

Working Group 2: Traffic Lights, Focus, and Ambiguity of Perception

Ian M. Mitchell

Technical Advisor

Defence Science and Technology Laboratory
Porton Down, Wiltshire, England, United Kingdom.
e-mail: IMMitchell@dstl.gov.uk

Ian Mitchell has worked in Operational Research (OR) since 1988, following a flirtation with accountancy. For the Centre for Operational Research and Defence Analysis (CORDA) he initially produced historical data compilations. Studies of the land battle followed until 1992. After two years as an independent OR consultant to the UK Department of Social Security and European Space Agency he joined the Defence Research Agency (DRA) at Fort Halstead in 1994. He managed the Battle Group War Game, and led infantry studies. He moved to Porton Down in 1998 managing OR studies until 2000 when he was seconded as the OR specialist for the Directorate of Equipment Capability, Nuclear Biological and Chemical (DEC (NBC)). As of 2004 he integrates analysis to support broader considerations of CBRN defence. Ian served on the Council of the UK OR Society from 1994 to 2000, and was elected as Vice-President in 2002. He was commissioned into the Territorial Army in 1984 and was introduced to OR as part of a Business Studies degree during 1986.

Contents include material subject to ©Crown Copyright 2004
Defence Science and Technology Laboratory, UK.

PARTICIPANTS

Anders Christensson (chair), Richard Hayes, Hugh Richardson, Andrew Hossack, Manfred Bartha, John Medhurst, Jan Foghelin, and Ian Mitchell (scribe)

THEMES

The three questions were addressed in turn. Each was given a short title:

- Traffic Lights.
- Focus.
- Ambiguity.

The group saw that these were inter-related. Nevertheless the discussions were dealt with each question discretely.

TRAFFIC LIGHTS

The use of traffic lights, following the western road traffic prioritisation control technology illustrated in Figure 1 was the first theme.

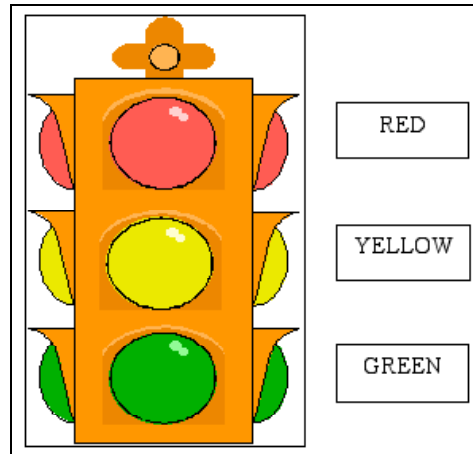


Figure 1: Traffic light from Microsoft Clip art.

Whilst early applications used the traffic lantern display as in Figure 1 many others use only the colours red, yellow and green within tables. There is a potential problem with the use of colour alone as colour blindness may prevent perception of red and green.

The use of colours to indicate ranges hides data, especially sensitivity as the last stage in the analytical process converting two figure decimal outputs to a three-integer scale of 1-2-3. Whilst this simplifies big problems to an understandable summary it is coarsening the display and hiding data.

For example if Red covers up to 75% of a range of target values the traffic light display will not indicate even a dramatic improvement eg from 10% to 70% that is 60% unless it passes the threshold. Providing actual numbers can reduce this effect. This offers limited support so an ability to “Drill Down” to underpinning detail is important.

Traffic light displays also hide interdependencies. Words rather than the “lights” should be applied for qualitative issues. Traffic Lights are often used for displays of assessed Combat Power based on numeric data.

FOCUS

Each operation has a variety of key effects, which it seeks to create. The structure should start with Measures of Effectiveness and then build the substructure with 2 measures for each effect sought.

The lower tier measures (often referred to as Measures of Performance (MoPs) become relevant to commanders when they cause problems to Measures of Effectiveness (MoEs). A Command Interrupt introduces new measures. These are driven by events causing a shift in

interest. This can be for classical reasons such as Friendly Fire but there are often “ Gnats” to distract a commander especially from media. The latter will increase their presence and influence on future operations. Whatever boss and boss’s boss are interested by tend to become the basis for the metrics to be tracked.

The effort may be resource constrained as experience with ISAF HQ has suggested that of the 5 HQ staffs that have existed, only 3 have included OA support and data gathering capabilities. The latter, despite its immense value for future activities, is often seen as an unnecessary distraction from the current operation. A focused command mandate is needed to provide this capability.

Where little additional information is provided for example where there are many red cells in a table it may be that there just a lot of red perceived by the viewer. If so aggregation of the relevant cells may be appropriate.

A separate display has value if it shows how an aspect of a situation has changed in a material sense. It is important that discipline be maintained in reporting so that Traffic light changes are only made for sound reasons rather than the need to feel that progress is occurring especially when it is too early to tell.

Confusion of MoP and MoE can arise from one incident even if extreme which in physical terms may not rate a high level change achieving this via psychological means.

Even an atrocious bombing can be turned to good by refusing to react as terrorists hoped (as Al-Sistani had recently demonstrated.)

The metric’s fitness for purpose is based on whether changes to it show:

- Impression of progress.
- Significant misallocation of resources.
- Big changes have happened requiring action.

A move from Deep Red to Light Red in one component of a system may be more beneficial than a move from yellow to green in another.

The metrics depends on whom the analysis is supporting. The branches J1 to J9 have specific interests and want more detail in these.

Different traffic lights may be required for different levels of command.

Mike Neighbour’s slide showed how the state of damage could be assessed visually.

The Visual field offers the biggest bandwidth.

Explicit standards for consistency are the means of discipline and quality of input.

Metrics may be MoP or MoEs Taking reconstruction of houses after a conflict the MoPs which tend to be actually measurable might be the number of roofs put back on to houses.

By contrast, MoEs seek to monitor progress towards the effect sought. Reconstruction is a means to repopulation. The level of population is the real bottom line. This may depend on more than just construction.

There is a problem in understanding that experts should design metrics. Local OA staff often by default become declared experts in this field but often recommend that a relevant specialist in the issue at hand should be used.

Historical data for combat power allows the setting of thresholds eg the significant shifts in combat power being found at 80% and 60% casualties.

The key question is what does a move on a scale mean?

This depends on its context and the practicability of Collection. Where levels should be set and the relevant interval between reports will vary. There will be “faster” traffic lights with narrow bands time bases.

The tempo of reporting may be established by considering who should be intervening in a given area, when this should occur and where spatially.

There is often a pressure for viable activity as well as the more subtle things for the long term.

There may be a need to have a free market system or means of selling the work to get the supported decision-makers to prioritise the issues of most genuine performance from the mass of information available.

Peace operations add layers of complexity. It is necessary to find and use the owners of processes such as Housing and the judicial system. They may advise on the appropriate frequency of report match tempo of operation. Some may be daily whilst others are Weekly or Monthly. It is important not to just push up the lower tiers lights

AMBIGUITY OF PERCEPTION

Semiotics the science of signs suggests three steps:

- Visual thing.
- Assignment of visual thing.
- What we assign in our mental model.

Sign may be made to blink to draw attention to itself. If there are too many blinking leading to sensory overload, for example an pilot flying into Arlanda airport in Stockholm was too focused on flying in difficult conditions did not hear a warning because of the other problems which he was experiencing.

The 7 +/- 2 items rule for simultaneous consideration implies that greater numbers of characteristics can be chunked into a higher level pattern

Traffic lights displays work with car drivers of the west because they are familiar with these symbols.

Colour blindness (30%) excludes users but whole traffic light can be used 100% inclusive or Black and White representation is needed.

What other symptoms should be covered? For urgency an indication may be 0-4 of an icon such as Alligators. This provides visual symbols of importance,

The quality of supporting information is another important issue.

Question marks may be suitable way to communicate although this suggests an inverse scale with no question marks indicating high confidence and four representing no confidence or knowledge.

Simplicity does not prevent key questions with deep consequences being used such as the location of the forward units of a soviet formation, with career and personal well being of the relevant commander at stake.

Statistics without surrounding data, for example, confidence, variance is of limited utility.

It is important to be wary of equivocation where explanations are available. Uncertainty should be acknowledged where it and ignorance exist.

That a display of more than one possible future is made is a good index of a robust command and control system.

Metrics should give a steer about areas with great uncertainty implying that measurement must be expected to be ambiguous. Uncertainty in indicators from different sources will rise, for example, Bomb Damage Assessment will differ from Satellite, bomber view, and reconnaissance view.

Reduction of the bandwidth of information is the fundamental problem caused by the use of traffic light displays.