



Australian Government
Department of Defence
Defence Science and
Technology Organisation



Degrees of Shared Awareness

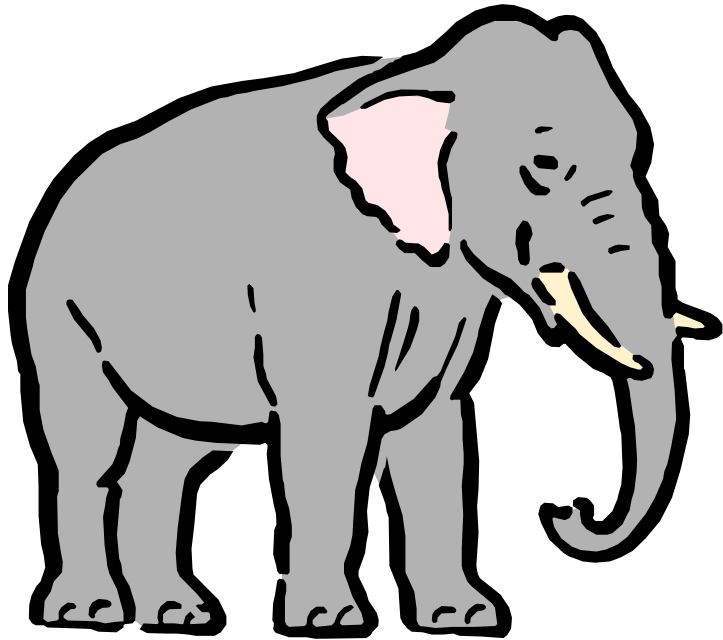
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ICCRTS, Denmark, Sep 2004



The Six Blind Men: A Parable



Basic Parable

- Each man obtained different information
- They shared it
- They didn't agree

Positives

- Greater information
- Knew they had different opinions
- In a different situation, they may have arrived at a better understanding



The Complexity of Information

- **Information is an abstraction of reality**
- **There are multiple ways of representing the same information**
- **Some similar measures are subtly different**
- **May be difficult to determine the relationship to reality, and thus between pieces of information**
- **Complex network of relationships, rather than a pure hierarchy**
- **May change of time**
- **May be known, measured or predicted**
- **May include qualifiers, pedigrees, uncertainties**
- **Consistency of information is not transitive**
- **Meta-data, context, and casting of information is important.**



Degrees of Information Sharing

<i>Similarity of Information Held by Two Nodes</i>	<i>Level Of Sharing</i>
Not Held	Original Information
All Information Identical	Common Shared Information
All Identical or Consistent Includes a consistent mapping between conflicting information held each node	Consistent Shared Information
All Conflicting	Conflicting Shared Information
Some Consistent or Common and Some Additional Conflicting	Ambiguous Shared Information



Sharing Information

Information

Organic Information

Organic Information
Placed on the Network

Organic Information
Sharing Acknowledged

Other
Organic Information

Non-organic Information

Non-organic Information
Found on the Network

Non-organic Information
Sharing Acknowledged

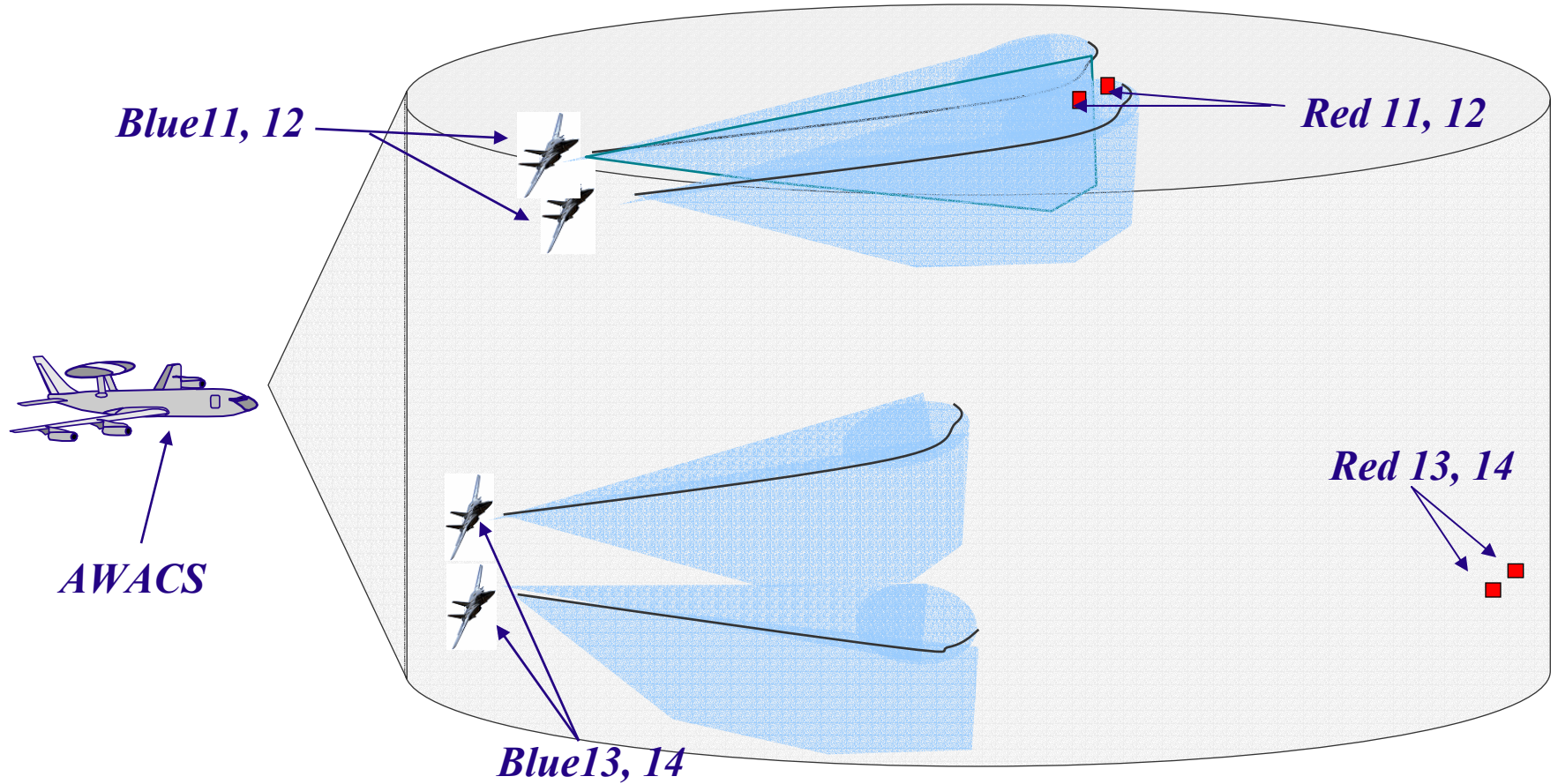


Degrees of Shared Awareness

	Aware of Sharing	Aware of Potential Sharing	Not aware of Sharing
Common Shared Information	Full Shared Awareness	Potential Shared Awareness	Common Awareness
Consistent Shared Information			
Conflicting Shared Information	N/A	Conflicting Shared Awareness	Conflicting Awareness
Ambiguous Information			
Original Information			



An Example



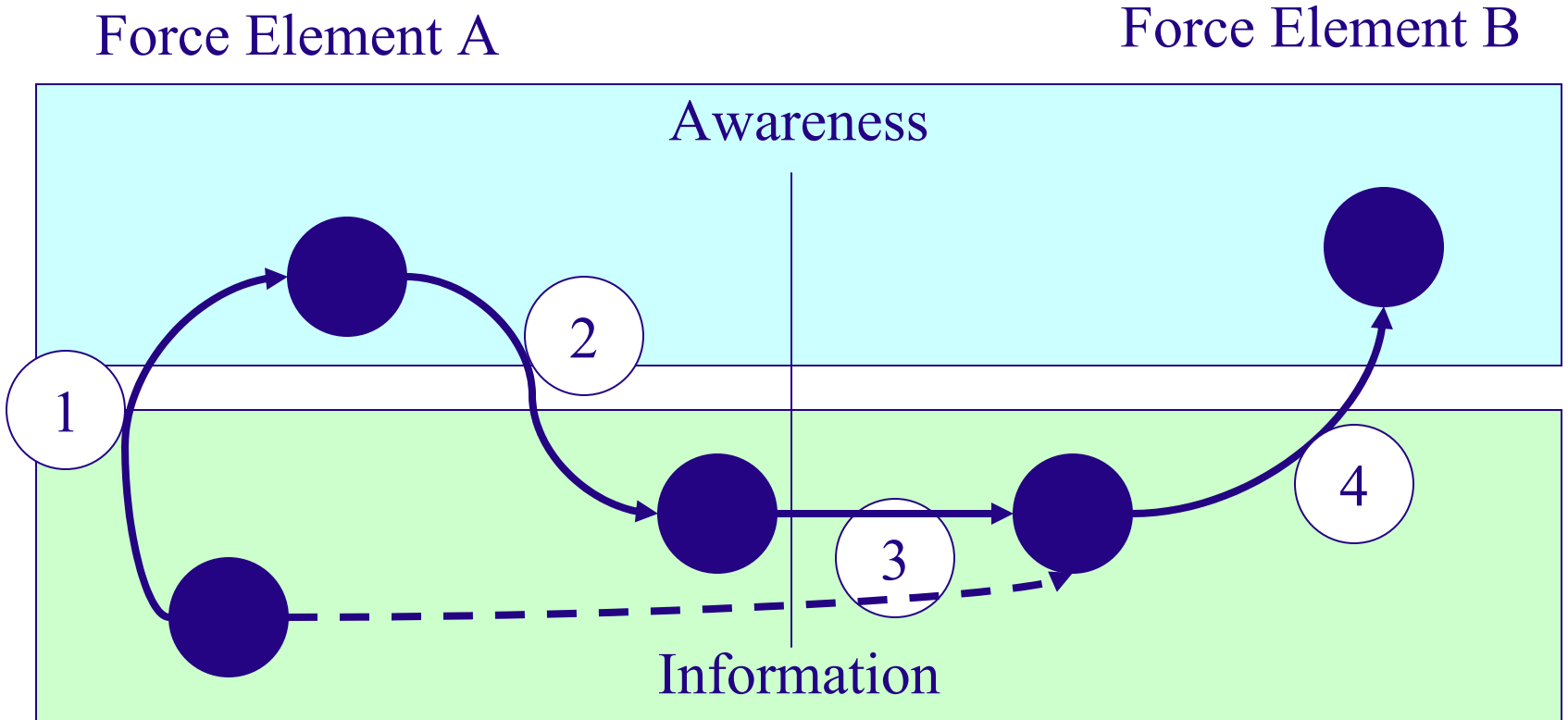


Blue Organic Information

Blue Asset	Organic Information	
	Blue	Red
AWACS	AWACS Blue 11, 12, 13, 14	Red 11, 12, 13, 14
Blue 11	<i>Blue 11</i>	<i>Red 11, 12</i>
Blue 12	Blue 11, 12	<i>Red 11</i>
Blue 13	<i>Blue 13</i>	
Blue 14	Blue 13, 14	



Steps to Obtain Shared Awareness





Voice vs Link-16 Using A Simple Communications Protocol

	1	2	3	4
Voice Only	Visual Retrieval and Integration, t	Voice Post, p	Voice Transmission, v	Voice Retrieval and Integration, r
Link 16	N/A	N/A	Link Transmission, l	Visual Retrieval and Integration, t

$$\begin{aligned} \text{Voice} - \text{Link16} &= (9(t + p + v) + 36r) - (18l + 45t) \\ &= 9p + 9v + 36r - 18l - 36t \\ &> 9p + 9v - 18l \\ &> 0 \end{aligned}$$

assuming $r > t$
assuming p and $v > l$



Summary and Conclusions

- **Simple model of shared information and awareness**
- **Other models required to capture the impact of prior knowledge, mental-models, tools, emotions**
- **Air-air scenario considered and showed that**
 - **Common Awareness exists without explicit sharing**
 - **Potential Shared Awareness involves less transmission time for Link-16 vs Voice**
 - **Future analysis could consider impact of errors**
- **Fully Shared Awareness appears easier with voice**
- **Conflicting Shared Awareness more likely with voice**

Is Potential Shared Awareness sufficient?