Chapter 5 – INDIVIDUAL CHARACTERISTICS AND BEHAVIOURS

INTRODUCTION

This chapter and the one that follows (*Team Characteristics and Behaviours*) address the variables and the relationships between and among them that describe human characteristics and behaviours that may affect the quality of decisionmaking in command and control processes. The quality of decisionmaking ultimately depends upon the quality of shared understanding that in turn is based on the awareness shared by the team members regarding the capabilities, environment, forces/actors, intentions, and the nature of the mission.

Shared awareness and understanding are developed in social processes of interaction among team members (as well as the interactions among these members), and they depend on the quality of the awareness and understanding of the individual team members. Individual awareness and understanding are the result of cognitive processes in which available information is processed by individual team members embedded in the social interaction processes of the team (that comprise Sensemaking). Both the social and the cognitive processes are shaped by the characteristics and behaviours of the team and its members.

Figure 5-1 highlights the role that individual characteristics and behaviours play within the C2 Model.

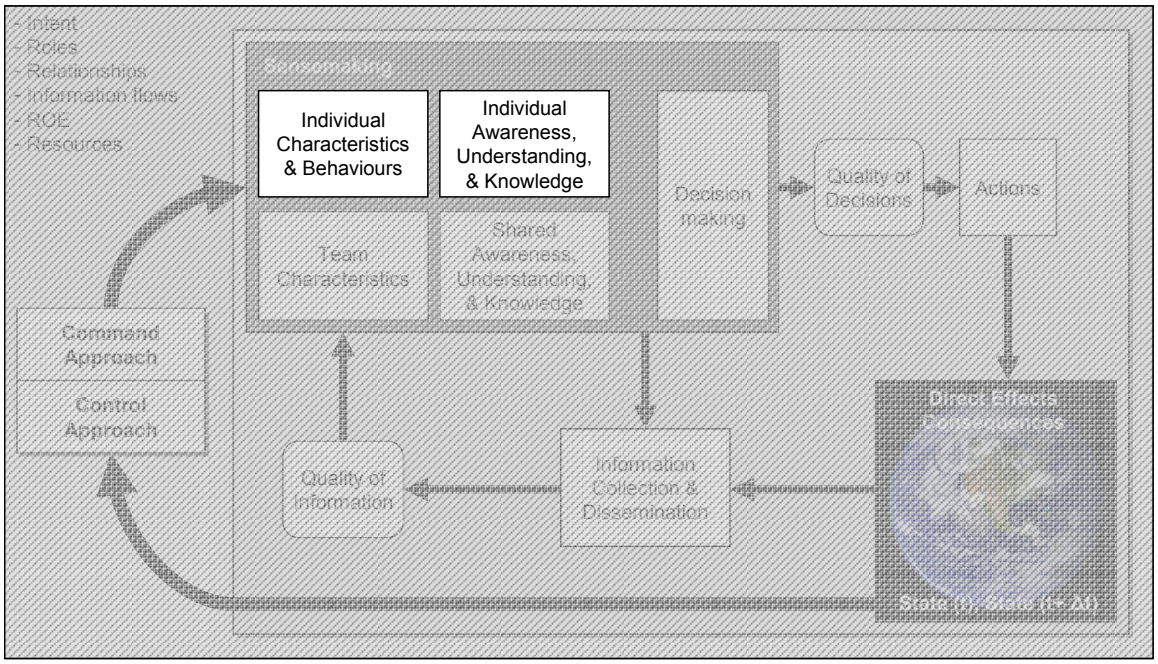

Figure 5-1: Overview of C2 Model Highlighting Individual Characteristics and Behaviours.

This chapter discusses variables that describe key cognitive issues involved in individual sensemaking. Understanding individual characteristics and behaviours requires an understanding of the following:

- Mental Models
- Awareness and Understanding

- Quality of Plan
- Task Performance

Variables related to Decisionmaking, which is also a key part of sensemaking, are described elsewhere in the report (see Chapter 8).

MENTAL MODELS

The concept of Mental Models is key to the way we have described sensemaking and the factors that influence it. The simple Awareness-Understanding-Action model that pervades much of the C2 literature focuses on the impact of Information as the chief driver of decisions. By introducing the Mental Model as a shaping and moderating influence in cognition, we have highlighted the need to consider the impact of other factors, such as cognitive abilities, personality traits, training and experience.

Mental Models are deeply integrated in individual understanding. The process of sensemaking has, at its core, the construction of Mental Models, and understanding can be thought of as the mapping of relevant Mental Models to observed reality. The connection of Mental Models and understanding is bi-directional because Mental Models are the repository of previous understandings, which are drawn down in the process of current understanding and updated for the future by that process.

However the existence of Mental Models has wider impacts. They shape the process of observation itself, impacting directly upon awareness. In a very real sense, we are incapable of becoming aware of phenomena for which we do not posses Mental Models. This reveals the criticality of training and experience to the cognitive process. Similarly, we cannot act with any deliberation or expertise without having formed Mental Models that allow us to connect actions with intents.

Mental Models are characterised by the following three variables: *Mental Models Richness*, *Mental Models Relevance,* and *Mental Models Confidence*. Figure 5-2 depicts important relationships between these and other variables.

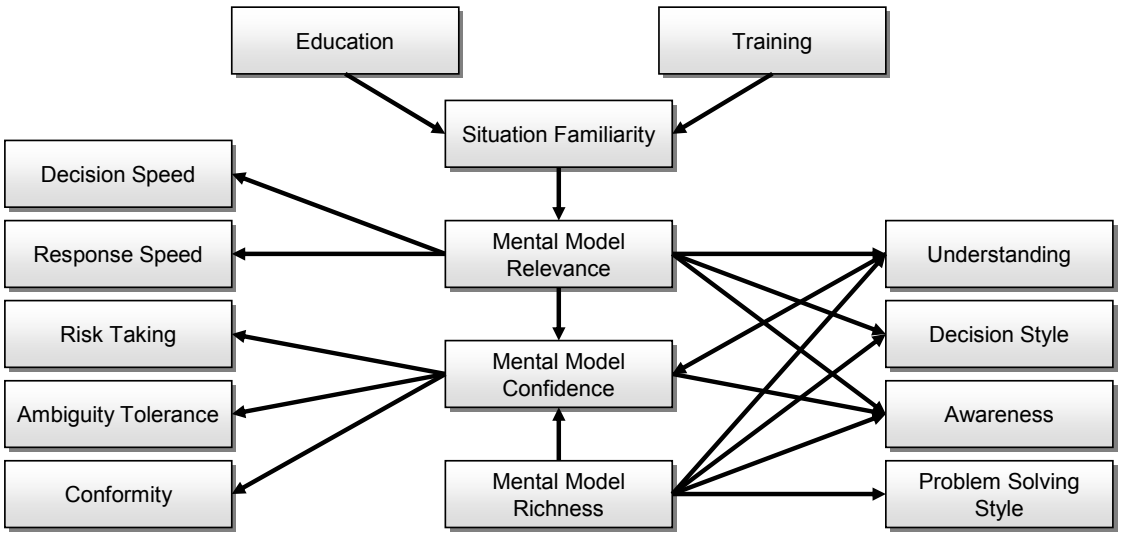

Figure 5-2: Mental Models.

Richness refers to the breadth and depth of the Mental Models an individual can bring to bear. Richness is influenced by a variety of *individual characteristics* and directly impacts upon a range of characteristics of *awareness* and *understanding*, including *correctness* and *accuracy*, as well *problem solving style* and *decision style*.

Relevance refers to the extent to which the Mental Model in use is appropriate to the situation and task at hand. In line with naturalistic decisionmaking theories, this is influenced by *situation familiarity*, which in turn depends upon *training* and *education*. *Relevance* directly affects, amongst other things, *awareness*, *understanding*, *decision style*, *decision speed* and response *speed*.

Confidence refers to the degree of subjective confidence that the Mental Model in use is appropriate to situation and task. This subjective confidence is influenced by, but not wholly dependent upon, the Mental Model's *Richness* and *Relevance* variables, as well as aspects of *understanding*. It directly affects *awareness uncertainty, understanding uncertainty, ambiguity tolerance,* and various behavioural factors, such as *conformity* and *risk taking*.

AWARENESS AND UNDERSTANDING

Both *awareness* and *understanding* are characterised by variables representing their *accuracy, completeness, consistency, correctness, currency, precision, relevance, timeliness,* and *uncertainty*. Specific relationships between these characteristics are identified in the Reference Model, and there is a general flow of effect from *awareness* to *understanding* moderated by *Mental Models* and a range of *individual and team variables*. Variables in the *understanding* group have direct impacts on behavioural variables, as indicated in the discussion above.

QUALITY OF PLAN

Quality of Plan is characterised by the variables representing their *accuracy, completeness, consistency, correctness, currency, feasibility, precision, relevance, timeliness,* and *uncertainty*. The Quality of Plan is influenced by *quality of command intent* and in turn influences the *accuracy, completeness, consistency, correctness, currency, precision, relevance, timeliness,* and *uncertainty of actions.*

TASK PERFORMANCE

Task Performance refers to task issues related to execution and contain the variables *individual task efficiency, individual task quality*, *task competence, task efficiency, task speed,* and *task understanding*.

Individual task efficiency is the degree to which an individual exhibits a high ratio of output to input in performing a task, while individual task quality is how well an individual performs a task.

Task efficiency is the degree to which the performance of a task exhibits a high ratio of output to input, *task competence* is the degree to which the knowledge required to execute a specified task is held by the individual or team, *task speed* is the time an individual spends performing a task, and *task understanding* is the extent to which the individual or team understands what is required to execute the specified task.

VARIABLES: INDIVIDUAL CHARACTERISTICS AND BEHAVIOURS

The variables discussed in this section fall into the five intermediate variables:

- Behaviour
- Individual Cognitive Abilities
- Personality and Values
- Physical Abilities
- Dynamic factors/State

Table 5-1 below gives an overview of the structure of these individual variables. A complete description of the variables follows below.

Table 5-1: Individual Characteristics and Behaviours

Behaviours	Individual Cognitive Abilities	Personality and Values	Physical Abilities	Dynamic Factors/ State
Memory performance Response speed Risk taking Self-monitoring Adaptive behaviour Conformity Cooperative behaviour Extra-role behaviour	General intelligence Cognitive capacity Cognitive complexity Cognitive flexibility	Emotional stability Conscientiousness Agreeableness Openness to experience Extraversion Decision style Problem solving styles Ambiguity tolerance Field dependence Impulsivity Levelling Locus of Control Relation to environment Repression Risk propensity Role of emotion Self-efficacy Self-esteem Trust propensity Willingness to interact	Physical strength Physical flexibility Other physical abilities Motor skill	Blood sugar level Physical health Sleep deprivation Alertness Stress level Anxiety Mental health Mood Motivation Trust Commitment/ Loyalty Position-based power

PHYSICAL ABILITIES

The domain of Physical Abilities can be differentiated into the variables *physical strength, physical flexibility, other physical abilities*, and *motor skill*.

Each of the first three variables is composed of a number of distinct constituents that have been found to determine the performance of physical tasks (Fleishman, 1979). *Physical strength* is composed of dynamic strength, trunk strength, static strength, and explosive strength. *Physical flexibility* consists of extent flexibility and dynamic flexibility. Finally, *other physical abilities* that account for physical performance are body coordination, balance, and stamina. These variables together influence an individual's *motor skill,* a skill required for proper use of one's muscles. However, motor skill also depends upon the proper functioning of the brain, skeleton, joints, and nervous system.

INDIVIDUAL COGNITIVE ABILITIES

Cognitive Abilities are characterised by the variables *general intelligence*, *cognitive capacity*, *cognitive complexity*, and *cognitive flexibility*.

General Intelligence is composed of a number of distinct factors. A most frequently used intelligence model suggests seven so-called "primary mental abilities" (tracing back to the work by Thurstone, 1938; see also Dunnette, 1976). These mental abilities include number aptitude, verbal comprehension, perceptual speed, inductive reasoning, deductive reasoning, spatial visualization, and memory. *Cognitive capacity* refers to the amount of information the human brain can hold and process within a given time (Simon, 1982). *Cognitive complexity* is the degree to which a person is able to differentiate cognitive elements, and the degree to which these elements can be integrated or related to each other (Van Hiel & Mervielde, 2003). *Cognitive flexibility* involves the willingness and ability of an individual to change their understanding of a situation when confronted with information that apparently contradicts their current understanding of the situation.

PERSONALITY AND VALUES

Variables that describe an individual's personality and values include personality traits, styles referring to an individual's approach to process information, and values held by an individual. The literature proves that these variables are crucial for information processing and decision processes. Personality factors and styles as well as personally held values are typically quite constant for a specific individual and can hardly be changed, and if they change only very slowly.

The psychological research literature contains a large number of personality theories, each having its own set of different personality dimensions. For the purpose at hand, the most useful personality theory refers to the "Big Five" model (e.g. McCrae & Costa, 1987; 2004), which is well validated and known for its high relevance in the field of performance (e.g. Judge & Bono, 2001; Salgado, 1998; Barrick & Mount, 1991; Hough, 1992; Tett, Jackson & Rothstein, 1991; Socan & Bucik, 1998; Spector, Schneider & Vance, 2000; Lauriola & Levin, 2001a, 2001b; Rose, Murphy, Byard & Nikzad, 2002; Ross, Rausch & Canada, 2003). The Big Five model contains five personality traits.

- *Emotional stability*: the opposite of the trait *Neuroticism,* which is more frequently discussed in the literature, characterised by nervousness, tenseness, moodiness, and temperamentality.
- *Conscientiousness:* characterised by organisation, thoroughness, reliability, practicality, and the absence of carelessness and negligence.

- *Agreeableness:* characterised by kindness, generosity, warmth, unselfishness, and trust.
- *Openness to experience:* characterised by imagination, curiosity, and creativity; the opposite of shallowness and imperceptiveness.
- *Extraversion* (Colman, 2001).

Extraversion (an individual's style to interact with their environment, characterised by awareness and reliance on the environment for stimulation and guidance, an action-oriented, sometimes impulsive way of meeting life, frankness, ease of communication and sociability) is also a component of the Myers-Briggs personality concept (Myers & McCaulley, 1992), together with its constituent dimensions.

- Sensing vs. Intuition: sensing refers to perceptions observable by way of the senses; intuition refers to the perception of possibilities, meanings, and relationships by way of insight.
- Thinking vs. Feeling: thinking is the function that links ideas together by making logical connections, it relies on principles of cause and effect and tends to be impersonal; feeling is the function by which one comes to decisions by weighing relative values and merits of the issues, it relies on an understanding of personal values and group values and is thus more subjective than thinking.
- Judging vs. Perceiving: in the perceptive attitude, a person is attuned to incoming information, in the judging attitude, a person is concerned with making decisions, seeking closure, planning operations, or organizing activities.

Furthermore, individuals differ in their Decision styles (a decision style is a habitual, albeit learned, approach to effecting a choice and then acting on that choice; Connor & Becker, 2003) in that they tend to decide:

- Analytically (high ambiguity tolerance, orientation to task and technical concerns; performance is achieved by analysis, planning, forecasting);
- Behaviourally (low ambiguity tolerance, orientation to people and social concerns; performance comes from focusing on people and their needs);
- Conceptually (high ambiguity tolerance, orientation to people and social concerns; performance is achieved by exploring new options, forming new strategies, being creative, and taking risks); or
- In a directive way (low ambiguity tolerance, focus on task and technical concerns; implementation of operational objectives in a systematic and efficient way).

An individual's Problem solving style may be either divergent, which means that a large number of potential solutions are produced for a specified problem, thereby often generating novel ideas and solutions, or convergent, in that information and knowledge focussed on a single solution to a problem are brought together or synthesized (Reber, 1995).

Ambiguity tolerance refers to the degree to which one is able to tolerate lack of clarity in a situation or stimulus (Reber, 1995).

The greater an individual's *field dependence*, the harder he/she will find it to differentiate perceptual and other experiences from their backgrounds or contexts (Colman, 2001).

Impulsivity is the tendency to respond spontaneously without deliberation, especially in situations of uncertainty, whereas the opposite, reflectivity, refers to the tendency to consider *deliberate* over *alternative* solutions to problems (Colman, 2001).

Levelling is the tendency to smooth over the unusual, irregular, or novel aspects of a situation or an event such that details are glossed over and that a homogeneous, less incongruous version ends up in memory than what was objectively presented. The reverse tendency is sharpening, in which details are (over-)emphasized and accentuated (Reber, 1995).

Locus of control (LOC) is an attribute characterised by the expectancy about the relationship between behaviour and its consequences. Individuals with internal LOC tend to expect reinforcements to be the consequences of their own efforts or behaviour; people with external LOC expect them to be the consequences of chance, luck, fate, or the actions of powerful others (Colman, 2001).

Relation to environment refers to an individual's style of interacting with their social environment; the ends of the continuum are "desire to control the environment" and "willingness to adapt to the environment."

Repression is a characteristic mode of reacting to threatening stimuli or ideas. Repressors tend to react by blocking, denial, and repression whereas sensitizers tend to react by approaching, facilitating, and increasing vigilance, i.e. confronting the threatening stimuli directly (Colman, 2001).

Risk propensity is an individual's natural inclination or preference for being exposed to possible harm or loss.

Role of emotion ranges from "neutral interactions" to "emotional interactions." "Neutral interactions" refer to the assumption that it is not appropriate to express emotions in social interactions; "emotional interactions" refer to the assumption that it is appropriate to express emotions in social interactions.

Self-efficacy is an individual's sense of their abilities, of their capacity to deal with the particular sets of conditions that life puts before them.

Self-esteem can be understood as a situation-unspecific generalization of situation- or task-specific self-efficacy and is defined as an individual's evaluation of him- or herself (Reber, 1995).

Trust propensity refers to the extent to which an individual is basically willing to rely on others (subordinate, superior, peers) and to be vulnerable to the consequences of their actions.

Willingness to interact refers to the disposed or inclined willingness to act on others.

Personal values are closely linked to an individual's personality and exert a significant impact on the individual's attitudes, intentions, and actual behaviours. A number of highly relevant values have been identified by extensive research (cf. Hofstede, 1980, 1991). The personal values included in the model are:

- Individualism (the extent to which a person perceives himself/herself as independent from others and their attitudes and opinions);
- Power distance (the degree to which one accepts that power is distributed unequally);
- Temporal orientation (the orientation towards future rewards, as opposed to short-term orientation which stands for fostering of virtues related to the past and present);
- Achievement orientation (preference of values such as assertiveness, the acquisition of money and material goods, and competition); and
- Nurturing (orientation toward relationships and concern for the welfare of others).

VARIABLES: INDIVIDUAL STATE/DYNAMICS

As opposed to the variables that characterise and describe an individual's personality and values, the values of variables related to dynamic human factors determine an individual's state and depend largely on the situational context, and thus are subject to permanent change. Also, they can be influenced more easily by leadership and understanding. The following dynamic human factors have been found to be highly relevant in the context at hand.

Blood-sugar level is the level of blood glucose. Too high a blood sugar level leads to hyperglycaemia, whereas too low a blood sugar leads to hypoglycaemia.

Physical health is the ability to cope with everyday activities, the state of fitness and well being, and the absence of illness.

Sleep deprivation refers to the condition of being deprived of sleep either under experimental or unusual real-life conditions.

Alertness is a state characterised by the preparedness to recognize and to react to stimuli. It can be differentiated into continuous alertness (the selective recognition of and reaction to continuously or frequently occurring stimuli) and vigilance (the recognition of and reaction to irregularly and infrequently occurring events).

Stress level is the extent to which an individual experiences psychological and physical strain or tension that has been generated by physical, emotional, social, economic, or occupational circumstances, events, or experiences that are difficult to manage or endure (Colman, 2001).

Anxiety is an affective state characterised by apprehension, dread, distress, and uneasiness (Reber, 1995).

Mental Health is the state of well being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community (WHO, 2001).

Mood refers to a relatively short-lived, low-intensity emotional state (Reber, 1995).

Motivation involves the driving forces responsible for the initiation, persistence, direction, and vigour of goal-directed behaviour, including biological drives, e.g. hunger, thirst, sex, self preservation, and social forms of motivation, e.g. need for achievement or need for affiliation (Colman, 2001).

Trust describes the extent to which an individual relies on specified others, e.g. subordinates, superiors, peers, and is prepared to make him or herself vulnerable to the consequences of their actions (Mayer, Davis & Schoorman, 1995).

Commitment/Loyalty is the degree to which an individual identifies with their organisation or group and its goals and wishes to maintain membership (Robbins, 2003).

Position-based power refers to the extent of an individual's legal power based on their holding a position of authority (Robbins, 2003).

VARIABLES: INDIVIDUAL BEHAVIOURS

Variables that characterise and describe an individual's behaviours result to a large extent from dynamic factors, personality variables, values as well as cognitive and physical abilities, leadership, and training. Identified as particularly relevant, the following variables were included in the model.

Memory performance is the correctness and extent of recall of cognitive contents previously encoded.

Speed of response refers to the speed with which an individual reacts to a cue and with which a person completes a response following response initiation (Luciano, Wright, Geffen, Geffen, Smith & Martin, 2004).

Risk taking is the degree to which an individual willingly undertakes actions that involve a significant degree of risk (Reber, 1995).

Self-monitoring describes self-observation and control of one's expressive behaviour and self-presentation (Colman, 2001).

Adaptive behaviour refers to any process whereby behaviour or subjective experience alters to fit in with a changed environment or circumstances or in response to social pressure (Colman, 2001).

Conformity is the tendency to attempt to act in ways consistent with the majority (Reber, 1995).

Cooperative behaviour is in effect when individuals work in common with commonly agreed-upon goals and possibly methods, instead of working separately in competition (Wikipedia Dictionary, 2005).

Extra-role behaviour involves activities that are essential for organisational effectiveness but are discretionary in nature, e.g. acting courteously and helping others (Becker & Kernan, 2003).