Capturing Cognitive Task Activities for Decision Making and Analysis

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Order of Presentation

- Influences Affecting the Capture of Cognitive Task Activities
- Tasks and Generic Processes
- Task Analysis Conditions & Outcomes

Cognition and Consciousness

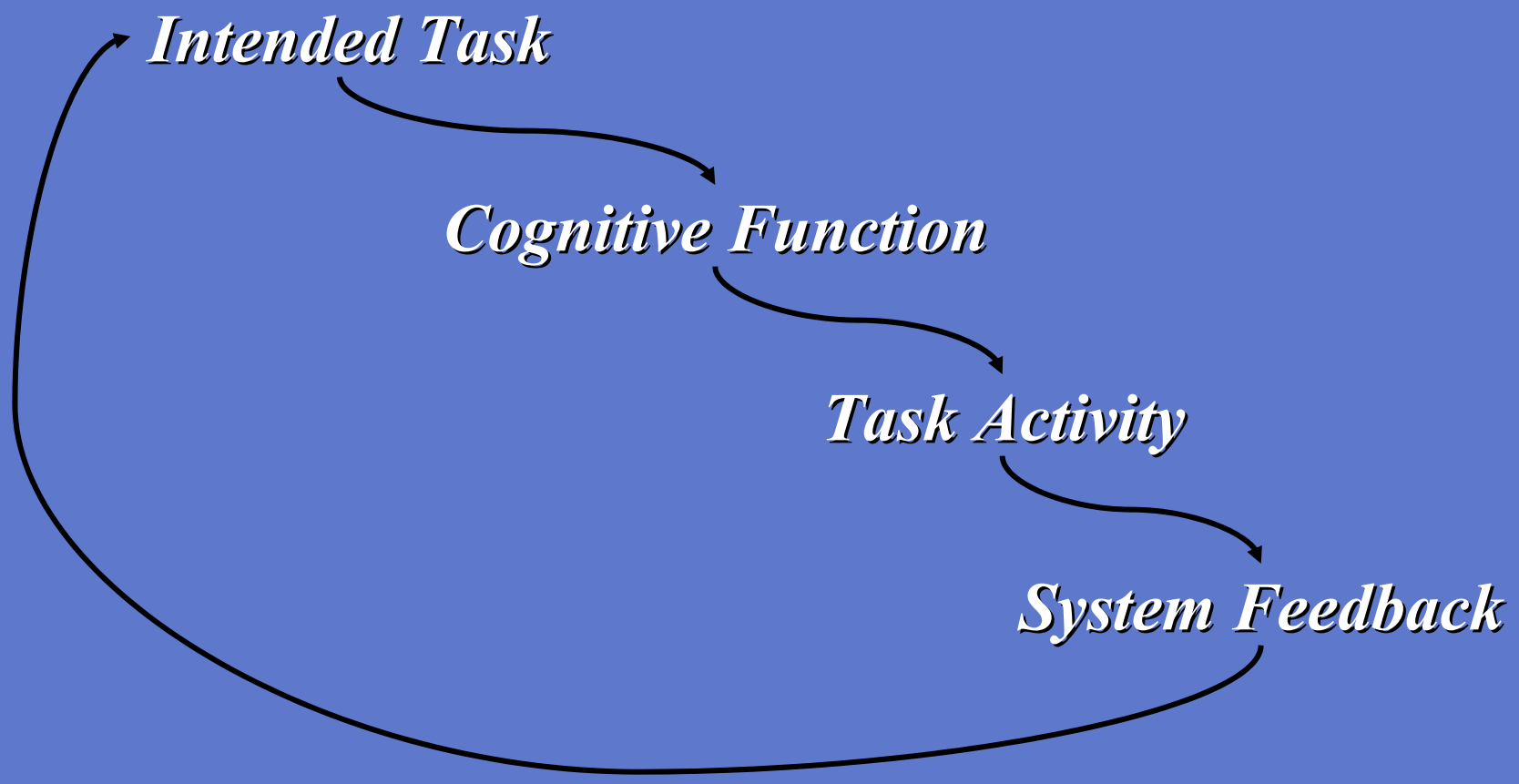
- Cognition in the human implies consciousness
- Consciousness is the basic ingredient of awareness and is the property that links the human with their environment and community.
- As the foundation to judgment and choice cognition encompasses :
  1. **mental processes,**
  2. **analysis,**
  3. **attitudes,**
  4. **skills / knowledge / experience.**
- Quality manifestation of all four is represented by high expertise in work performance.

System Cognitive Functions

- ” It needs to be recognised that some essential human machine system functions can be purely cognitive”. [MacLeod and Taylor, 2000].

- ” Is it possible that our advanced command and control systems will require cognitive human performance that defies our ability to measure and predict? .. What none of the existing models are much good at is analysis of cognitive behaviour." [Miles, 1993]

Tasks and Cognitive Function

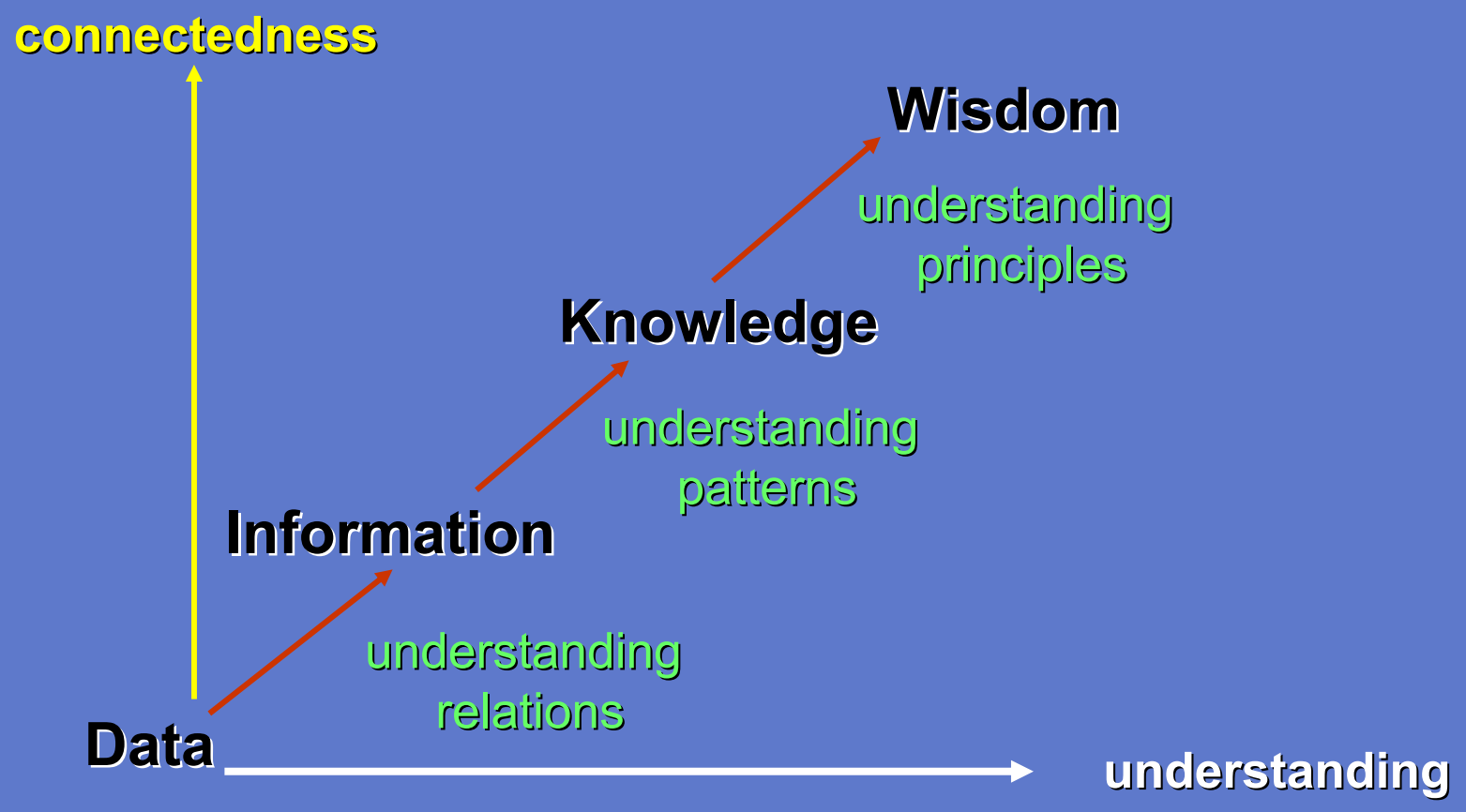


Understanding - an Awareness

Understanding is associated with awareness and is founded on the skilful use of knowledge and judgement by the individual or team.

To understand the nature of knowledge you need to be aware of the differences and associations between data, information, knowledge, and possibly wisdom.

Progression from Data to Wisdom



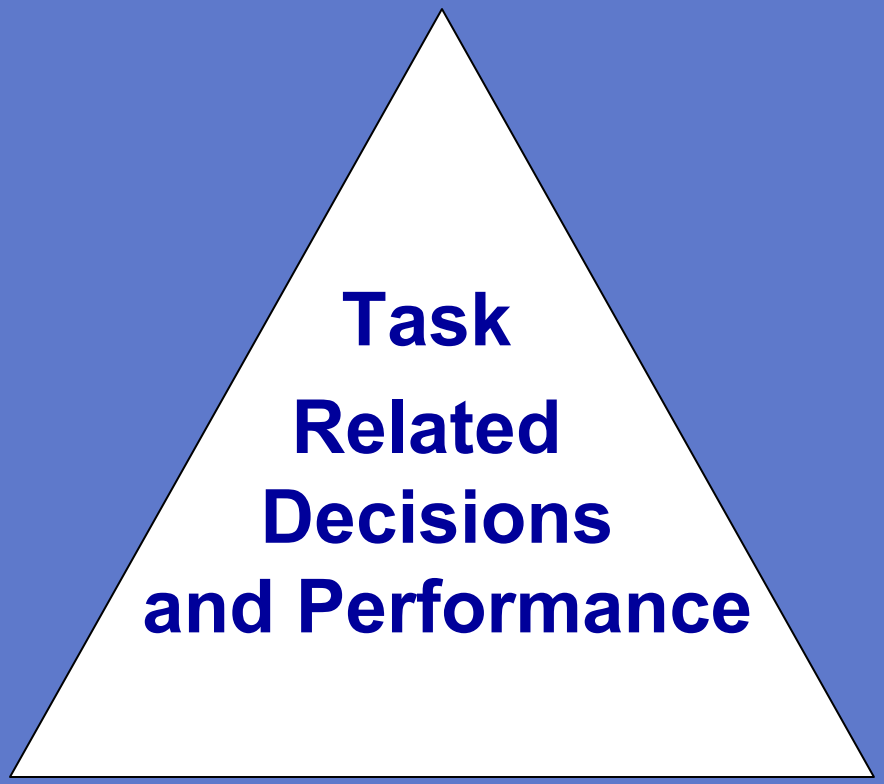
Ackoff, R. L., "From Data to Wisdom", Journal of Applies Systems Analysis, Volume 16, 1989 p 3-9.

Knowledge Skills and Attitudes (KSA)

- *Knowledge* provides the means for the handling and use of the facts and information on a state or condition of the environment and situation to support understanding, decision making, and task performance as appropriate to the context.
- *Skill* can be defined as the application of knowledge to decision making and work as mediated by the type of task, related performance goals, and the level of expertise in the application of a skill or combination of skills. The basic innate capability of an individual to develop skills is termed aptitude.
- *Attitudes* are strongly related to motivation. Cognitive attitudes or values can be trained but are also strongly influenced by issues related to the relevant society, culture, organisation, involved personalities, and the appreciated status of the individual or team within their group.

KSA - Task Performance

Attitudes



Knowledge

Skills

Information Forms - Don't Confuse!

Some of the information forms supporting task performance for control of dynamic system processes are:

- ***Ephemeral Information*: Information with a short term value e.g. platform speed, direction;**
- ***Collateral Information:* Supporting information to the performance of a mission often in the form of map and planning information, information on enemy capabilities and intentions, information on environmental forecasts;**
- ***System Information:* Information on the state of system processes e.g. Built In Test (BIT);**
- ***Environmental Information*: Information on the actual mission environment obtained by system sensors or through operator senses e.g. missile warning, weather observation;**
- ***Tactical Information*: Information pertaining to the performance of tactics and associated results;**
- ***Expertise:* Information selection, retrieval, and analysis related to cognition (the use and handling of knowledge).**

Cognitive Tasks and Processes

Task Related Mission Phases, Target Recognition, and Associated Biases

- Examples

Generic Process of Target Address - Phases

- **Search** - Looking for an object of interest / target.
- **In Contact** - Possible in contact with an object of interest.
- **Localisation** - localisation of object.
- **Tracking** - determining ‘accurate’ position, course, and speed of object.
- **Attack** - evidence and accuracy obtained allowing attack performance.

Standard Definitions – Recognition Training

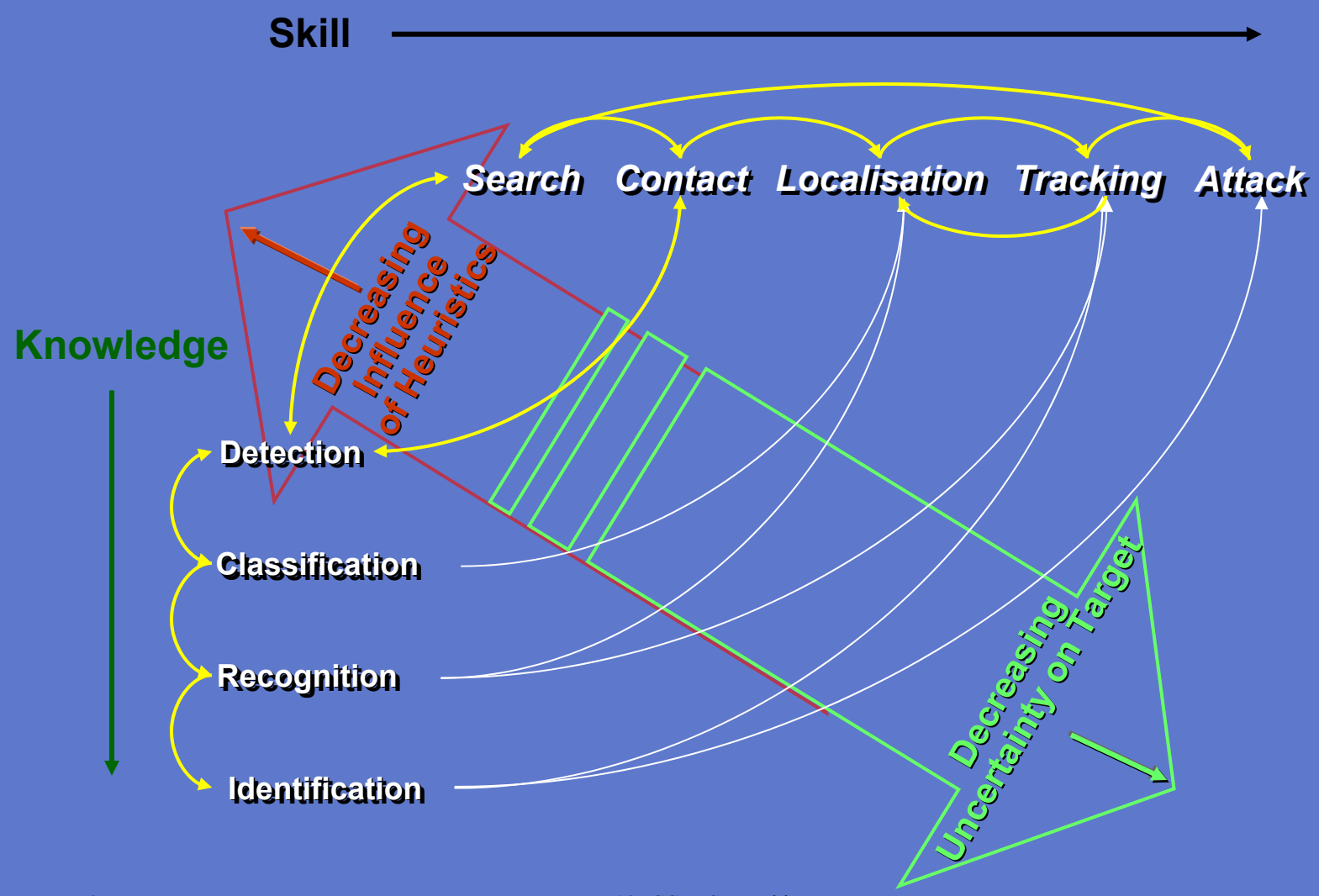
The standard definitions used in recognition training for the UK RN, Army and RAF are produced by the Joint Services Recognition Training Committee.

- **Detection** - Awareness of a phenomenon of potential military significance.
- **Classification** - Assessment of the detected object into a broad class e.g. tank, destroyer, fixed wing aircraft, submarine.
- **Recognition** - Determination of whether the detected object is friendly or hostile.
- **Identification** - Designation of a classified object by name e.g. Krivak, Flogger, T72, Akula Class.

Biases from Immutable Human Heuristics

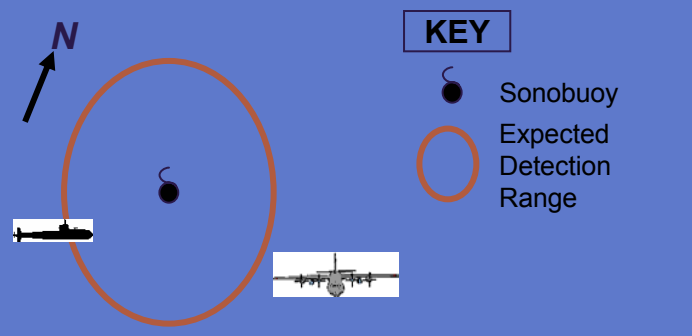
- **Availability** - classification of a situation to a category that is readily remembered (or recent).
- **Representativeness** - stereotyping or typecasting a situation.
- **Confirmation** - Searching for information to confirm a belief rather than seeking information that may challenge that belief.
- **Anchoring and adjustment** - Approaching a situation in a certain way and then making small adjustments to the chosen approach regardless of any contrary evidence.

Identity and Process Stage Correlation

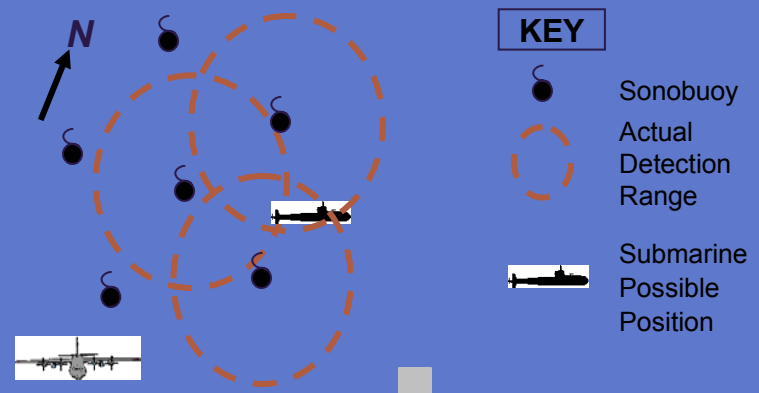


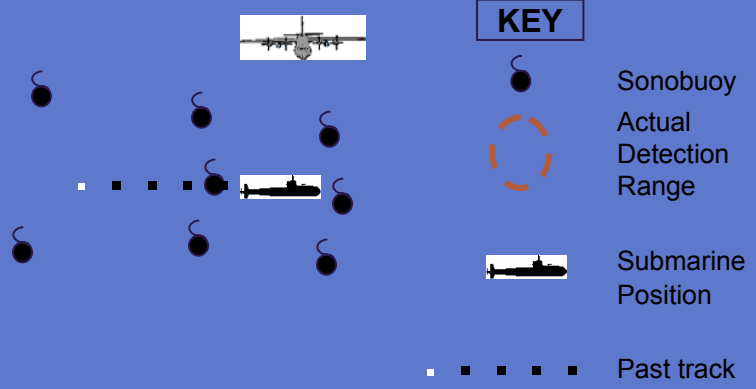
Process Stage Association with Target Knowledge

Search* to *Contact In* after *Detection

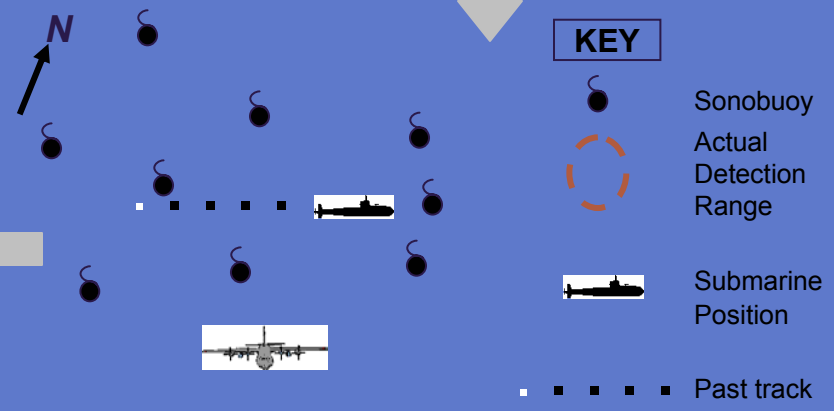


Classification* and *Localisation





Identification* and *Tracking



Recognition* and *Tracking

Consideration on Conditions and Outcomes

- The form of the task dictates the analysis that needs to be performed both during task execution or for the analysis of what task execution activities should be performed.
- Task performance conditions can relate to both external events and individual or team KSA influences on task performance.
- The quality of decision and the performance of task related activities is strongly affected by the KSA influences on the conditional use of information.
- The KSA of an individual or team is always open to the adverse influences of human heuristics.
- An understanding of generic work task processes must include attention to the criteria / conditions needed to support task performances at each stage of the process.

Two Forms of Task Analysis Compared

CTA	Traditional TA
Focus on human consideration of work related information, task goals and the means to achieve them	Focus on actions / activities; goals are implied

Any Questions?

This paper has been produced as a result of work initiated by the Research Director CBD/Human Sciences, under the auspices of the UK Ministry of Defence (MoD) Human Factors Integration (HFI) Defence Technology Centre (DTC).

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