

# Stress Resilience Training System (SRTS)

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**Abstract.** The SRTS is an eLearning iPad app that incorporates both cognitive knowledge and proven neurological biofeedback based on Heart Rate Variability (HRV) Coherence. SRTS uses HRV-controlled games as a way of motivating today's young soldiers and sailors. The objective is both to minimize the adverse effects of stress and enhance its productive effects in order to help improve immediate performance as well as help prevent the occurrence of future problems such as post-traumatic stress disorder (PTSD). The initial phase of the research resulted in a PC-based SRTS demonstration system, as well as positive responses to formal and informal usability and utility studies. The current phase of the project has involved the complete development of the iPad version of the SRTS, and also its operational evaluation for efficacy by the Naval Center for Combat and Operational Stress Control (NCCOSC), US Navy Bureau of Medicine and Surgery (BUMED). Many potential customers for SRTS in the Navy, Marine Corps, Air Force and Army are waiting completion of the NCCOSC efficacy evaluation.

**Keywords:** Stress resilience training, eLearning, Heart Rate Variability, PTSD.

## 1 Introduction

Stress resilience is an important issue in the military today. The negative effects of stress can be evident before, during and after exposure; they include decrements

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in performance both on and off the battlefield, psychological injuries leading to high-risk behaviors such as alcohol and drug use, and in extreme cases, PTSD and suicide.

At the same time, there are positive aspects to stress as well. It has long been recognized that warfighters adapt to combat stress after the first few experiences and that training can help duplicate this process [1], with recent studies showing that experienced military personnel are able to control and even utilize stress productively [2]. An important part of what experienced personnel learn is self-awareness of their stress state and self-regulation of stress energy. Accordingly, the current DOD definition of stress resilience is: The ability to withstand, recover, and grow in the face of stressors and changing demands.

Our Stress Resilience Training System (SRTS) is completely consistent with current DOD resilience doctrine and objectives in that it aims both to minimize adverse effects of stress and enhance its productive effects in order to improve immediate performance and prevent the occurrence of future problems such as PTSD. In fact, the SRTS emphasizes the performance-improving aspects of stress resilience. This differentiates it from the great majority of other stress resilience programs and methodologies, which tend to be more focused on stress pathology and therapy.

## 2 Hypotheses

The key hypotheses upon which we have based the development of SRTS are:

- Incorporating both *Cognitive Learning* and *Evidence-Based Biofeedback* in a scientifically-designed system to enhance stress resilience can minimize the adverse effects of stress.
- Minimizing the adverse effects of stress *and enhancing its productive effects* at exposure will improve immediate performance and will also help prevent the occurrence of longer term psychological injuries such as PTSD.
- A state-of-the-art mobile device such as the *iPad* will greatly improve training effectiveness by enabling individualized, on-the-spot refreshment training and practice before, during and after deployment.
- Embedding the Neurological Biofeedback methods in a set of *Casual and Serious Games* will help motivate today's young military population [3].

## 3 Technical Description

The initial phase of the research resulted in an end-to-end PC-based SRTS demonstration system that contained most of the key features of the final product. Formal and informal studies showed that the SRTS interface, training modules and practice games were easy to understand and enjoyable as well, and yielded very positive comments [4]. As a result, the research progressed to development of the originally-planned complete iPad-based mobile stress resilience training course. SRTS is now available as an iPad app that provides access to four main training components:

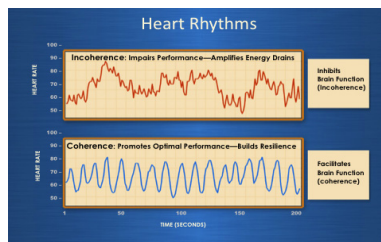
- **KNOW HOW:** Provides a set of short narrated video modules that include: an introduction to SRTS; general information about stress effects, stress resilience and

putting stress in perspective; and also specific instructions on preparing for, performing in, and recovering from stressful situations or operations.

- **TECHNIQUES:** Teaches the HeartMath Coherence Advantage technique, which includes self-regulation of Heart Rate Variability (HRV) and shifting from negative to positive emotions.
- **GAMES:** Provides a set of entertaining HRV-controlled games in which the trainee can practice maintaining HRV Coherence while performing under increasingly absorbing and challenging conditions.
- **REVIEW:** Allows the user to review his or her progress in learning the cognitive material and in the acquisition of Coherence Advantage skills.

In addition, there is a built-in Adaptive Coach that monitors the trainee's progress and self-test results, and provides recommendations on how best to progress through the training program. Each component has been human factored for ease of use, and professionally designed and produced to the highest standards of iPad apps. The current iPad SRTS has a Navy orientation because it fit the Navy's Operational Stress Control Program so well [5], but the framework is applicable to many different users.

An important part of SRTS is Coherence Advantage training using methods developed and validated by our team member the Institute of HeartMath. Coherence Advantage employs Heart Rate Variability biofeedback to control the neuropsychological responses associated with counter-productive emotional states. Heart Rate Variability (HRV) is a measure of the strength and regularity of the changes in the heart's beat-to-beat interval, sometimes called Heart Rhythm. The intervals between heart beats vary, and can be expressed as a variation in Heart Rate with time. A strong and regular Heart Rate Variability is called Coherence; it is when the sympathetic and parasympathetic nervous systems are in synch, and is associated with good neurophysiological function and stress resilience. A weak and irregular variability is called Incoherence, and is associated with poor neurophysiological function and stress. The top graph in Figure 1 shows the edgy, jerky HRV pattern associated with Incoherence. The bottom graph shows the more even HRV pattern associated with Coherence. Coherence represents the neurophysiology of optimal function, when everything seems easy and cognitive performance is high. Athletes call this *THE ZONE*.



**Fig. 1.** Heart Rate Variability (HRV) in Incoherence and Coherence

In SRTS the heart beat is detected with an ear pulse sensor. The HRV value goes from 0 to 100, and is calculated using an algorithm developed by Institute of Heartmath that uses power spectral analysis. A low HRV number is associated with Incoherence, a high number with Coherence. Using biofeedback techniques coupled with voluntary shifts in emotion, individuals can learn to increase their HRV value, thus improving their immediate performance and enhancing their stress resilience.

Figure 2 shows how Coherence feedback is included in a typical HRV-controlled SRTS game. This game, Slingshot Racer, is the most challenging and requires the trainee to increase the speed of the jet racer while avoiding various obstacles. A breath pacer time-graph helps the trainee regulate his or her breathing rhythm, while HRV is shown in three ways: one, as a Heart Rate time-graph above the breath pacer; and two, as a slider on a red-to-green Coherence bar; and three, as a numerical Coherence value. The trainee can use the feedback mode or combination of modes that best helps him or her to achieve and maintain higher Coherence in the game.



Fig. 2. HRV-Controlled Slingshot Racer Game

## 4 Efficacy Evaluation

Usability of the initial PC-based SRTS and current iPad SRTS app has been validated by several experimental studies at the George Mason University Psychology Dept. The first usability study was done in 2011 with the PC-based SRTS version using questionnaires, observations and interviews. The results showed that the interface, modules and games were easy to understand, fast to learn, and enjoyable. The second study was done in 2012 with the iPad SRTS app and also produced very positive results on measures of usability and stress control potential [6].

The military utility of SRTS has been initially established in a series of trial evaluations by military groups such as Navy Operational Stress Control (OSC) Program Office, the Navy Special Warfare Group 1, Naval Air Station Lemoore, the Army Family Advocacy Program at Ft. Sam Houston, the Army CSF-PREP Program at Ft. Hood, and others. Typical comments included, "...it's great; very engaging. Would give it to our guys." And "Catches my attention all the time. Will work with adolescents."

SRTS' operational efficacy is being tested in a large-scale, formal evaluation study now under way at the Naval Center for Combat and Operational Stress Control (NCCOSC), San Diego. The NCCOSC evaluation study will provide groups of about

35 subjects with SRTS units for several weeks. It will base efficacy on pre- and post-trial stress and resilience questionnaires (and potentially other available performance measures) as compared with two other groups: one group will receive an iPad app on Progressive Muscle Relaxation (PMR) and the other group will receive no training for the period. The total study will involve about 200 volunteer subjects from two Navy commands in the San Diego area; the study protocols have received IRB approval and the experimental portion of the study is scheduled to begin in early May, 2013.

## 5 Conclusions

Two major problems have precluded effective stress control in the military: the stigma of weakness prevents personnel from seeking psychological help; and existing soft programs do not build transferable skills. SRTS addresses both of these problems by its “de-stigmatizing” emphasis on performance over pathology, and by its combination of instruction about stress with specialized training in how to build actual neurophysiological resilience. Its mobile iPad format allows personnel to obtain individualized stress resilience training before, during and after deployment. As a result of the successful evaluations and demonstrations to date, there are many potential customers for SRTS in the Navy, Marine Corps, Air Force and Army who are waiting completion of the efficacy evaluation and broader distribution of the SRTS product.

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