Representing Command Decision Making in the Assessment of Future C2 Concepts

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Scope

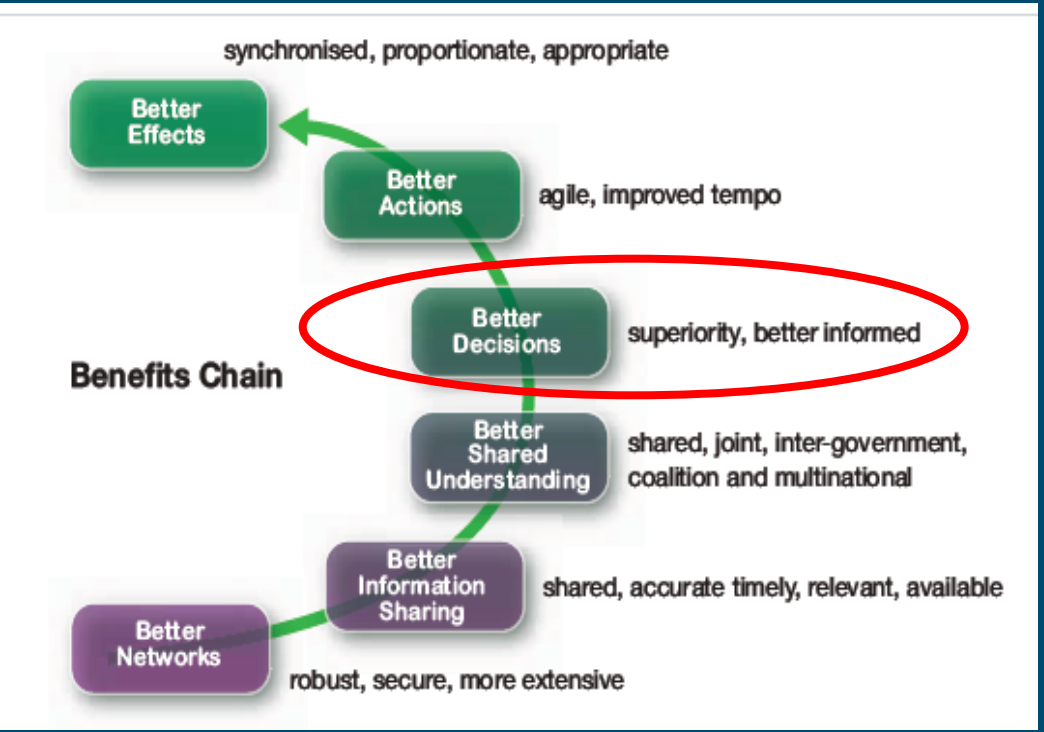
- Introduction and aims
- Understanding the requirement
- Method
  - The Wargame Infrastructure and Simulation Environment (WISE)
  - The Enhanced Rapid Planner (ERP)
  - Assessing the Psychological validity of the ERP
- Conclusions and recommendations
- A perspective on multi-disciplinary working

Introduction

- UK MOD Director Scrutiny have a requirement for analytical tools/methods that support the assessment of the benefit and impact of investment in Network Enabled Capability (NEC)
- The ‘Representing NEC’ (RNEC) project was tasked in 2009 to address this requirement and enhance the ability of existing analytical tools to represent NEC, enabling examination of:
  - Shared awareness
  - Agility
  - Self synchronisation
- Key component of RNEC is assessment of the psychological plausibility of the representation of human decision making in the existing toolset

C2 and NEC analysis – the ‘requisite model’

- Decision making key component of NEC benefits chain
- Robust representation of human decision making (HDM) essential when modelling NEC concepts
- Without this consideration danger of over-simplifying relationship between information and decision quality



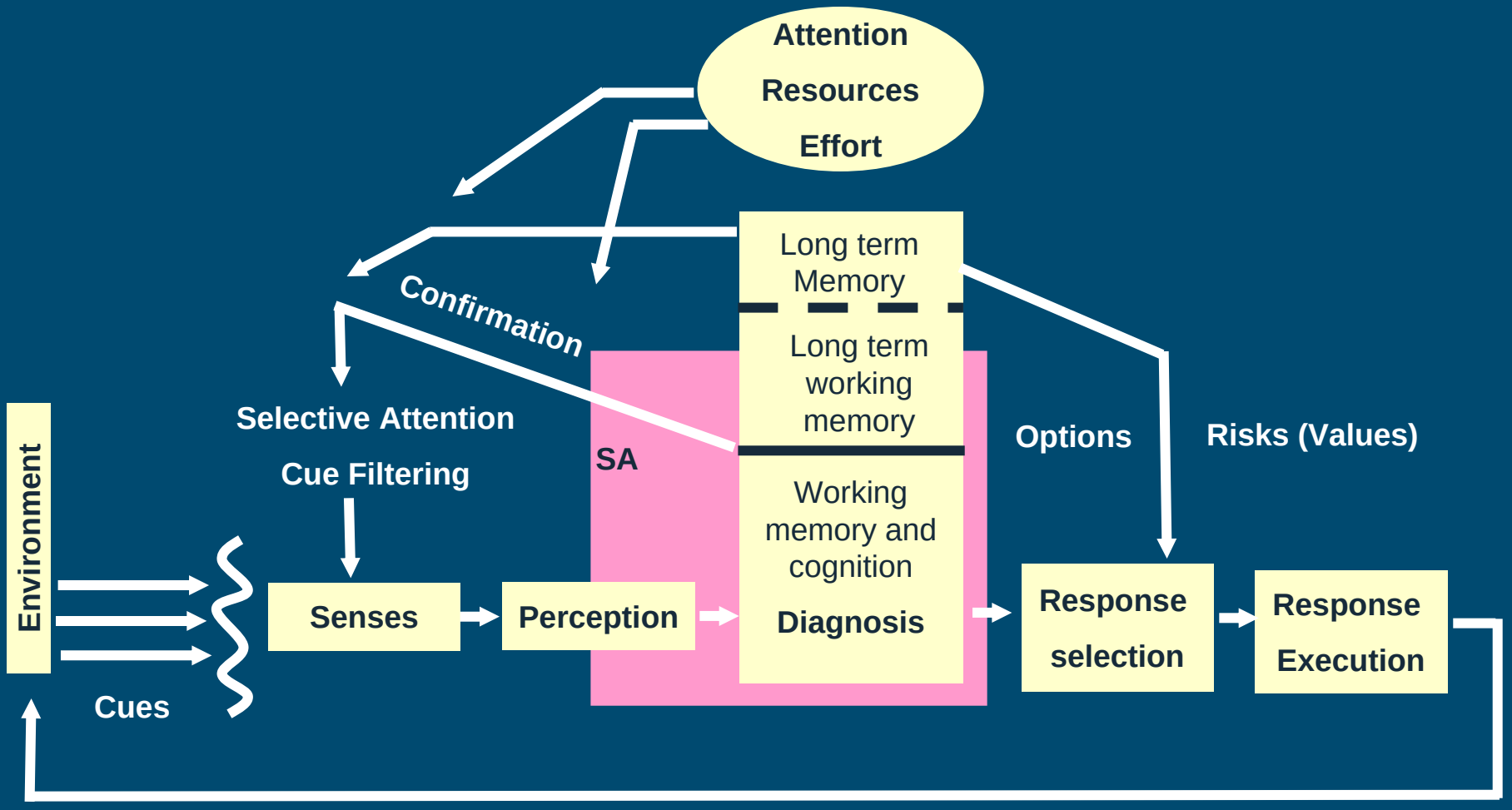
People are not passive information consumers!

Some audience participation…

- What's that?
- Why is the dog sniffing the floor?

Some audience participation…

Human Information Processing Model



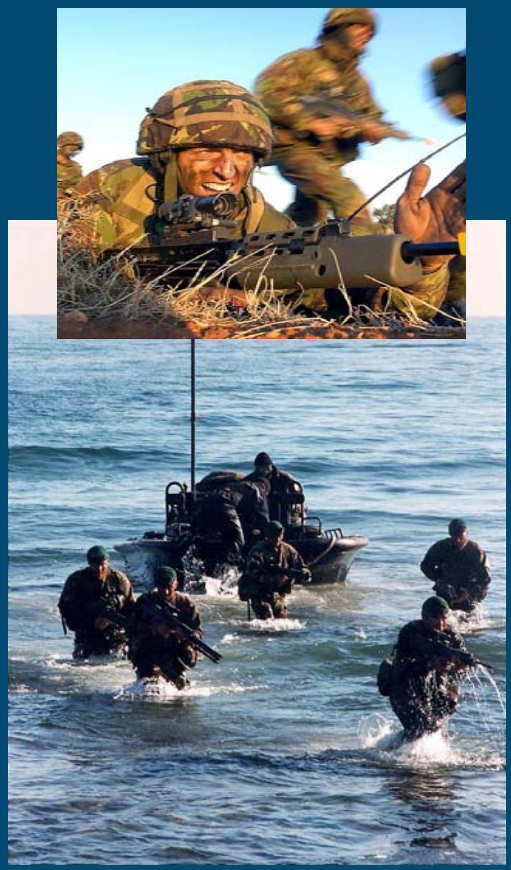
Adapted from Wickens and Hollands 2000

Human Decision Making (HDM)

- HDM is the on-going process of determining courses of action (including the option to continue as at present) with an aim of achieving tasks and goals
  - **HDM is goal directed**
    - Courses of action determined on the basis of what the decision maker, based on their experience and perception of the situation, believes will result in a satisfactory outcome
  - **HDM is a process**
    - Part of wider situational awareness and assessment process rather than rational evaluation of courses of action at a discrete point in time
- Shaped by interaction of external (e.g. stimuli) and internal (e.g. expectation, experience) influences

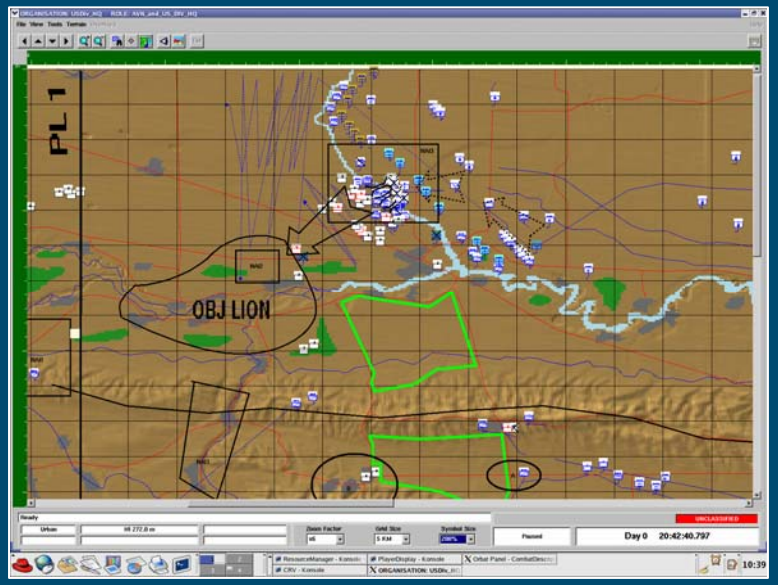
Human Decision Making (HDM)

- Description based on observations of manner in which people make decisions in real world situations
  - Ill-structured problems
  - Uncertain, dynamic environments
  - Time pressure
  - Shifting, ill-defined goals
- Approach termed naturalistic decision making
  - Most commonly cited example Klein's Recognition Primed Decision making (RPDM) Model
  - Builds on classical cognitive schema theory
  - Emphasises role of experience
  - Suggests decision makers generate and assess options one at a time and go with first workable option



Focus on RNEC (1)

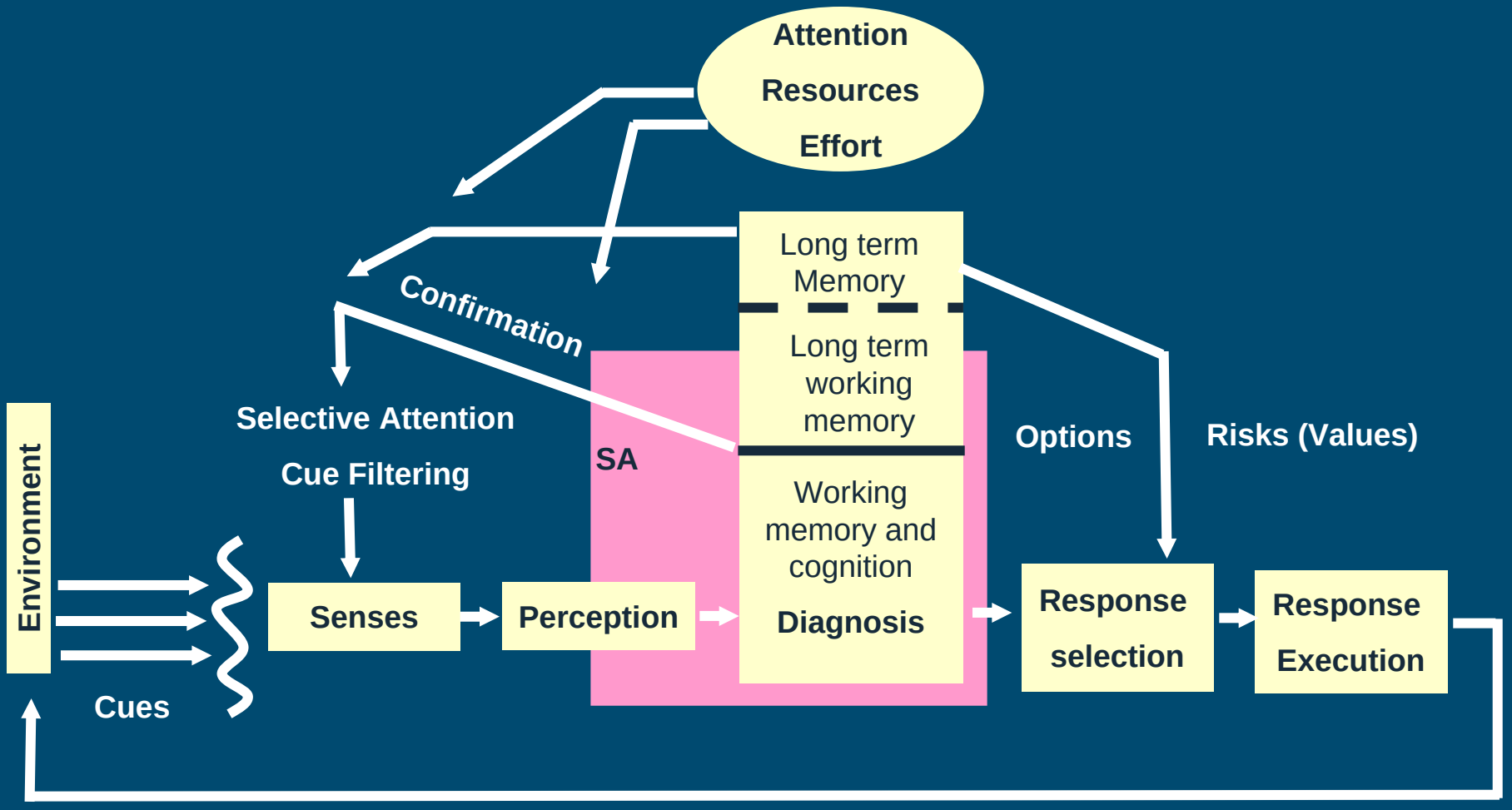
- Work focussed on representation of HDM within Wargame Infrastructure and Simulation Environment (WISE)
- Multi-sided C2 based model
  - Both a wargame and a simulation
  - Allows decisions to be made by players, software or a combination of both
  - Land domain model (sea and air support to land ops represented)
  - Stochastic, event driven model
- HDM in simulation mode generated by the Enhanced Rapid Planner (ERP)



Focus on RNEC (2)

- Enhanced Rapid Planner (ERP)
  - Configured to respond to data defined situational ‘cues’ (e.g. perceived enemy casualties) generated by WISE command nodes
  - Assesses cues against 4 dynamic linear models (DLM) to determine the most likely cue state (no change, blip, step change, change in slope)
  - If a change in cue state is indicated, cue fuzzy states (e.g. high, medium, low) are selected using the mean and variance of the most probable DLM
  - ERP matches sets of cue fuzzy states with representations held in an ‘experience base’ and selects a Course of Action
  - The selected Course of Action is then returned to WISE for processing and execution.

What does the ERP represent? (1)



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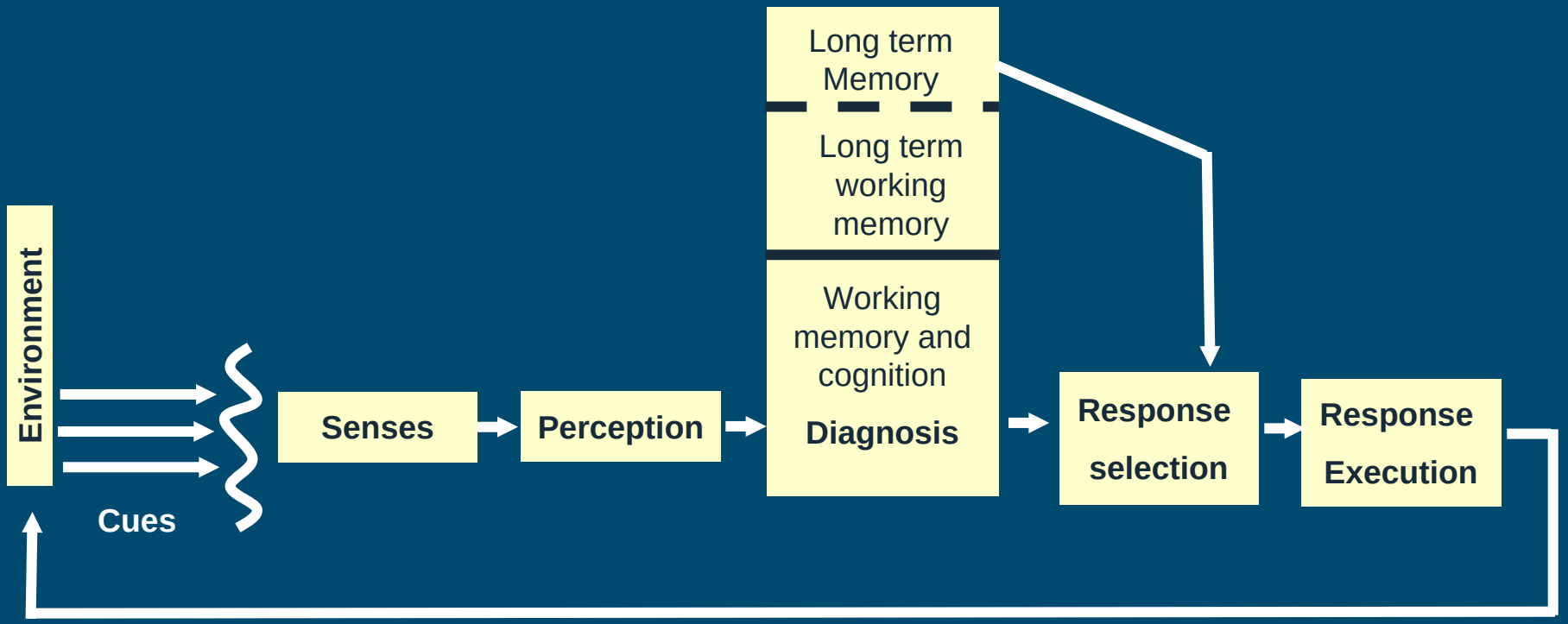
What does the ERP represent? (2)



Implications and Recommendations

- The ERP provides a reasonable representation of **part** of the human decision making process, but implementation of the model requires careful consideration to ensure more robust representation of top down processing and goal directed behaviour

- Suggested extensions to enhance representation of human cognition:
  - Representation of attentional limitations
    - Constrain amount stimuli that can be considered within a given time period
  - Representation of source trust
    - Weight attention to particular sources
  - Priming (confirmation bias)

- Extensions will be taken forward in later model development

Closing thoughts: multi-disciplinary working

- The success of this work relied on the ability of the team to integrate human factors into OA models and bridge between different disciplines
- A number of recommendations were derived from the experience
  - Understanding the requirement
    - Essential that clear understanding of human variables of interest is defined/agreed
  - Multi-disciplinary team working
    - Team members should work together in an integrated manner rather than sectioning tasks off by specialism
  - Agreeing common terminology
    - Team members must be rigorous with terminology, and establish common understanding of key terms

Questions?

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