Decide Now – Ditch Decision Making

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Abstract

The paper was motivated by the following dissatisfactions:

- The failure of mainstream academic psychology to have anything interesting or useful to say about people in the real world.
- The separation of psychology into sub-disciplines or paradigms that don't talk to one another.
- The failure to distinguish between technical and common language usage when dealing with concepts such as decision making and command.
- Partly as a consequence of the above, the failure to scope issues properly and preserve different levels of description.

Many of these failures arise from inadequate use of language. The language we use to describe phenomena matters. Amongst other things, it divides our world into particular chunks. Two such divisions that have been unhelpful are the separation of decision making into Naturalistic Decision Making (NDM) and Classical Decision Making (CDM), and the separation of Command into chunks such as Situation Awareness and Decision Making.

It is argued that these divisions are unnecessary if we preserve the unity of what we might call the executive process consisting of a knowledge structure, a control process and an energy element. Links with some classical notions in cognitive psychology are established and some implications for command system design are discussed.

Introduction

When I was an undergraduate, a lecturer in physiological psychology suggested that the aim of psychology was to answer the following two questions: "Why do we do anything at all ?" and "Why do we do what we do ?" Many years later I appreciate just how profound these questions were. A moment's consideration, for example, makes it clear that any discipline that starts from the point of view that the mind and brain are mere information processing devices (seemingly standard doctrine these days in cognitive psychology) is wide of the mark.

Although some of what the mind/brain does may reasonably be construed as information processing, much of it – the most important parts of it – may not. The mind/brain is primarily concerned with directing humans towards achieving some changed state of the world they find themselves in. I want to take this idea and explore it in relation to military decision making and command.

The paper has grown out of a number of chronic background dissatisfactions and was finally prompted by a recent invitation to write a commentary article for The Behavioral and Brain Sciences (Campion, in press). Key background dissatisfactions are the following:

- The failure of mainstream academic psychology to have anything useful to say about people in the real world (including the military world).
- The separation of psychology (in both its pure and applied forms) into sub-disciplines or paradigms that don't talk to one another.
- The failure to distinguish between technical and common language usage when dealing with concepts such as decision making and command.
- Partly as a consequence of the above, the failure to scope issues properly and preserve different levels of description.

Many of these failures arise from inadequate use of language. The language we use to describe phenomena matters. It matters because it determines the way we think about those phenomena and therefore the way we go about dealing with them. Language does a number of things; one is that it divides our world into particular chunks. Two such divisions that have been unhelpful are the separation of decision making into Naturalistic Decision Making (NDM) and Classical Decision Making (CDM), and the separation of Command into chunks such as Situation Awareness and Decision Making.

Decision making

The differences between NDM and CDM and the reasons for their separate development have been well rehearsed elsewhere (e.g. Yates, 2001) so I shall not repeat them. In essence NDM developed out of the work of Klein and others (1993) who found that CDM theories and paradigms that used invented laboratory based tasks were unsuitable for dealing with the complex dynamic environments encountered in the real world. However, it suffered from two important limitations; first, it emphasised the mental structuring of a situation in contrast to the explicit analysis of CDM (which was very important) but it played down two important elements that were, to some degree, better exposed in the CDM paradigm – control and energy; second, it failed to pick up on some important notions that were already around in the mainstream literature (for example Frames of Minsky (1975) and Scripts of Shank and Abelson (1977)) that were doing very much the same sort of thing as Klein's Situation Templates but tended to be treated, not as part of Decision Making, but as part of Perception and Understanding, respectively.

These are discipline structuring problems and I want now to argue for a different structuring by considering some very basic notions.

Consciousness

I was first sensitised to the issue of consciousness by my work on Blindsight (Campion et al, 1983) and Visual Agnosia (Campion and Latto, 1985). A vast literature has been spawned on the back of it and we even have a journal devoted to the subject (The Journal of Consciousness Studies, Imprint Academic). Responses tend to fall into two camps; those who ignore it, claiming that it is either not important or that it is too intractable a problem; and those who are bewildered by the difficulty of dealing with such a complex and elusive phenomenon. But I think it is central to our understanding of human cognition and, in the context of this symposium, central to our understanding of command.

Consider the well-known perceptual phenomenon of the Necker Cube as shown in Figure 1 which can be flipped mentally into two states – a top or bottom view of a cube. There are a number of important features of this phenomenon:

- Pure shape cannot be separated from its semantics
- It can adopt only one of two semantic states
- The state can be shifted by voluntary control
- The control process requires effort
- The control process cannot be scrutinised – only the product

Thus, if we think of consciousness, not just in terms of some separate state or store (as in things "entering" consciousness) but in terms of what it does, we can identify three quite distinct but separate elements; a Product (what one is conscious of), a Control process (what creates the product), and an Energy component (what motivates the whole process). I think this probably has important things to say about how the brain is structured, but I shall now turn to the implications it has for command.

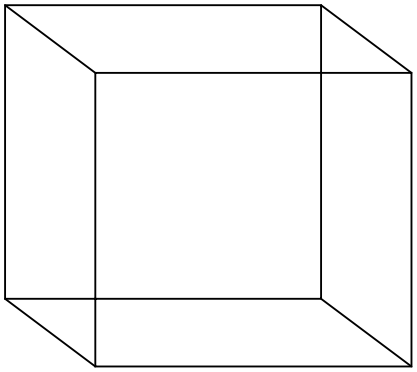

Figure 1 The necker cube reversible figure

Command

Let us consider the most basic elements of command as in Figure 2. We have an executive that sits between a real world of ships, planes, vehicles etc and a higher command world of orders, plans, rules of engagement etc. The executive receives information about real world objects via sensors and acts on them using weapons. It does this while factoring in top-down information from higher command and reports back to higher command.

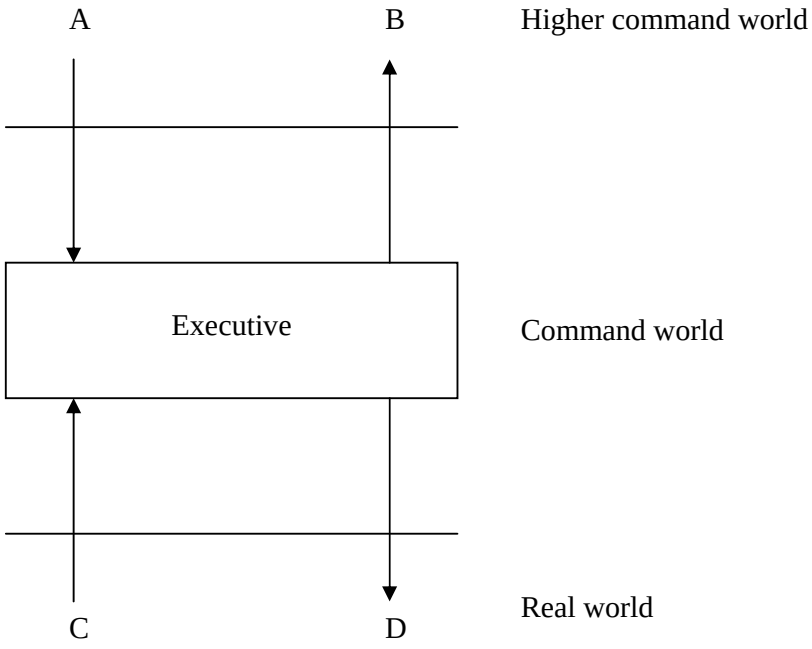

Figure 2 Command framework

Now, I want to argue that this is a very general framework that is applicable at any level of command and over any timescale. I also want to argue that all components should be considered together at whatever level or timescale one is dealing with. But conventional structuring of the discipline has tended to split this framework up so that, for example, situation awareness is represented by limb C and decision making by limb D. But consider the following scenario (Campion et al. 1996a):

A naval commander is in charge of a group of ships under threat of air attack. Rules of engagement dictate that he may only attack aircraft that are clearly intending to attack him (a rule). He has established, in planning the mission, that an intention to attack (instantiation) may be recognised as an aircraft emitting a certain class or radar (categorisation) and travelling fast and low and towards the task group and not in an air lane and armed with missiles (feature matching). An aircraft is detected exhibiting all of the above characteristics except that visual contact is needed to establish whether it is armed or not. The commander is minded to attack it but he recalls that similar events (similarity) had been occurring over the past days without actual attack (Script), indicating that the enemy were simply probing his defences and testing his resolve (Inference). He cannot, however, assume that the pattern will repeat (Confirmation bias). He needs to seek the single feature that will demonstrate a change from the previous pattern (Disconfirmation) so he orders supporting fighters to intercept the incoming aircraft, check visually if it is armed (feature matching) and, after appropriate warnings, if it is armed (contingency rule) to shoot it down (production rule).The fighters report that the aircraft is not armed (feature detection), so they warn the aircraft to stay clear of their airspace and return to station. The naval commander reports back to higher command.

I have put in brackets the names of processes that might be used within the CDM paradigm. But what is situation awareness and what is decision making here ? Such distinctions are unhelpful. Klein has called this sort of thing, albeit in a simpler scenario, “story building”, but what is it other than a very complex script (in the technical sense) whose structure has been defined by past experience of naval operations (i.e. an “air defence under rules of engagement” script) with values pertaining to the specific situation plugged into the slots during the planning phase. But the important thing is that it is a *command* script for such a situation.

Some years ago, with the assistance of workers at what was the old United Kingdom (UK) Defence Evaluation and Research Agency, I developed a four-layer model based on the notion of Frames and Scripts. The layers were defined as Goals, Methods, Operations and Primitive Operations. The model was used to develop some putative decision making support tools which have been reported on elsewhere (Campion et al,1996b).

It was implicit (but not then made explicit) in the model that Decision Making should not be seen as a separate function or paradigm but, if anything, should be seen as the Executive part of “Command”. In the model the Executive is seen as the control function that recruits different frames and which creates them and links them. Thus, and for example, NDM rightly demonstrates that a commander recognises a particular situation with given default responses, but in the case of naval command it is often necessary to decide whether one of a number of different possible situations exists. For example, does the behaviour of hostile aircraft indicate “attack” or simply

"reconnaissance". This would be accomplished using conscious (i.e. analytic) processes either online or offline. These processes, however, would still be frame based.

Frames and scripts are normally referred to as instances of the general class of things called "schemas" but I think it is probably more wholesome to refer to them as knowledge structures. Knowledge is a fundamental concept in cognitive psychology and frames, scripts, templates or whatever are simply bits of knowledge about the world organised in complex ways and structured so that specific values can be plugged into them. This is all very rudimentary at present, but I do think it indicates a better way forward.

Referring to my original three-part framework, we have dealt with Control and Product, but what about energy ? The issue of energy is not normally dealt with under this heading but emerges in the academic laboratory world as "attention" and in the applied world as "workload". As an aside, it is interesting that even here two quite different phenomena (channel capacity and energy) are lumped together under the same heading.

In relation to our concerns here, we need to think of energy in the longer term as the effort needed by experts to build up the appropriate knowledge structures and to maintain them, rather than in the short term. And we need to think of the performance required in terms of tasks to be accomplished so that the necessary tradeoffs can be made. A simple illustration is contained in a letter I wrote recently to one of our UK daily national newspapers in response to a restaurant owner who was complaining that the university students he employed were so uneducated that they were unable to add up customer bills without the use of calculators (Campion 2004). I reproduce the letter here:

Peter Scott's students can't add up a bill (letter February 26), not because they are uneducated (as I think he implies), but simply because adding up (and all mental arithmetic) is a what is technically known as a "perishable skill" and it is not very much needed and therefore not very much practised these days.

A calculator is a great deal faster and more reliable for the great majority of calculations commonly undertaken and is therefore the method of choice. This might not be the case for Peter Scott's three-line bill, but it is not worth the effort maintaining a skill for the few occasions such as this when it might be useful.

If Peter Scott really wants students who can add up then I suggest he tries selecting applicants on the basis of their dart-playing record. In fact, come to think of it, it would be interesting to see if the subtracting skills required for darts transfers !

Although this is a relatively trivial example (although not that trivial, because there is currently a strong push to reintroduce or strengthen the teaching of mental arithmetic in primary schools in the UK) and although it is written in a light-hearted tone, it embodies many principles relevant to decision making and the introduction of decision support tools. Let us now consider some of the implications.

Implications

I have already argued that the way that the discipline of psychology is structured can be handicapping in terms of theory development, especially if we want to apply those theories to the real world. But are there any practical implications in terms of the way command systems are procured and used ? I believe there are.

Many years ago the UK discovered that one of its command systems ADAWS (Action Data Automated Weapon System) was under-performing. A Human Factors audit suggested that the complex command language keyboard interface was difficult to learn and operate effectively and later systems were menu driven. However these under-performed because they were too slow for experts. The real problem with ADAWS was not the command language interface per se but the fact that the users were under-trained because of circumstances beyond the system designer's control. A good command-language interface coupled with a highly trained user who had invested the energy to build up the necessary knowledge structures was better performing.

In a major helicopter project I worked on, there was (rightly given that it was to be a single pilot aircraft) a strong emphasis on the impact of the design on workload, but only as channel capacity, whereas probably the most severe problem, given the degree of automation, reduced manning and operational situations envisaged, was energy in terms of boredom and fatigue.

More seriously, given the amount of time, money and effort invested in it, was the rejection of STANAG (Standard NATO Agreement) 4420 for UK Type 45 Destroyer command system symbology. I was a member of the NATO (North Atlantic Treaty Organisation) working group that developed the standard and also a member of the Type 45 design team that rejected it. The testing that had been done on candidate symbology was based on simplistic laboratory tasks, using naïve subjects and took no account of the sophisticated knowledge structures that the expert user brings to bear when using such displays.

Also on the Type 45 project and as Human Factors Integration leader, I still found subcontractors speaking of their equipment interfaces as "intuitive" or "matching the user's mental model". These are harmful concepts. What is required is that the knowledge structures required to operate the system operate to maximum efficiency and match the time and effort required to build them.

Finally, it is a salutary lesson that none of us is immune from making errors. I developed a task management aid for the UK Defence Evaluation and Research Agency which was based on a quite sophisticated (by psychological standards) command team management model (Campion et al, 1998) but was probably pitched at too low a level of command. This was not because the model was poor or that the system design was flawed, but because the pace of events at this level meant that the energy overheads imposed on the team by using the aid meant that the team under-performed.

Numerous reports I have read begin with attempts (that usually fail) to define Decision Making. This indicates the lack of an appropriate technical language – a

problem endemic to Psychology. I argue that we should abandon the term Decision Making and refer instead to Command, but command, fleshed out in detail and expressed at a number of different levels in a variety of different scenarios.

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