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A Conceptual Model of Information Processing by Land Commanders at Low Tactical Levels

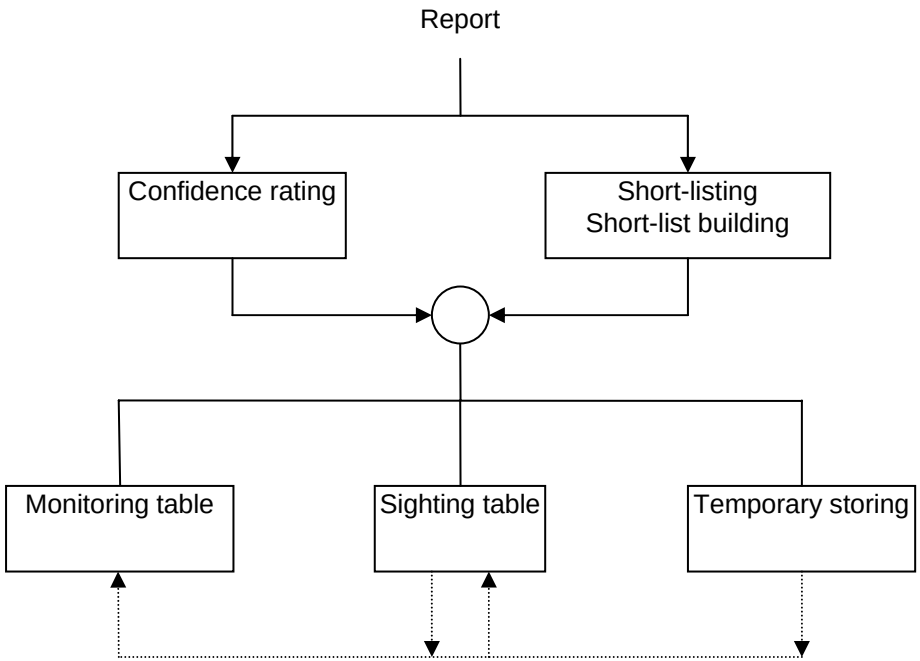
Introduction

- Significant research effort deployed to understand the parameters conditioning the translation of more real-time information into better military effects.

- But:
  - current modelling efforts are particularly dedicated to the whole decision-making process within headquarters
  - significant operational responsibilities are now granted to company-groups

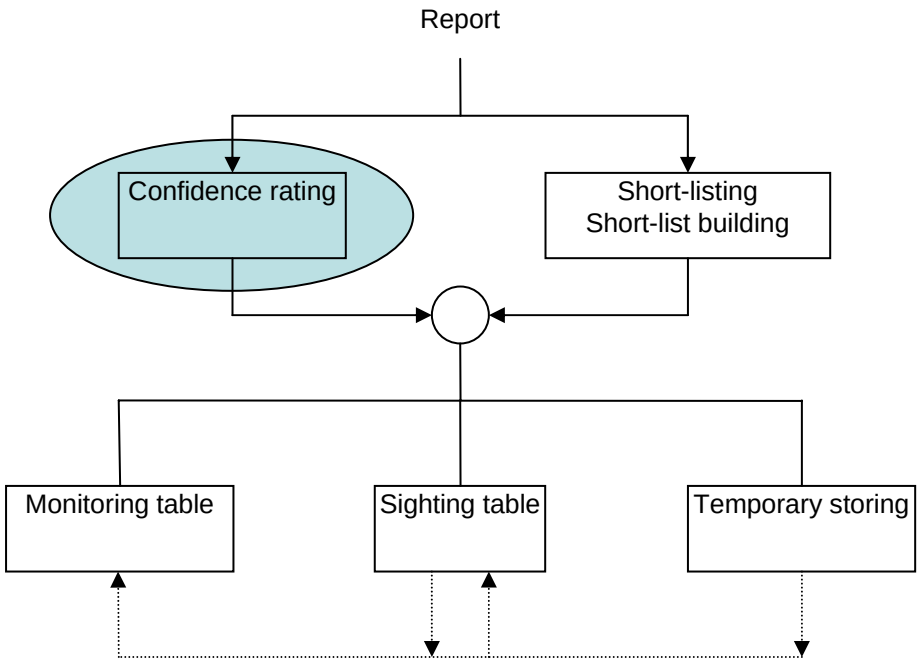
- Thus a need to understand how commanders at these levels transform data into intelligence.

Model's Structure



Subjective Appraisal

Model's Structure



Information Quality

- CCRP information quality attributes:
  - Correctness
  - Completeness
  - Currency
  - Timeliness
  - Consistency
  - Precision
  - Accuracy
  - Relevance

- Accessible to commanders:
  - Currency / Timeliness
  - Consistency
  - Precision / Accuracy

Information Quality

- Currency / Timeliness:
  - Often estimated with rough rules-of-thumb
  - Still an objective rather than subjective evaluation
- Consistency and Precision / Accuracy
  - Their influence on the subjective appraisal depends on the trust in the source

1) Report's Aspect

- Confidence in a message relies on
  - How it appears (formatting, phrasing)
  - How it sounds (expression)

- At low tactical levels, aspect provides
  - An immediate rating of the report's worth.
  - The progressive building of confidence in the source's professionalism.

2) Trust in the Source

- Usually combines the commander's perception of:
  - The suitability and reliability of its set of sensors (technical).
  - The competence of its operators (human).

- Such perception may be
  - Based on preconceptions
  - Built over time (esp. through common training activities)

- Among the mechanisms that contribute to preconceptions:
  - Combination
  - Similarity
  - Reputation

- Particular case: information sources as fusion centres

Experimental Inputs

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- We assumed that two features contribute to the subjective appraisal :
  - Its aspect (i.e. structure, wording and expression)
  - Its source (actual or relay)

- For each feature, an experimental effort must be dedicated to the determination of:
  - The factors that make them up
  - Their evolution with time
  - Their contribution to the confidence rating

- Two additional questions need to be addressed:
  - What scale does a commander use to express the confidence rating of a piece of information?
  - Depending on the level of trust it is conferred, how is processed a piece of information?

Objective Exploitation

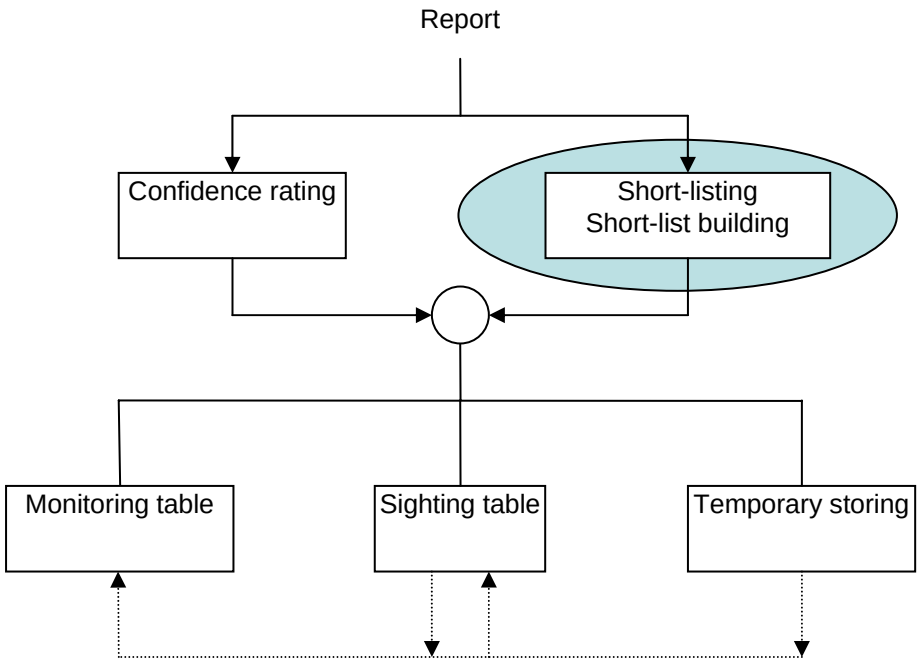
Mental Mechanisms

- Based on two assumptions:
  - ‘Behavioural’ consistency
  - ‘Local’ consistency

- Utilisation of a two-stage process to model the objective exploitation of reports by the company commander:
  1. Attempt to recognise the enemy formation from the elements reported.
  2. Attempt to link the content of successive reports over time.

First Stage

Model's Structure



Mental Template (Part)

Report								
Level of precision	Reported nature	Reported volume	Command vehicle	Recon patrol	Tank troop	Infantry platoon	Engineer section	FOO vehicle
Element detection	Vehicles	1	X	X	X	X	X	X
		< *ptn*	O	X	X	X	O	O
		> *ptn*	O	O	O	O	O	O
	Personnel	< *sqd*	X	X	X	X	X	X
		> *sqd*	O	O	O	X	O	O
		> *ptn*	O	O	O	O	O	O
Recognition	Tank	1		X	X			
		< *ptn*		O	X			
		> *ptn*		O	O			
	Tracked Armoured Vehicles	1	X			X		X
		< *ptn*	O			X		O
		> *ptn*	O			O		O
	Wheeled Armoured Vehicles	1		X			X	
		< *pat*		X			O	
		< *ptn*		O			O	
		> *ptn*		O			O	
		> *pat*		X				
		> *sqd*		O		X	X	

Short-List

Platoon-level elements	Command vehicle	Recon patrol	Tank troop	Infantry platoon	Engineer section	Observation vehicle
Potential presence						

Keys: - an X is used when the element can account for all the elements reported

- an O is used when the element can only account for part of the reported elements

- a void means that the element has nothing to do with the report

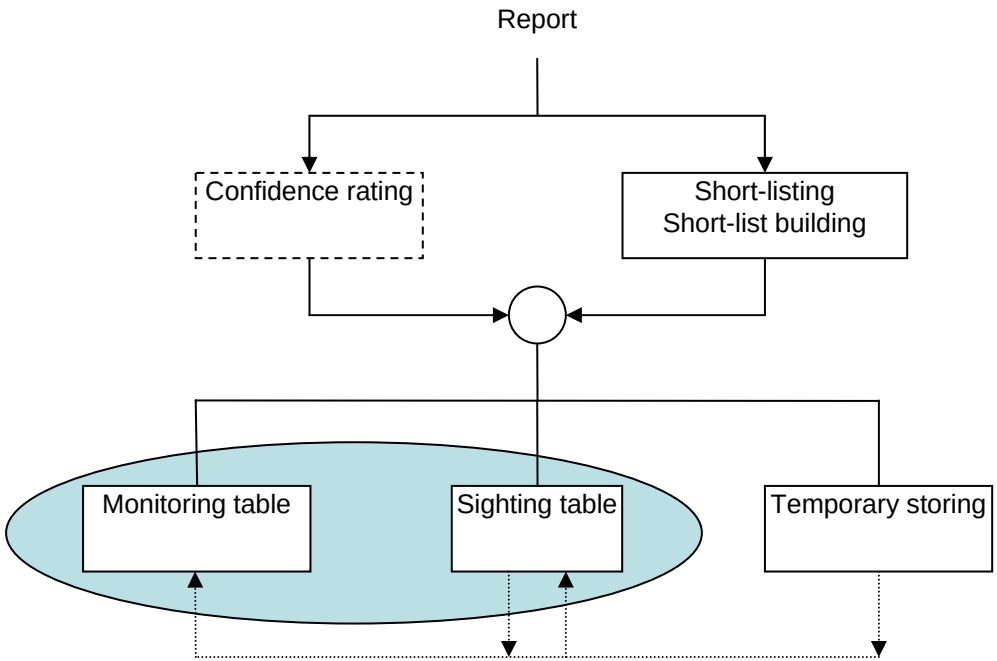
Short-List Building

- In this mental template, we assume that the reported elements can be found in the opponents' known resources and structures.

- When these assumptions are not valid:
  1. No short-list is established and the report is carried forward through the process in raw form.
  2. A mental template is built upon the monitoring of opponents' patterns (not investigated in the thesis).

Second Stage

Model's Structure



Monitoring Template

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		Last position	Last attitude	Sighting time	*Validity time limit*	*Tactical mobility*
Command vehicles	1					
	+					
Recon patrols	1					
	2					
	+					
Tank troops	1					
	+					
Infantry platoons	1					
	2					
	3					
	+					
Engineer sections	1					
	2					
	3					
	+					
Observing parties	1					
	+					

Sighting Template

		Instance	Volume	Position	Attitude	Time tag	*Validity time limit*
Activity detection	Smoke	1	N/A		N/A		N/A
		2	N/A		N/A		N/A
			N/A		N/A		N/A
	Noise	1	N/A		N/A		N/A
		2	N/A		N/A		N/A
			N/A		N/A		N/A
	Etc.		N/A		N/A		N/A
Element detection	Vehicles	1					
		2					
	Personnel	1					
		2					
Recognition	Tanks	1					
		2					
	Tracked armoured vehicles	1					
		2					
	Wheeled armoured vehicles	1					
		2					

Mechanism

- Reports in raw form are placed in the sighting table.

- Short-lists go through the following process:
  - If it contains only one X (i.e. elements identified):
    - If it is matched with an element already detected, information is updated in the monitoring table.
    - If it cannot be matched, it is logged as a new element in the monitoring table.
  - If it contains more than one X:
    - If one of them is matched with an element already identified:
      1. Information is updated in the monitoring table.
      2. The entities represented by this element are removed from the short-list which is sent back to the first stage.
    - If none of them can be matched, the result is logged in raw form in the sighting table.

Matching Procedure

- Elements short-listed at the end of the first stage or carried through in raw form are, in the second stage, compared to elements in the monitoring or sighting tables.

- A match between two reports can be established if some conditions are fulfilled, such as:
  - Matching natures and consistent volume.
  - Distance between reported positions.
  - New attitude consistent with previous one.

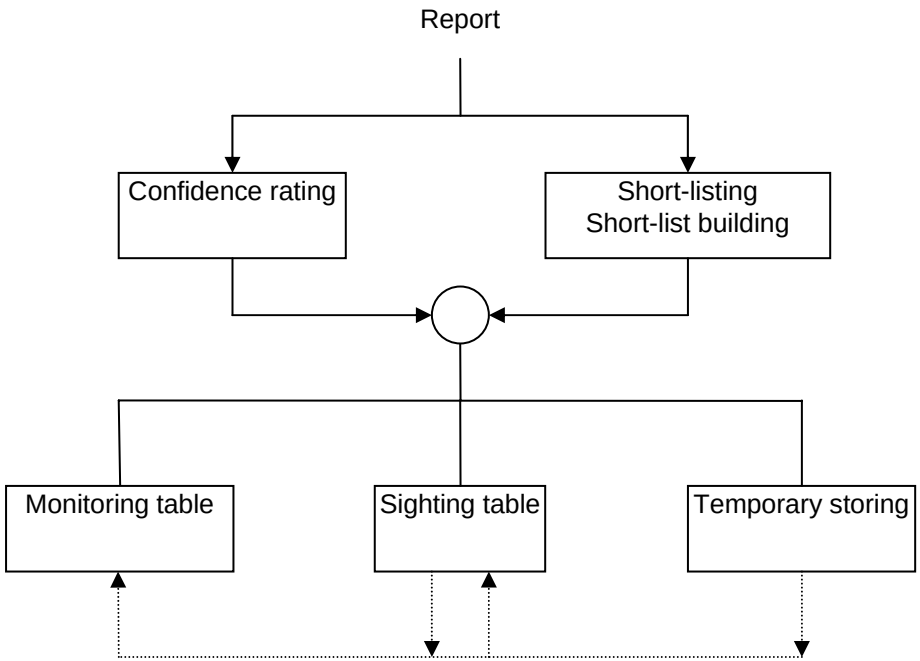
Delayed Reports

- An untimely report delivers valuable information only if:
  - It represents the most recent reference to a particular series of events.
  - It confirms a more recent but distrusted report.

- However, reactions in the face of delayed reports are variable:
  - What parameters contribute to the evaluation of timeliness and to what extent?
  - What scale is used to express the timeliness of a piece of information?
  - Depending on the timeliness rating on this scale, how is processed a piece of information?

Complete Model

Model's Structure



Monitoring / Sighting

- The complete model works as follows:
  1. Confidence rating is attributed.
  2. Reports go through the first stage without consideration for this rating.
  3. The subjective appraisal influences the second stage. Depending on trust behaviour and confidence rating, an ‘inconsistent’ report is:
     - Logged.
     - Discarded.
     - Held up in a temporary table.

Conclusion

- Primarily intends to transcribe the main features of the sense-making process and to provide a foundation for further investigation.

- Built without reliance on specific command structures, means of communication or means of visual display.

- Next steps of development:
  - Formally validate the model's mechanisms
  - Characterise the various parameters

- Owing to its simplicity, the model can be implemented using rule-based applications.