Work Domain Analysis

Gavan Lintern
Cognitive Systems Design
glintern@cognitivesystemsdesign.net

Concept

Work domain analysis identifies the functional structure of a socio-technical system. That functional structure will encompass properties ranging from object descriptions, through specific and general functions, to values and specifications of system purpose.

A work domain is a functional space in which work is accomplished for a specific purpose. The first step in work domain analysis is to identify the purpose of the work. In the rail domain, that is something like *transportation of goods and passengers*. Work domain analysis also identifies values. In the rail domain, *safety*, *productivity*, *economy* and *timeliness* are likely to be important. Work domain analysis also identifies the physical resources (*rolling stock*, *tracks*, *signalling systems*, etc.) and the functions of those resources.

The product of work domain analysis is a representational product named the abstraction-decomposition space. It is an activity-independent representation of the functional structure of the work domain. It is activity independent in the same sense that an area map is activity independent. A map does not specify action sequences or strategies but rather lays out opportunities for and constraints on travel in a manner that enables the map user to develop useful action sequences and strategies.

However the content of a map is, in general, restricted to representations of physical layout and physical features. Such properties as functionality and value are implied but not specified explicitly except in those maps annotated with comments related to value statements such as *shortest route* or *scenic route* or that relate to functionality such as *impassable when wet*. An abstraction-decomposition space specifies such properties explicitly and comprehensively and also shows the relationships between physical, functional, and value properties.

Role in cognitive systems engineering

A picture is worth a thousand words!

An abstraction-decomposition space provides a picture of the targeted work domain in functional terms as they relate to the cognitive problems faced by workers in that domain. It depicts resources, functions and values that must be represented (either explicitly or implicitly) within a domain's cognitive work system. It is, in itself, a cognitive support tool for the cognitive systems engineer to assess the coherency and completeness of that cognitive work system.

Figure 1 shows a simple (and partial) abstraction-decomposition space for wild-fire management. The domain purpose, *Suppress & contain wildfires & limit harm to forest land, wild life, residents, property & infrastructure*, is supported by the domain values of *effective action* and *tactical sensitivity to emerging opportunities*. The domain value of *effective action* is supported by the domain functions of *relocation*, *manoeuvre*, *fire containment*, *fire suppression* and *evacuation*.

The domain function of *fire containment* is supported by the technical function of *fuel starvation*. Various physical resources are shown as supporting the technical functions.

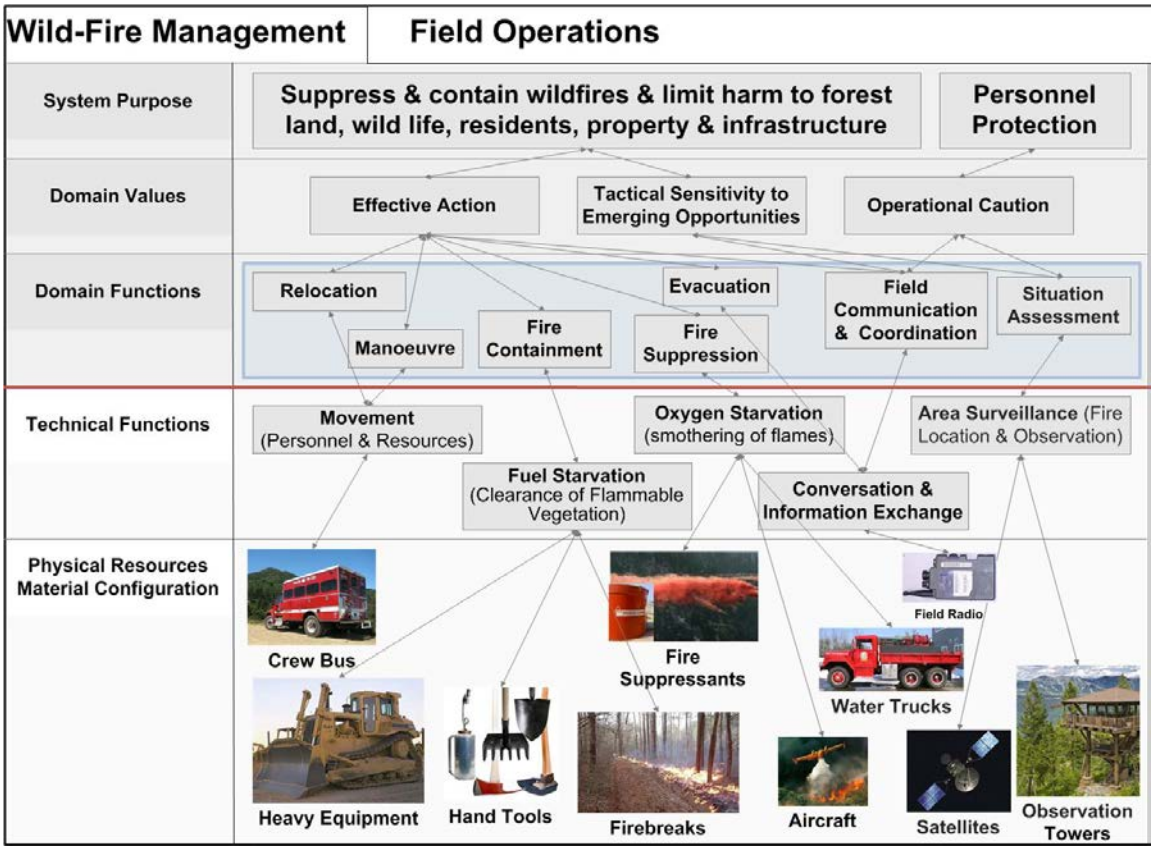

Figure 1; Abstraction-decomposition space for wild-fire management

The abstraction-decomposition space has a defined internal structure which permits internal validation. That is, a cognitive systems engineer can review the representation to ensure that all functions are supported by physical resources, that all values are supported by functions and that the values fully support the system purpose. That review will also reveal whether there are redundant physical objects or functions (properties or elements in the representation that do nothing useful). Problems of this sort are anomalies that may exist only in the abstraction-decomposition space (thereby revealing that the abstraction-decomposition space does not truly reflect the actual system) or may exist within the actual system (thereby revealing that the system is deficient).

Once constructed, the abstraction-decomposition space provides the basis for design of tools (displays, decision aids, planning aids, communication aids, etc.) that will support the cognitive work of human participants at all levels (operational, mid-level management, senior management). It will become a stable artefact to be used as a guide to all aspects of cognitive design throughout a long-term project. It provides a foundation for analysis of individual, team and management activity within an enterprise by showing what resources are used in the cognitive activities of deciding, planning and communicating and then indicating what sort of activity analyses need to be undertaken in relation to the use of those resources. All cognitive support tools will be designed in response to the available resources and constraints (as represented in the abstraction-decomposition space) and the way they can be used to support cognitive work.

Summary

Work domain analysis identifies the functional structure of a socio-technical system and represents it as an abstraction-decomposition space. Although activity independent, the abstraction-decomposition space offers a foundational guide for selecting issues that are to be explored via analyses of activity. It provides a comprehensive and detailed view of the cognitively-relevant aspects of a system and thereby avoids the problem of looking at a system from a particular point-of-view. Additionally, it offers a structured overview that can reveal subtle interdependencies, thereby ameliorating the risk that a particular cognitive solution will benefit performance at its intended point but will have negative impacts elsewhere in the system. Work domain analysis promotes a systems perspective on designing for cognitive work in contrast to the more common approach of piece-meal design of support tools for specific cognitive activities.