WHITE PAPER

Product Development

RESCUE HUMAN FACTORS™

by Sean D. McKay
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Designing Equipment to Meet the Physiological & Psychological Demands of Today's Warriors

Carl Von Clausewitz coined the term "fog of war" in his seminal work On War. He defined it by stating "war is a realm of uncertainty" where combat takes place in "a kind of twilight, which like fog or moonlight, often tends to make things grotesque and larger than they really are." Clausewitz elaborated that "fog can prevent the enemy from being seen, a gun firing when it should, a report from reaching a commander."

Clausewitz's 1831 work wasn't the first to note the mysteries of combat actions. As early as 413 BC, battlefield commanders noted perception is one of the first victims in combat. Thucydides observed, "Even in daytime, fighters do not perceive anything; indeed, nobody knows anything more than what is going on right around them."

Rescue Human Factors™ engineering is the applied science and study of the interface between human psychological and physiological reactions under stress and the critical performance parameters of casualty management.

Researchers have long recognized that stress is responsible for deteriorating cognitive and physical performance. Reports of tunnel vision, auditory exclusion, time distortions, loss of fine and complex motor skills, unexplainable accidental weapons discharges and irrational behavior have been well documented.

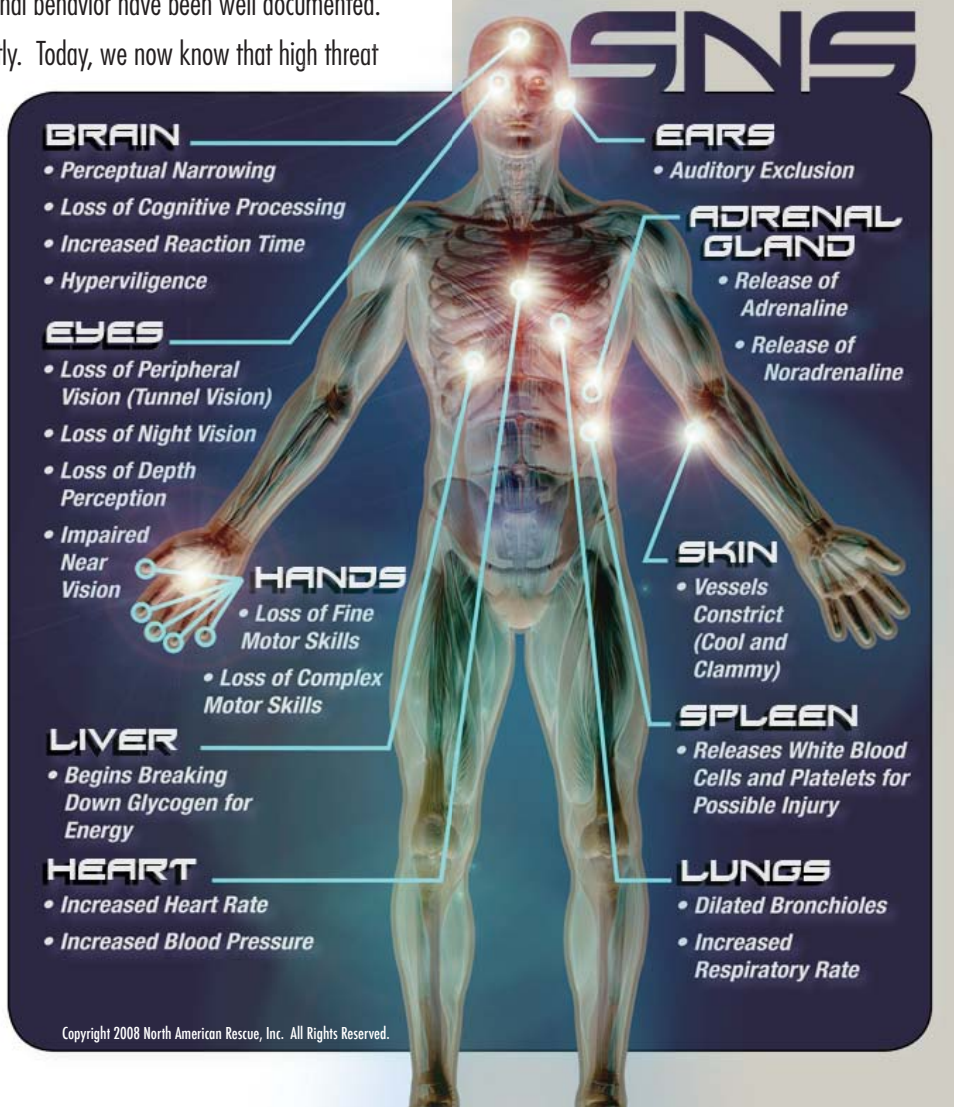
Why these phenomena occur has remained elusive until recently. Today, we now know that high threat rescue performance is connected to the Autonomic Nervous System (ANS). This system controls all of the voluntary and involuntary functions of the body, and is divided into the parasympathetic (PNS) and sympathetic nervous systems (SNS).

During times of non-stress, the two branches work together to create a state of balance known as "homeostasis". It is during this state of balance between the PNS and SNS input that specific functions - such as high-level perception, analytical processing, and fine or complex motor skill execution - are performed at peak levels. It is during the state of homeostasis that "man the species" is smart, precise and deliberate. However, anytime the brain perceives an imminent threat, the SNS is activated involuntarily, resulting in an immediate discharge of stress hormones.

The SNS is recognized as the "fight or flight system" and prepares the body for survival by releasing a mass discharge of stress hormones. The release of stress hormones increases arterial pressure, increases heart rate, increases blood flow to large muscle mass (resulting in enhanced gross motor skill and strength capabilities), initiates vasoconstriction of minor blood vessels throughout the body, enacts multiple changes to eye physiology, and cessation of the digestive process.

The environments and situations in which we work innately activate SNS response. Integral understanding of the body's response and its subsequent capabilities are what drive the Rescue Human Factors™ engineering process.

North American Rescue is committed to empowering today's elite professionals with the equipment, training and education needed to successfully execute casualty management in our current and future operational environments.



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The combination of these physiological changes helped early man avoid becoming a meal for another predator. The activation of the SNS results in man becoming fast, quick and strong – but at a price of becoming dumb. However, this was not an issue with early man when action was more important to survival than determining whether the threat was a male or female lion. All early man needed was to either flee the area or respond with the strength of Samson to kill the threat.

Yet, the skills of rescue personnel center on fundamental hand/eye coordination, high levels of acuity or accuracy, and a higher level of cognitive processing. For these processes to work optimally, the body must be in a state of balance (homeostasis). Unfortunately, activation of the SNS is automatic and it uncontrollably inhibits the PNS.

The implications of SNS dominance is catastrophic to vision, cognitive processing, as well as fine and/or complex motor skill performance. For example, SNS excitement will cause the loss of near vision; it disrupts depth perception and collapses the peripheral

field. Also consider that vision is the dominant sense and is the primary sensory source on which the brain relies in high threat environments. However, if the visual system is feeding impaired information back to the brain, threat recognition, processing skills, and spatial awareness will be flawed.

The SNS is even more devastating on cognitive processing, which is an extremely efficient and lightning fast operation in non stress situations (PNS dominance). It is a process that is normally managed by the cerebral cortex and higher brain functions. But SNS activation inhibits higher brain functions centered in the cerebral cortex, resulting in a deterioration of threat recognition, response selection and the ability to communicate complex thoughts. The result is a dramatic increase in survival reaction time.

Finally, all casualty management results in the execution of a motor skill. Typically, all skills can be segmented into three categories; gross, fine and complex. Unlike other facets of the warrior profession, virtually every motor skill executed by rescue personnel is a fine or complex (precision) skill set. Almost one hundred years of research has demonstrated that under SNS excitement, only gross motor skills are performed optimally. Fine motor skills such as precision-based casualty care (IV/IO access, airway management, bandaging, etc) all deteriorate when the SNS is activated.

The situational paradigm in which the rescuer's skill sets reside is that they are needed immediately when situations become hazardous to life, whether to the casualty, the rescuer, or both. It is then critical that the techniques, equipment, and training are designed and engineered to improve function and performance at the point of wounding or the impact is catastrophic.

Casualty management equipment and technology must not only be an extension of the human body, but also must compliment rescue physiology. Rescue Human Factors™ engineering mitigates many of the inhibiting variables that occur in high stress situations and empowers the rescuer's ability to excel under these physiological and psychological stressors.

The *Rescue Human Factors™ (RHF™)* criteria consists of the following *Stop Gates:*

Effective: **Is the skill or equipment effective in accomplishing the desired result?** Through an aggressive preliminary testing process, does it perform as advertised? Emphasis is placed on exploiting foundational strengths and weaknesses.

Efficient: **Is this skill or equipment efficient in the area of operation of its intended use?** Based on the specific area of operation, a skill and/or equipment requirement list should be performed. A list of characteristics pertinent to the environment where the skill and/or equipment will be utilized must be compiled.

Executable: **Will the rescuer have the capability of performing the skills or utilizing the equipment suggested?** Having the capability of accurately predicting the physiological and psychological effects of survival stress (Rescue Human Factors™) in the specific area of operation is the requirement for this consideration. First, predictable stress levels based on the area of operation and/or phase of care during application are identified. Second, the above information is then utilized to determine technique, equipment and skill selection. Compatibility of skill selection to the area of operation and subsequent sympathetic nervous system (SNS) response is a critical consideration.

References:

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Whenever you see this icon next to a product from North American Rescue, it has been specifically designed and engineered to spec according to the Rescue Human Factors™ Stop Gates for effectiveness, efficiency and executability in its operational environment.