For the purposes of this paper, the focus of our analysis was on the goals of the MSSTs, their role in relation to their civil and military partner organisations and the people, processes, artefacts (tools) and techniques employed in the achievement of these goals. The academic perspectives of Crew Resource Management and Distributed Cognition have been applied to the analysis of the data collected, with specific consideration given to the implications for training, as the MSSG was only formed in 2009 and the training programme is still under development, affording potential for timely interventions. Attention was concentrated on the following activities:

1. Investigation of CIMIC HTM in practice: what information are the military trying to gather and how is it currently collected, analysed and shared?

2. Discussion of HTM training with reference to the frameworks of Crew Resource Management and Distributed Cognition

Access was granted to undertake data collection with the UK Military Stabilisation and Support Group (MSSG) based at Gibraltar Barracks, Camberley; observations of classroom training and field exercises were conducted during the 13 week pre-deployment training programme for Military Stabilisation and Support Teams (MSSTs) between November 2009 and January 2010. Semi-structured interviews were also conducted with six CIMIC/MSST training staff and subject matter experts (SMEs) who have undertaken this role in Afghanistan.

## 3    Case study: Military Stabilisation and Support Teams – understanding the human environment

In order to identify and address local priorities, achieve buy-in for reconstruction projects at different levels and then manage and evaluate the success of projects, the MSST collects information from the local population through direct engagement. The process by which information on the human environment is collected and analysed is summarised in Figure 2 and a brief description of their main engagement-related activities is provided below.

<u>Baseline assessments</u>

The MSST are unable to coordinate reconstruction activity in the local community until they know what that community already has and what they say they need. The baseline assessment is a process for the generation of a broad profile of the local community, in terms of a range of factors, including: Infrastructure (e.g. access to water, education, shops, employment, medical care); Population (ethnic groups, tribal backgrounds and affiliations, population shifts and trends); Local history (recent Taliban, ISAF, ANA, ANP activity; warfighting, level of civilian disruption/displacement and casualties);

Local opinion (community motivators and stressors, opinions on local Government figures and their effectiveness, attitudes towards ANA, ANP and ISAF); Potential development projects.
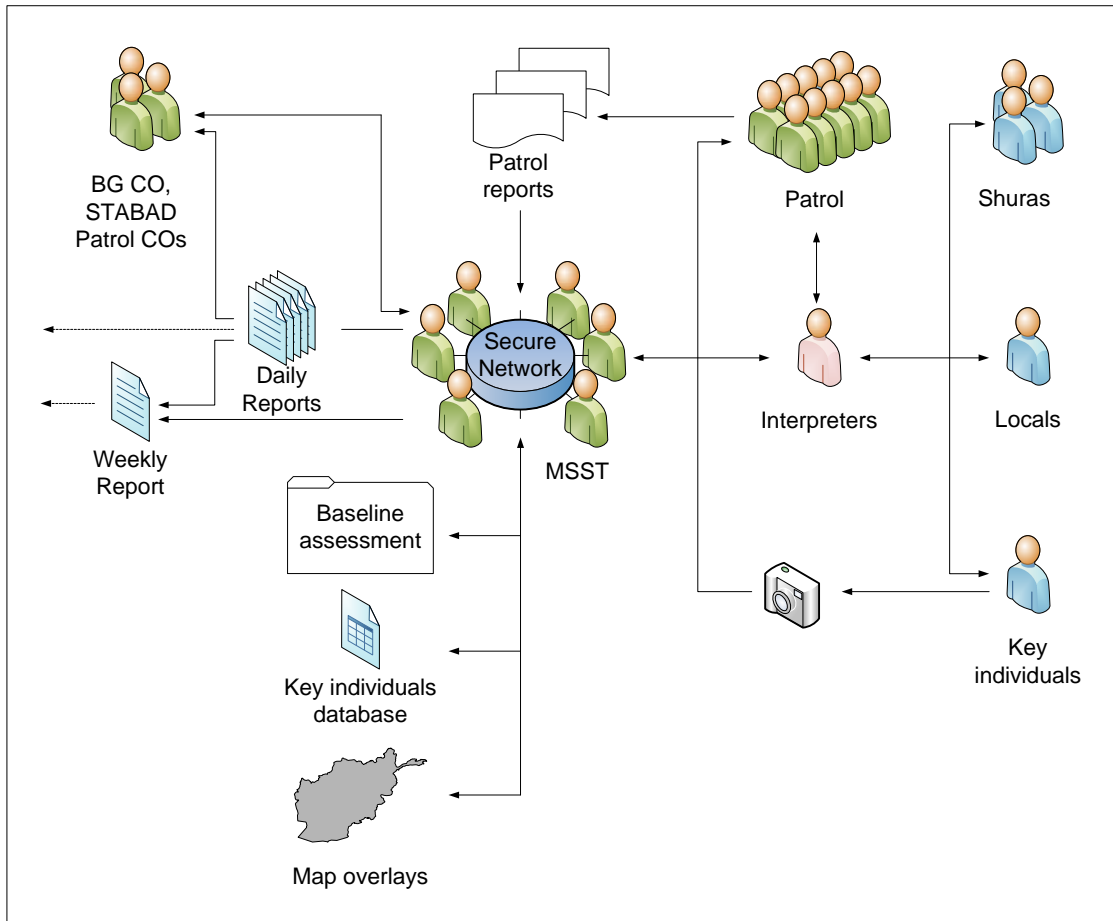


**Figure 2**: Simplified representation of the people and artefacts involved in understanding the human terrain at the tactical level[1].

The purpose of the baseline assessment is not to change anything, but to act as an up to date description of what is currently there. This is used to identify potential reconstruction projects, which may be proposed to the Provisional Reconstruction Team. MSSTs describe the importance of identifying why certain views are held within the local community, in order to subsequently plan how best to address them and resolve issues.

The baseline assessment is both a process and a document. The document is owned by the MSST, though it is freely available to other parts of the military through their secure network. The MSST constantly update the baseline assessment to reflect evolving

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[1] The arrows indicate interactions and the direction of information flow through the system, based on direct observations during training and interviews with SMEs

conditions on the ground over time and it is used as a source document for their reports and map overlays.

Representing community information: map overlays

MSSTs have the facility to produce digital map overlays from information within the baseline assessment and other databases. These may be printed onto maps used during briefing and patrolling activities. A variety of information may be added to a standard geographic map, including: Key infrastructure (mosques, schools, markets, wells, government buildings, medical centres); Tribal breakdowns; Patrol bases; Compound numbers in an area; ISAF, ANA, ANP locations; Key individuals within the community (tribal leaders, elders, etc.).

There is no single 'ideal' map overlay and a map with all known information on it would be unreadable, so a variety of annotated maps are printed for specific purposes.

Encounters during patrols

During patrols, civilians are frequently encountered; MSST staff, as the CIMIC experts will take the lead in engaging them in dialogue – greeting them and asking (via interpreters) if they would be willing to talk. When locals speak to the patrol if they have any issues, they will steer the conversation in that direction, for example they may wish to express their gratitude for the reconstruction work that is being undertaken, for example the rebuilding of a school or mosque; whilst some may appear aggressive and will ask why ISAF forces are in their country, or may complain that ISAF have caused damage to their crops or buildings. MSST staff will try to address their concerns and explain the process for handling any complaints of damage. MSST SMEs reported that engaging in dialogue with initially hostile people and using reasoned arguments often resulted in changing their opinions, with the result that they were then willing to support ISAF operations and passed information which was of use to the Battle Group.

Shuras and Key individuals

Shuras are group discussions and decision making processes, which operate along community power hierarchies, with elders, tribal leaders and other dignitaries occupying prominent positions and taking leading roles. MSSTs will engage in dialogue and as with roadside encounters, locals will steer the conversation towards matters of importance for them. It is important for MSSTs to gain an understanding of the attitudes and motivations of key individuals within the community, as this is necessary in order to know how to obtain buy-in from them for redevelopment projects. Having an understanding of the politics within the room is also necessary (such as inter-tribal rivalries), in order to know how to interpret what is said correctly; interpreters are often able to provide this additional level of information.

Key individuals are loosely defined as anyone who is able to further their mission (i.e. stability and reconstruction). With permission, the MSST will take a photograph of each key individual and record their details (name, father's name, tribe, where they live, tribal elder, mobile phone number), which are added to their contacts database. These database currently do not capture information relating to the circumstances of their contact, or the MSSTs assessment of their attitudes or motivations.

Atmospherics

Atmospherics relates to the articulation and capture of 'gut feelings' of military personnel when out on patrol. There is no formal definition of what constitutes atmospherics, but it goes beyond mere threat identification (e.g. combat indicators) as reflecting on what is seen and heard produces a 'snapshot' of the situation on the ground, in terms of the state of the local community and the reception given to the patrol. Atmospherics information is collected through direct MSST involvement in patrols and shuras, by reviewing patrol reports (which include a section on atmospherics) and from informal conversations/debriefs with soldiers from patrols. From one of the SMEs, the sorts of topics questions might be asked (or reflected) on could be along the lines of:

> *"In the market, are shops open? How many? What variety of produce? Were there people on the street? Were people out sitting drinking chai? Were you offered any chai? Would people talk to you? Were men working freely in the fields?"* (MSST SME)

The assessment of atmospherics serves a number of purposes, including in providing a feedback loop, i.e. providing a measure of effectiveness for stabilisation projects and Battle Group activity; for example, a key measure of success is when people are seen to be returning to an area which was previously unoccupied. Consequently, atmospherics is one of the categories which the MSST will include in their reports to the PRT.

Identifying changes in atmospherics over time will also prompt the MSST to investigate what has caused this, for example if ISAF patrols suddenly begin to receive a noticeably colder reception in one area, the MSST will look further to find out why this is and to see what can be done to remedy the situation. Also, if atmospherics have suddenly improved unexpectedly, the MSST will want to know why so that they can try to replicate this elsewhere.

Distributed team working

In order to travel to meetings with key individuals and to hold community shuras, staff from the MSST will attach themselves to infantry patrols, located at different patrol bases (PBs) across their district. this resulting in the team spending prolonged working from separate locations. The MSST are able to communicate and share data through the use of

radios and laptops connected to secure networks, enabling them to continue to write reports, maintain information databases and discuss progress with projects.

As it is very difficult for PRT staff to travel freely across the districts they serve, each MSST also produces collaborative reports (including daily and weekly reports), which consist of:

- Key leader engagement, shuras and future plans;

- Progress with projects;

- Atmospherics.

The MSST meets daily to discuss their activities, progress on projects and any problems they have encountered. They will discuss the perceived motivations and perceptions of key individuals involved in problematical projects and will attempt to identify root causes for difficulties faced and the best course of action to take.

<u>Summary</u>

From the above description of MSST activity relating to the collection and analysis of community information, it can be seen that it is possible to label much of this activity as Human Terrain Mapping: MSSTs use their knowledge of the local culture to help them identify community issues, social groupings, power structures and affiliations, as well as engaging in dialogue with key individuals to establish their motivations in relation to ISAF, the Afghan Government and reconstruction projects; they then produce a variety of human terrain products, from reports and databases to map overlays and briefings. Comparing this back to the Army Field Manual description of the human terrain confirms that MSSTs cover many of the relevant components at the tactical level.

Examination of the role of MSSTs emphasises the team-based nature of HTM activity and the importance of effective communications skills, namely the ability to open dialogue and establish a rapport with people from different cultures. In terms of training the skills necessary for HTM; Crew Resource Management (CRM) is one approach to the training of team working skills which may be of relevance to HTM.

**4      Crew Resource Management**

Originating in the aviation domain, Crew Resource Management (CRM) is concerned with the optimisation of team processes in order to improve decision making and therefore safety (Robertson and Endsley, 1995; Salas, et al., 2006). CRM is thought of as *"...the effective use of all resources."* (Federal Aviation Administration, 2004) and was developed in order to move away from a deferential culture where the captain of an aircraft was seen as the sole decision maker, to a safety-focussed approach where all relevant individuals (crew, cabin staff and Air Traffic Controllers) are jointly involved in

the decision making process and are actively encouraged to contribute and voice their concerns (Helmreich, et al., 1999). There are a variety of approaches to the training of CRM and even in opinions of what the term means and which competencies should be included (Salas, et al., 2006), however CRM generally involves awareness of and training in 'non-technical' interpersonal team work skills, including Cooperation; Leadership and managerial skills; Situation awareness; Decision making; Communication (van Avermaete, 1998). The training of these skills may involve the use of simulators, though more often problem solving exercises or role plays are used in order to illustrate points and allow trainees to practice techniques (c.f. Barnett, 2004; Federal Aviation Administration, 2004).

On the face of it, an approach originally developed for air crews may not seem relevant to the environment and activities of MSSTs as described on the preceding pages. There are however a number of similarities between the two: both sets of activities are fundamentally team-based, they both require close coordination amongst not only team members, but also with those outside of the unit and both teams also have to deal with and evaluate multiple sources of information. CRM has been successfully applied to a number of other safety-critical domains, including the emergency services, railways, operating theatres and offshore oil platforms, demonstrating the versatility of the approach. However, whilst the activity of the air crew could be said to be the management of the aircraft as a system, the human terrain system is harder to define; there is therefore a question as to whether CRM can be applied to less well defined and rigidly controlled environments than those of the airline cockpit and the operating theatre. We will now discuss how CRM relates to HTM as performed by MSSTs to explore this issue.

*People as resources*

The CRM concept of considering people as resources leads to two ways to consider interactions between people, which we have termed 'people as products' (i.e. as sources of information) and 'people as processes' (i.e. someone to engage in a process of dialogue with). These two notions are expanded on below.

People as products

Adopting the view of 'people as products' is likely to lead to considering them primarily as sources of information; from a training perspective this would have the consequence of emphasising what might be thought of as the mechanics of interpersonal interaction. In the MSST environment, this would include training in the protocols surrounding shuras, such as how to greet people, where to sit and how to avoid eye contact. It could also lead to the tendency to treat interaction with civilians as information collection sessions, for example through the asking of lists of questions – which seems to fit with the description of HTM in Iraq provided earlier (Marr, et al., 2008).

People as processes

An alternative perspective of people as resources would be to consider them as important partners in a process of dialogue intended to find a mutually satisfactory outcome for the situation; here we have drawn on the concept of communities of practice. Communities of practice are described in terms of three elements: a common domain of interest; a community of members engaged in joint discussions and activities and who develop a shared practice, or common repertoire of resources (Wenger, McDermott and Snyder, 2002).

Using the communities of practice perspective to assess a shura between MSST staff and local elders in an area not visited before, is likely to reveal a high level of common commitment to the domain (all involved are keen to improve conditions for the local population in terms of security and infrastructure), but their commitment to the community itself is likely to be low (with initial mistrust of the MSST), as will be the commitment to the practice (with a lack of common culture, experiences and approaches to viewing the cause of and solutions to problems). Communities of practice are thought to develop gradually over time; the process for transforming a shura from a meeting into a community of practice would be through dialogue (probably over the course of several sessions), in order to establish points of commonality (e.g. desire to improve conditions) and to gradually build up trust (e.g. through openness and the demonstration of trustworthiness by following through on promises). Once a community of practice has been established, then all parties can begin to work together to come up with mutually satisfactory solutions to their common problems.

Identifying the attitudes and motivations of key individuals is a major concern for MSSTs, as part of achieving buy in for reconstruction projects. Whilst MSSTs already engage in dialogue to this end, the use of the community of practice as an overarching concept may help them to structure their approach to discussions of reconstruction projects, providing them with a desired 'end state' for the nature of the shura as community, rather than adversarial debates or arguments. Achieving a community of practice within a shura would deliver buy-in, as the solution oriented process of identifying and agreeing solutions to local problems within the shura / community of practice, ensures that those involved have bought in to the resulting project.

This description of mechanistic vs. dialogue-based interactions would appear to ring true; MSSTs are taught cultural protocols and avoidance of offence as part of their training on cultural awareness; however training also involves taking part in several mock shuras, which are held with Afghan nationals and interpreters. A comparison of trainee MSSTs with limited experience of shuras and more experienced personnel reveals a transition from an awkward, mechanistic approach, with the observance of customs but no real ability to establish a rapport and a concentration on the collection of information via

direct questioning, to a more smooth and natural process of engaging in dialogue with civilians in order to establish points of commonality, identify concerns and work together to implement agreed solutions.

Information vs. Intelligence

MSST are not tasked as an intelligence asset, however they are open with civilians about the fact that information given to them is shared with other parts of the military and whilst they do not collect intelligence, as we have described they do actively seek to gather 'environmental' information which includes both the physical and human environments. Within the structure of an established dialogue and possibly a community of practice, it would be possible to build trust and allay fears regarding the MSSTs motivations for collecting information, whereas the direct use of question sets without building relationships is likely to breed resentment and decrease already low levels of trust. This view is supported by MSSTs SMEs, who reported that they found question-sets to be of limited value, as locals (who have likely been asked the same questions many times by previous patrols) will just provide the responses they thought were expected of them. MSSTs place greater value on engagement through dialogue and empathy with the concerns of the local population, who are then more likely to want to engage with the MSSTs and support them.

Use of interpreters

Adopting a 'people as product' approach and seeing them as an information source is likely to lead to using them to just literally translate verbatim what is being said to them. On the face of it, this would seem an entirely sensible use of a translator. However, the use of certain terms, phrases and gestures convey additional meaning over and above the literal meaning of the individual words themselves and it is likely that even with enhanced cultural awareness, military staff may struggle to pick up on all of these cues.

Taking the 'people as process' / communities of practice perspective may result in choosing to involve the interpreter in conveying the deeper meaning in the conversation; this could be done by pre-briefing with the interpreter before going out on patrol, discussing the objectives of any planned meetings and discussing how best to approach the situation. Involving the interpreter more deeply in planning will improve their understanding of the MSSTs' intention, so that they are more likely to be able to convey this properly, whilst at the same time having more flexibility to use language that avoids causing any offence or misunderstanding. MSSTs would appear to already be doing this: during training exercises involving Afghan Nationals, it was observed that during interpreter mediated role play conversations between trainee MSSTs and 'local civilians', the interpreter was directly involved with MSSTs in problem solving activities. MSST SMEs reported that in Afghanistan, they rely on their interpreters to provide them with their own assessment of situations, as Afghan tribal politics is extremely complicated and

the interpreters will pick up on underlying issues during meetings which the MSSTs would otherwise miss, suggesting that MSSTs and their interpreters have a more sophisticated relationship than merely using them to translate conversations.

*Resources as artefacts*

Returning to the definition of CRM as *"...the effective use of all resources."* (Federal Aviation Administration, 2004), this FAA advisory circular expands the definition to include *"human resources, hardware and information"* as resources, as problem solving involves all available tools. Within well defined and controlled environments, such as aircraft cockpits and operating theatres, artefacts (objects) in the environment are almost solely 'technical' in that they specifically relate to the task of flying the aircraft or performing the operation. As CRM concentrates on non-technical team work skills, the use of these artefacts is therefore ignored.

As we have described above, HTM takes place in much more unconstrained environments; the use of many of the artefacts available to MSSTs (such as databases, contacts lists, reports, photographs and map overlays) cannot be considered as purely technical skills and they are directly involved in the development of situation awareness and decision-making, which are areas covered by CRM. These artefacts are in many cases still being defined and are redesigned 'on the ground', however CRM is not able to comment on their design or use.

This raises the question of how such artefacts are to be conceptualised as part of HTM activity. Distributed cognition addresses the role of both people and artefacts in cognitive (problem solving and decision making) activity, therefore it would seem suitable to apply it to the discussion of HTM activity.

## 5      Distributed Cognition

Distributed cognition (DC) is the study of cognitive processes of groups of individuals and artefacts engaged in the performance of a task (Flor & Hutchins, 1991; Artman & Garbis, 1998). DC studies cognition at the systems-level and it is argued that these cognitive processes are emergent properties of the whole system and are distributed across it, rather than being contained within a single individual (Artman & Garbis, 1998). DC views artefacts themselves as acting as representations of task relevant information and the system arrives at its goal-state by performing transformations upon these representations (Flor & Hutchins, 1991; Perry, 2003). The transformation of representations is achieved by combining, interpreting and re-presenting information provided by both artefacts and individuals in the system (Hutchins, 1995; Artman & Garbis, 1998). Therefore, in order to study the nature of cognition at the systems level, researchers focus on the role of observable external representations, the flow of information between components and the environment in which the system operates

(Baber et al., 2008; Hutchins, 1995; McMaster and Baber, 2006; McMaster et al., 2006; Perry, 2003).

*Human Terrain Mapping as DC activity*

From our interviews and observations, it is evident that this social network exhibits distributed cognition properties; cognitive activity (i.e. the creation, dissemination and transformations of representations) is spread across the network, facilitated by the use of 'networked' artefacts (i.e. reports, databases, photographs and map overlays). For example, information on the state of atmospherics in a particular region might be collected by the patrol that visits the area; this is then analysed and formalised by an MSST member and may be discussed and assessed by the whole MSST, before being used to update the baseline assessment and further summarised (with an accompanying assessment) in the team reports to the PRT, where it will be used in the ongoing assessment of project plans. The MSST may also use this assessment in the structuring of their own plans and also as part of a subsequent briefing, both to the Battle Group Commander and to future patrols heading to that area. This distributed information processing activity is supported by a number of artefacts, which perform a number of important roles.

Artefacts as resources for action

Continuing with the example of the use atmospherics information in HTM, we now discuss the role of the baseline assessment. Whilst this document would appear to merely be a storage mechanism for information pooled from a number of sources, we would argue that it also acts as resource for action. The notion of artefacts functioning as resources for action argues that their design, appearance or functionality may act as prompts for agents to perform certain activities, without consciously reflecting on them first (Baber et al., 2008; Fields, Wright & Harrison, 1996). Working in clinical settings, Nemeth et al. (2007) performed studies of the role of patient records and displays and identified other ways that the structure and complexity of information directs the attention of the viewer to the most important parts. The baseline assessment may be accessed by non-MSST staff via the secure network and contains information likely to be of interest to a number of people involved in planning and working within a region. As was described earlier, the baseline assessment contains details on a wide variety of aspects of local life and concentrates on those areas that are of particular importance to the people of the specific region in question. In this way, the structure of the baseline assessment provides the viewer with a rapid overview of the state of the local environment (via subject headings) and also directs their attention to the key factors to pay attention to by reflecting the level of complexity of a specific issue through the amount of information provided on it.

Nemeth and Cook (2004) assert that cognitive artefacts represent the information that is critical within a work domain. Whilst this may be the case within well defined and relatively static environments, in the case of MSST documents in relation to the human terrain, this is not so for a number of reasons, which are again illustrated with reference to the baseline assessment:

- *Baseline assessments relate to information outside of the human terrain*: As the MSST role is wider than merely the collection of information on the local human terrain, their baseline assessments include details on reconstruction projects, infrastructure and a number of other elements which fall outside of the 'human' element of the local terrain. This is likely to compromise their effectiveness in disseminating human terrain information as, whilst they are available via the military secure network, their broad topic area may disguise their relevance to other groups engaged in similar activity.

- *Baseline assessments do not reflect the totality of human terrain information:* the discussion of human terrain assessment activity as undertaken by MSSTs in this report demonstrates that human terrain information resides in a range of artefacts used by MSSTs and that there is likely to be other relevant information held elsewhere which is not currently reaching the MSSTs.

- *Baseline assessments do not optimise the presentation of human terrain information*: as was described earlier, information is taken from baseline assessments and databases and is used to create map overlays; these artefacts re-present text information in a graphical format which reduces cognitive effort and enables the visualisation of data points in physical relation to one another. However, this is by no means an optimal mode of presentation for all human terrain information, especially when considering the individual or family level. Thus, there is no single 'best' presentation method for human terrain information.

The current artefacts in use by the MSST are not optimised for the collection and analysis of human terrain information. This is unsurprising as each artefact performs a number of other unrelated roles, in addition to their use in HTM, which results in a compromise. Additionally, the role of MSSTs is still under constant review and development – the Military Stabilisation and Support Group which trains MSSTs was only launched in 2009 (MoD, n.d.) – with the consequence that the artefacts used by MSSTs are constantly being adapted as the requirements of their role become clearer.

MSST SMEs indicated that they would like to be able to capture information on key individuals' attitudes and motivators, as this information is not currently adequately recorded in any of the artefacts described above, with the result that only resides in the heads of MSST staff, limiting the ability to share it with partner agencies outside of the

tactical level and raising the risk that it will be lost to the organisation at the end of their tour. This would then require the next MSST to begin the process of capturing this information again. As we have described, one function of artefacts as resources for action is in prompting people as to what information to gather; if there is currently no means of satisfactorily recording and therefore sharing information, there is a danger that key information is not captured, reducing the effectiveness of the MSST in accurately assessing the human terrain and therefore limiting their ability to implement stabilisation and reconstruction projects.

*Designing CIMIC and human terrain artefacts*

This paper raises the requirement for the redesign of artefacts relating to CIMIC and HTM, in order to prevent the loss of valuable information and to jointly optimise them for their dual roles. The detailed design of artefacts requires a more extensive analysis of the work system than we have been able to complete as part of this preliminary research (Nemeth, 2004)[2], however a number of proposals for alternative methods for the presentation of human terrain-type information (such as values and attitudes) have been suggested, which could be applied to the individual and community level and which may in some circumstances be more appropriate than map overlays. Figure 3 is taken from *"Beneath the surface: Intelligence preparation of the battlespace for counterterrorism"* (Thomas, 2004); the wheel on the left of Figure 3 represents the 3 dimensions of the battlespace (information, social and physical), which are then sub-divided into sectors that represent the mission-relevant characteristics of the environment. Thomas (2004) describes how each sector may be analysed in turn, in terms of the level of impact it has on the goals of different actors involved in a conflict; it is then possible to mark out the relative positions of the different actors in the environment across these sectors (the right hand 'wheel') – the further from the centre of the wheel the line for an organisation is, the greater influence that Sector has on the organisation. This provides a quick visual reference which shows their positions relative to each other (Thomas, 2004).

Whilst Thomas (2004) describes in detail applying this process from a counterterrorism perspective, he states that the different sectors are open to modification, based on the purpose of the activity and we have already described the parallels between HTM for counter insurgency / counter terrorism and other activities, such as CIMIC. It is apparent that this method could be adapted for use in CIMIC or other HTM related activities: the relevant dimensions and sectors could be taken from the issues identified through the baseline assessment and much of the data required to undertake the analysis is already

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[2] A task analysis of the work system incorporating a CRM approach, such as van Avermaete's (1998) NOTECHs (non-technical skills) would also identify measures of effectiveness, i.e. objectives, behaviours and associated risks for the various MSST tasks, which could be used in the design and evaluation of training, as well as in assessment of MSST effectiveness in-theatre.

collected. This form of representation could be adapted to indicate points of commonality and areas of divergence, not only between ISAF and the local community, but between different sub-groups within the population. These could then be addressed through the process of engagement. Additionally, this method could be used at multiple levels, from mapping the attitudes and values of key individuals, to families, tribes or the wider community.
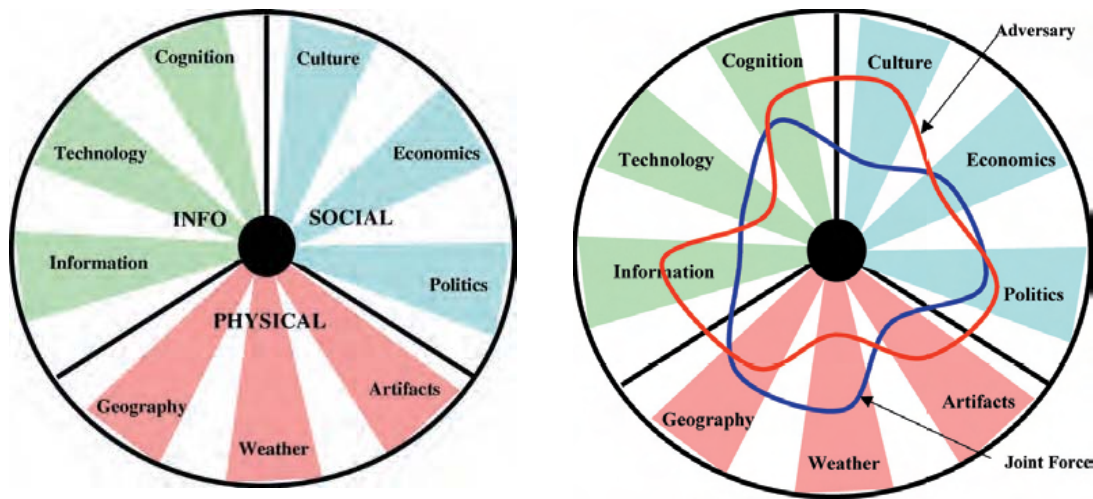


**Figure 3**: Dimensions and sectors of the counterterrorism 'battlespace' (Thomas, 2004)

Another possible form of representing inter-group information is the relationship matrix (Figure 4), which summarises attitudes of different sub-groups towards one another (RAND, 2002). Matrices like this which present an assessment of the nature of each relationship for all groups can be used to help reveal motivations behind actions or allegiances which may at first appear contradictory, for example where two rival tribes suddenly begin to cooperate, it may be in order to defeat a common enemy.

## 6       Discussion

The preceding discussion of the use of CRM as a training technique for HTM has raised a number of questions as to the applicability of the approach to less well defined domains than the original setting of airline cockpits. The notion of communities of practice demonstrates that there are different ways of conceptualising people as resources and we would argue that these are borne out in the different approaches to human terrain mapping which are currently in use.  Fully applying the definition of CRM (as the use of all available resources) and including artefacts in the analysis revealed relevant aspects of the process of understanding the human terrain which were not obvious through the traditional, narrow focus of CRM on interpersonal skills.
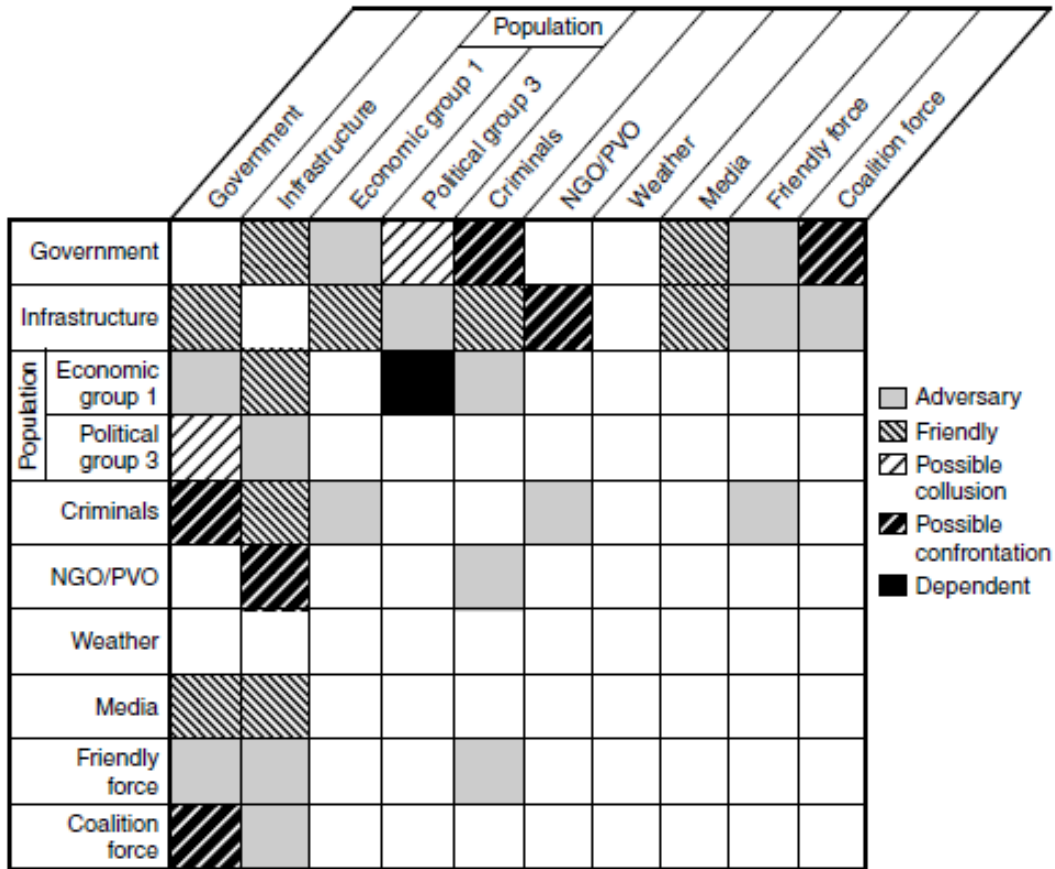
**Figure 4**: An example of a relationship matrix (RAND, 2002)

As the above discussion of MSST work has suggested, human terrain mapping takes place in an environment which presents very different challenges; HTM involves a large number of people, many of whom may not recognise that there is any commonality of purpose with the MSST; discussions take place from the starting point of very different cultural perspectives and life experiences and the information environment is almost entirely unstructured, with the MSST developing the tools they use in the collection and assessment of information as they go.

Marr et al. (2008), make the following observation regarding HTM:

> *"In retrospect, we would also point out from our experience that having a human terrain map is not nearly as valuable as doing human terrain mapping. Human terrain mapping provided an effective technique to learn and begin to understand the battlespace which we were responsible for."*

This quote illustrates the importance of remembering that, whilst new artefacts are required for CIMIC HTM, these products should be designed to fit the process, not the other way around.

The design of appropriate artefacts requires not only an understanding of the tasks that the (work) system must complete, but also the wider social, organisational and cultural elements of coordinated activity (Vicente, 1999). The adoption of a more sociotechnical systems based approach to the design of work systems is known as macroergonomics and is increasingly acknowledged as necessary for the development of successful innovations within complex work systems (Hendrick, 1997). Distributed cognition fits within this macroergonomic perspective and provides a methodology for eliciting the information requirements of the work system which may then be translated into designs for better tools (McMaster and Baber, 2005).

# References

AAA (2007) American Anthropological Association Executive Board Statement on the Human Terrain System Project. Retrieved 26th January 2010 from:
http://www.aaanet.org/about/Policies/statements/Human-Terrain-System-Statement.cfm

Artman, H. and Garbis, C. (1998) Situation awareness as distributed cognition. In T.R.G. Green, L. Bannon, C.P. Warren and J. Buckley. (eds.) *ECCE 9: Proceedings of the Ninth European Conference on Cognitive Ergonomics*, (pp. 151-156). Le Chesnay, France: European Association of Cognitive Ergonomics (EACE).

Baber, C., Smith, P., Cross, J., Hunter, J. and McMaster, R. (2008) Crime scene investigation as distributed cognition, in I. E. Dror and S. Harnad (eds.) Cognition Distributed, John Benjamins: Amsterdam, 159-184.

Barnett, M. L. (2004) Risk management training: the development of simulator-based scenarios from the analysis of recent maritime accidents. In proceedings of the Advances in International Maritime Research Conference, Tasmania: IAMU.

Connable, B (2009) All our eggs in a broken basket: how the human terrain system is undermining sustainable military cultural competence, Military Review, March-April 2009. Retrieved 26th January 2010 from:
http://usacac.army.mil/CAC2/MilitaryReview/Archives/English/MilitaryReview_20090430_art010.pdf

Federal Aviation Administration (2004) Advisory Circular: Crew resource management training, AC No: 120-51E.

Fields, B., Wright, P. and Harrison, M. (1996) Designing human system interaction using the resource model. In L. Yong, L. Herman, Y. Leung and J. Moyes, (Eds.) *Proceedings of the APCHI'96 conference*, (pp. 181—191) Singapore : Information Technology Institute.

Flor, N. V. and Hutchins, E. L. (1991) Analyzing distributed cognition in software teams: A case study of team programming during perfective software maintenance. In J. Koenemann-Belliveau, T. G. Moher and S. P. Robertson (Eds.) *Empirical Studies of Programmers: Fourth Workshop*. Norwood, New Jersey: Ablex Publishing Corporation.

González, R. J. (2009) American counterinsurgency: Human science and the human terrain, Prickly Paradigm Press, Chicago.

Helmreich, R.L., Merritt, A.C., & Wilhelm, J.A. (1999). The evolution of Crew Resource Management training in commercial aviation. *International Journal of Aviation Psychology*, 9(1), 19-32.

Hendrick, H. W (1997). "Organizational design and macroergonomics", in G. Salvendy (ed.), *Handbook of Human Factors and Ergonomics*. Wiley, London.

Hodge, N. (2008a) *Afghanistan Diary: Mapping the Human Terrain in Helmand, Part I*, online article. Retrieved 26th January 2010 from:
http://www.wired.com/dangerroom/2008/10/afghanistan-d-1/

Hodge (2008b) *Afghanistan Diary: Mapping the Human Terrain in Helmand, Part II*, online article. Retrieved 26th January 2010 from:
http://www.wired.com/dangerroom/2008/10/afghanistan-d-3/

Hutchins. E. (1995) How a cockpit remembers its speeds. *Cognitive Science, 19* (3), 265-288.

Marr, J., Cushing, J., Garner, B. and Thompson, R (2008) Human terrain mapping: a critical first step in winning the COIN fight, Infantry Magazine, Jan-Feb 2008. Retrieved 26th January 2010 from:
http://findarticles.com/p/articles/mi_m0IAV/is_1_97/ai_n25129936/

McMaster, R., and Baber, C. (2005). Integrating Human Factors into Systems Engineering through a distributed cognition notation. *IEE People and Systems Symposium 2005.*

McMaster, R., Baber, C. and Houghton, R.J. (2005) Investigating alternative network structures for operational command and control. In *The Proceedings of the 10th International Command and Control Research and Technology Symposium: The Future of C2,* June 13-16, McLean, Virginia: CCRP.

McMaster, R. and Baber, C. (2006) Assessing the impact of digital communications technology on existing C2 systems; a distributed cognition perspective, in *Proceedings of the 11th International Command and Control Research and Technology Symposium: Coalition Command and Control in the Networked Era*, September 26-28, Cambridge, UK.

McMaster, R., Baber, C. and Houghton, R.J. (2006) Investigating Distributed Cognition Processes during Effects-Based Operations, in *Proceedings of The Technical Cooperation Program Human Systems Integration Symposium,* May 4-5, Canberra, Australia.

McFate, M. (2005) Anthropology and Counterinsurgency: The Strange Story of their Curious Relationship, Military Review, March-April 2005. Retrieved 26th January 2010 from:
http://www.army.mil/professionalwriting/volumes/volume3/august_2005/7_05_2.html

MoD (2009a) *British military team help reconstruct Garmsir online article*. Online article, retrieved 26th January 2010 from:

http://www.mod.uk/DefenceInternet/DefenceNews/MilitaryOperations/BritishMilitaryTeamHelpReconstructGarmsir.htm

MoD (2009b) *British and Danish soldiers help reconstruct Gereshk*. Online article, retrieved 26th January 2010 from:
http://www.mod.uk/DefenceInternet/DefenceNews/MilitaryOperations/BritishAndDanishSoldiersHelpReconstructGereshk.htm

MoD (2009,c) (MoD (2009c) Army Field Manual, Vol1 (10) *Countering Insurgency*, 71876. Retrieved 26th Janaury 2010 from:
http://news.bbc.co.uk/2/shared/bsp/hi/pdfs/16_11_09_army_manual.pdf

MoD (n.d.) *Military Stabilisation and Support Group*. Online article, retrieved 26th Janaury 2010 from:
http://www.mod.uk/DefenceInternet/AboutDefence/WhatWeDo/DoctrineOperationsandDiplomacy/MSSG/

Nemeth, C. P. and Cook, R. I. (2004) Discovering and Supporting Temporal Cognition in Complex Environments, in *Proceedings of theTwenty-Sixth Annual Conference of the Cognitive Science Society*. Chicago: 1005-10.

Nemeth, C. P., O'Connor, M. F., Nunnally, M. E. and Cook, R. I. (2007) RePresenting Reality: The Human Factors of Health Care Information, In Carayon, P. (Ed.). The Handbook of Human Factors and Ergonomics in Health Care and Patient Safety. Mahwah, NJ. Lawrence Erlbaum Associates: 439-55.

Perry, M. (2003) Distributed cognition. In J. M. Carroll (ed.) *HCI Models, Theories and Frameworks. Towards a Multidisciplinary Science*. London: Morgan Kaufmann.

Pryor, M (2008) Human terrain team helps soldiers in Iraq understand cultural landscape, Infantry Magazine, Jan-Feb, 2008. Retrieved 26th January 2010 from:
http://findarticles.com/p/articles/mi_m0IAV/is_1_97/ai_n25129935/

RAND (2002) Street smart: Intelligence preparation of the battlefield for urban operations. Santa Monica, CA.

Thomas, T. S. (2004) *Beneath the surface: Intelligence preparation of the battlespace for counterterrorism*, Joint Military Intelligence College, Washington, DC.

van Avermaete, J. A. G. (1998) NOTECHS: Non-technical skill evaluation in JAR-FCL, National Aerospace Laboratory.

Vicente, K. (1999). *Cognitive work analysis: Toward safe, productive, and healthy computer-based work.* Lawrence Earlbaum Associates, Mahwah, New Jersey.

Wenger, McDermott and Snyder (2002). *Cultivating communities of practice: a guide to managing knowledge.* Harvard Business School Press.