Police Performance Under Stress

Since lower stress levels potentially equate to better performance and greater chances of winning critical encounters, police trainers strive to facilitate the achievement of "optimal performance" for their officers through various techniques, such as skill-proficiency, biofeedback (heart rate and breathing), Reality Based Training (RBT), and even through actual experience such as that found in FTO programs. Since perceptions and emotions play a large role in one's reaction to stressors, they cannot be ignored even in the police profession – one in which officers are sometimes unrealistically, expected to be unemotional and composed at all times. Just what exactly *is* stress and how does it affect performance?

One of the most comprehensive definitions of stress that includes the all-important emotional factor, McGrath defines stress as the "interaction between three elements: Perceived demand, perceived ability to cope, and the perception of the importance of being able to cope with the demand" (1976). This definition encompasses not only an officer's own skill and confidence compared to the task at hand, but also the relative importance of handling the challenge successfully.

Stress in law enforcement can range from a rookie handing out his very first citation, to a seasoned veteran responding to a lethal force attack. It can encompass taking a sniper shot from a rooftop, dealing with an irate citizen, or even experiencing an inflamed internal affairs complaint initiated by a malicious command officer. While each stressor has its own characteristics, the toll on the human body can be exceedingly destructive if not dealt with properly.

Yerkes-Dodson

The pursuit of performing well under stress is certainly not new to the police profession, and most of our research and modus operandi wisely come from the field of psychology. More recently and more specifically, the field of sport psychology has contributed to the journey. Yerkes and Dodson seemingly related stress (arousal) and performance an entire century ago when they studied rats placed under induced "stress" consisting of a mild electrical shock. Their findings eventually led to the "Inverted-U Theory" which basically suggests a curvilinear relationship between performance and stress, in the shape of an upside-down "U." In other words, as stress ("arousal" as termed by Yerkes and Dodson) increases, performance improves up to a point at which stress begins to become too great and performance then diminishes. Although not without its critics, the theory has withstood the test of time, because it makes *intuitive sense* and is virtually impossible to disprove. After all, how can one argue that optimal performance is *not* found between the two extreme states of comatose and panic? Of late however, the field has moved on to more acceptable theories that encompass many differing variables, so why hasn't the police profession moved ahead as well?

Generalizing an "Optimal Performance Zone"

Since heart rate is one of many factors that can indicate stress levels in most (not all) people, Siddle took this a step further and attempted to put actual heart rate values on

the Inverted-U. An "Optimal Performance Zone" was created with a range of 115 – 145 beats per minute (bpm). This zone was based on the onset of physical skill loss/improvement at specific heart rates (Figure 1). The studies Siddle used to incorporate heart rate into a generalized "optimal performance zone" however involved physical exertion rather than psychological and/or emotional arousal; aka stress (Levitt & Gutin 1971, and Levitt 1972). There may not have been at the time, but now there is a well-established difference between heart rate elevation due to physical exertion and heart rate elevation due to stress or psychological arousal, and it would be difficult at best to generalize one to the other.

Although the Inverted-U theory is well-known within the police training arena, many essential components have unfortunately been omitted or forgotten over the years. Siddle included these components in his book Sharpening the Warrior's Edge, however much of the information has been left behind. For example, even in basic psychology text books both task complexity characteristics and personality characteristics are mentioned as affecting one's performance, relating these characteristics to an *individualized* Inverted-U (Figure 2). Rarely, if ever, are these mitigating factors even mentioned in defensive tactics programs.

Trait Anxiety, State Anxiety, and Task Complexity

Trait anxiety is a person's general predisposition to respond across many situations with high levels of anxiety, and state anxiety is a person's anxiety at a particular moment. *Generally, the higher the trait anxiety, the higher the state anxiety.* Task complexity is influenced by a number of components, and is broken down into three categories: **Decision characteristics** (number of decisions necessary, number of alternative decisions, speed of decisions necessary, required sequence of decisions), **perception characteristics** (number stimuli needed, number of stimuli present, duration of stimuli, intensity of stimuli, and clarity of correct stimulus among conflicting stimuli), and **motor act characteristics** of the skill (number of muscle actions needed to execute the skill, the amount of coordination of actions required, precision and steadiness required, and fine motor skills required).

Based on a point system to determine the overall "complexity score" of any given task, the higher the complexity score, the lower the arousal level should be for optimal performance. Conversely, the lower the complexity score, higher levels of arousal are acceptable to successfully complete the task (Figure 3).

Hence, someone performing a very complex task, who also happens to have high trait anxiety and high state anxiety, will perform worse than someone performing a simple skill, who has low state and trait anxiety (Figure 2). Even Yerkes and Dodson a century ago realized that each person would have his/her own individualized "Optimal Performance Zone" based on personality and task complexity characteristics. Relating this to police positions, a SWAT team would certainly want a "calm, cool, and collected" personality on the trigger of a sniper rifle, and an adrenaline-pumped muscle-head on the business end of a battering ram… At any rate, Siddle's basic concepts had a positive influence on police physical skills training, in that skill-simplicity with teaching physical skills was emphasized (gross motor skills) as well as controlling stress via influencing heart rate by controlling respiration.

IZOF Model

Since human beings are so different and complex, attempting to categorize or generalize an optimal performance zone to one specific heart rate range would be virtually impossible. Rather than trying to reinvent the wheel, the police profession may be better off looking to the athletic profession in terms of improving physical and mental skills under elevated stress levels. When comparing athletes to officers and operators, both must perform physically and cognitively well while experiencing elevated stress. Skill level, training, and physical fitness all affect performance, and there are consequences to poor performance (although more severe in the police profession with the potential loss of life). Professional athletic organizations have spent millions of dollars developing techniques and systems for improving physical and mental performance under stress, why not tap into that which has already been developed?

Rather than the highly-debated Inverted-U Theory, we might obtain more benefit from looking to the field of sport psychology and studying the IZOF Model, or the "Individual Zones of Optimal Functioning" in which personality characteristics, maturity level, trait anxiety, state anxiety, coping skills, task complexity and skill-proficiency, all play a part in determining one's performance levels and optimal zones. Additionally, these zones are not without change and will cultivate based on personal development, physical skill improvement, maturity, and practical experience. This of course is much more complex and difficult than the simple Inverted-U Theory with definitive heart rate zones plopped onto the graph, but human performance is very complex!

Empirical Heart Rate Data

Heart rate data has been collected by LouKa Tactical Training for the past six years using the Polar S810 heart rate monitor in the following arenas:

- Police academy physical fitness sessions (Figure 4)
- Police academy firearms training sessions
- Police academy emergency vehicle operations (data not usable due to ignition interference)
- Police academy RBT in Ann Arbor, Michigan (Figure 5)
- In-service RBT across the country (Figures 6, 7)
- On duty actual incidents, with and without physical exertion (Figure 8, 9)
- During one officer's voluntary taser "ride" (Figure 10)

Heart Rate Graph Observations

These examples are but a few of the hundreds of graphs collected, but some *general* observations could be made based on the empirical heart rate data collected:

- There was no specific heart rate range for "optimal performance" that could be generalized to everyone
- Some cadets and most officers did not lose fine and complex motor skills at elevated stress levels as indicated by heart rate
- Very few (but some) lost most skills during low stress incidents (possibly due to any number of possibilities such as a lack of police experience, lack of maturity, new task versus trained task, high trait anxiety, high state anxiety…)
- Absent physical exertion:
    - The lower the heart rate curve the better the performance

    - The higher the HR Curve the worse the performance, although not necessarily bad or catastrophic performance
    - The more frequent the HR spikes the worse the performance, and in very rare cases even catastrophic performance (HR spikes are not possible to see when using heart rate monitors which provide a 5-second average instead of heart rate variability, or beat-to-beat recording). An officer's ability to recover from a startle response may be just as important as the lack of HR spikes in those with low trait and low state anxiety..
- With physical exertion:
    - Proficient performance was observed in "stressful" incidents by self-proclaimed "physically fit" officers
    - Less proficient performance and elevated heart rates were observed in self-proclaimed "physically unfit" officers
- *Experience related most to proficient performance and to lower heart rate curves,* as can be witnessed by overlapping HR graphs of in-service officers of varying levels of experience. For example, two officers participating in RBT as partners, each has a different number of years working the street and thus differing levels of "street" experience, both are exposed to identical stimuli in RBT, but the officer with more "street" experience will almost always show a lower HR Curve than his/her more inexperienced partner. This is strikingly evident when the HR monitors are started and stopped at the same time, and the printed graphs can be overlapped and held up to the light to compare HR Curves. An officer with more street experience will consistently show a lower HR Curve, sometimes up to 40-50 beats per minute lower…

Interventions

Utilizing biofeedback such as heart rate and respiration rate, is but one of many possible interventions to stressful situations. Recording and downloading heart rate data can provide valuable information to cadets, in-service officers, FTOs, and police trainers. This can lead to improved performance on the street and improved chances of winning encounters. Other interventions include but are not limited to:

- Training to skill proficiency leads to higher confidence which results in better performance under stress.
- RBT is of course another great tool to stress inoculation and improving performance. Keep in mind however, that even RBT loses its stressor capabilities with seasoned veterans who experience RBT on a regular basis. The challenge to RBT trainers becomes that of keeping the scenarios realistic while still inducing a startle or stress response in those individuals.
- Imagery, mental rehearsal and positive self-talk are powerful tools in controlling stress, performance, and ultimately outcomes.
- An offensive rather than defensive mindset will help the officer formulate a plan in advance and expect the worse, thus staying ahead of the reactionary curve.
- Concentration skills development can help an officer stay focused on the immediate task at hand while minimizing distractions.

- Physical Fitness
    - An exercise routine not only releases endorphins on a regular basis, but also improves skill level and therefore confidence.
    - Appropriate body weight allows for efficiency of movement in emergency situations
    - Open-chained or reactionary drills added add to the ability to react to physical stimulus.
    - Plyometrics (explosive muscular movements) greatly improve police-specific striking, kicking, and sprinting abilities which can all equate to elevated performance on the street.
    - A physically fit body has more efficient heart and lung capacity during stressful situations.
    - The cardiovascular system is able to recover quickly after physical demands.
    - Respiratory muscles can shuttle more oxygen to the brain and muscles.
    - Bone, tendon and muscle strength result in less likelihood that an officer will be put out of the fight due to injury
    - If an inevitable injury does occur, a fit body has a higher tolerance to pain and stress, which just might be the difference in a life-or-death struggle.
    - Proper nutrition and a constant blood sugar level are imperative as the brain and muscles require adequate carbohydrates to perform optimally when the "fight-or-flight" system is activated. This can result in clearer mental functioning under stress, and efficient and powerful muscular movements. This is easily achieved by keeping pre-planned food available at all times and snacking every few hours. Adequate carbohydrates are imperative to muscle and brain function, and adequate protein is needed to maintain adequate muscle, tendon and ligament strength to perform the emergency task without injury.
      (Asken, 2005)

Looking to the Future

Monitoring heart rate is one of *many* methods to keep track of and control stress levels for some people, but it is still be a valuable tool for police and military trainers who strive for current and future performance-improving applications. Heart rate graphs are currently being used to provide objective data to support dismissal from basic academies when deficient performance is present during RBT. They are currently being used in FTO programs and in-service RBT for awareness of one's own performance zone. If the ignition interference issue is resolved, heart rate monitors could be useful during emergency response and vehicle pursuits in the future, and may even have a place in the career selection process (not everyone was meant to *be* the police). More specifically, they may be used for selections relating to fitness such as bicycle patrol, as well as for stress performance positions and for specialty-within-specialty positions such as a sniper on the SWAT team. The "gold" standard of course would be actual on duty

incidents, and perhaps one day there may even be a "head's up" display in an officer's patrol vehicle along with a real-time monitor display in the communications center; as the officer pursues an armed robbery suspect during a high speed pursuit, abnormally high readings may trigger a calming voice over an internal speaker to bring the officer's stress level back into his/her personal IZOF… Whatever the future, heart rate monitors are certainly not *"The Tool"* but they have the potential to be *"A Tool"* in the field of optimal human performance.

Polar USA now has a Law Enforcement/Government program through which agencies can host training and purchase heart rate monitors at greatly reduced cost. Contact *Polar Sales Manager, Tricia Sterland, MS, CSCS Tricia.sterland@polarusa.com, phone: 877-630-9924*

The National Strength and Conditioning Association (NSCA) has recently unveiled its "Tactical Strength and Conditioning" (TSAC) program and certification specifically for police/fire/military fitness. For more information visit www.nsca.com/TSAC

Kathleen Vonk has worked the street since 1988, currently Ann Arbor PD in Michigan. She has a BS in Exercise Science and a BA in Criminal Justice. She recently taught a block of instruction on heart rate and performance under stress at NSCA's TSAC conference. Her work in this area is highlighted in Ken Murray's book Training at the Speed of Life as well as Dr. Michael Asken's book Mindsighting. She is a Team One Network adjunct instructor and former H&K adjunct instructor. She designed and implemented the Police Wellness Instructor program for the Michigan Commission on Law Enforcement Standards, which can be tailored to any state. She is the lead fitness instructor for the Washtenaw Community College Police Academy. She is an instructor in many police use-of-force and survival skill disciplines, and teaches nationally in those areas. She is a former collegiate athlete and remains competitive in several sports. She is co-owner of LouKa Tactical Training which specializes in physical skills training for law enforcement. Visit www.loukatactical.com for more information and current schedule. Kathy can be reached directly at kathyvonk@aol.com

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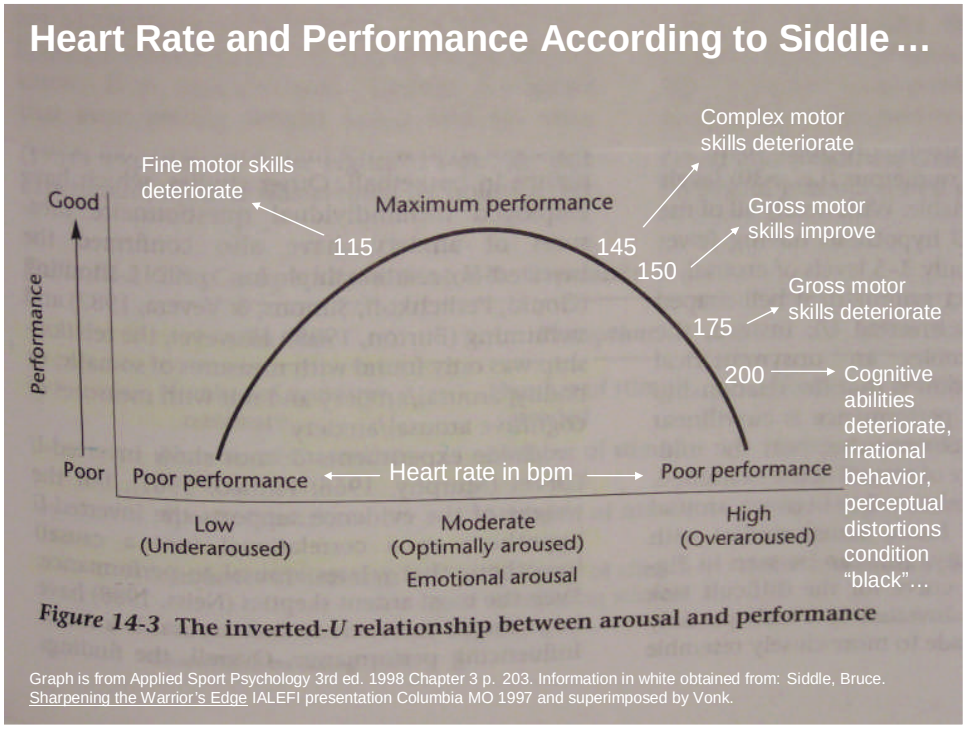

Figure 1

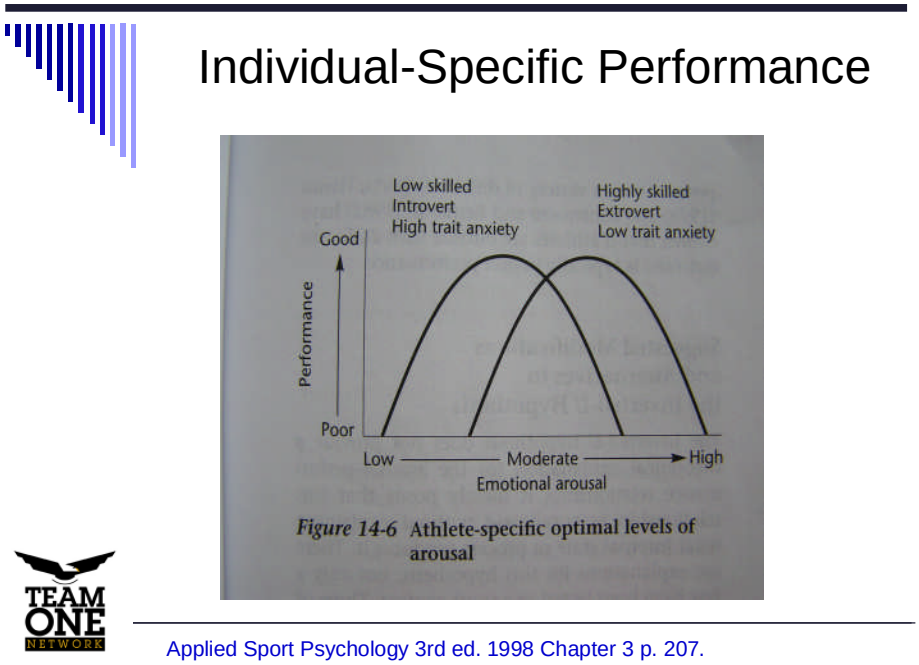

Figure 2

Estimating Complexity of Motor Performance (score 0-4)

- Decision characteristics of skill (16 possible pts)
  - # decisions necessary, # alternatives/decision, speed of decisions, sequence of decisions
- Perception characteristics of skill (20 pts)
  - # stimuli needed, # stimuli present, duration of stimuli, intensity of stimuli, clarity of correct stimulus among conflicting
- Motor act characteristics of skill (16 pts)
  - # muscle actions to execute skill, amount of coordination of actions, precision and steadiness required, fine motor skills required

Williams, Jean M. ed. Applied Sport Psychology: Personal Growth to Peak Performance. 3rd ed. 1998. Pp. 211 - 214

Complexity Score paired with Arousal Level

- Sum of score: the higher the complexity score, the lower the arousal level should be for optimal performance (possible 52 pts total)

Arousal Level*	Complexity Score	Police Task
5	0-10	Kick in door
4	11-16	Foot pursuit/take down
3	17-21	Fight w/suspect
2	22-31	Vehicle pursuit
1	32+	Sniper shot

Arousal level: 5 = extremely excited, 4 = psyched up, 3 = medium arousal, 2 = some arousal, 1 = slight arousal

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Figure 3 (both frames above)

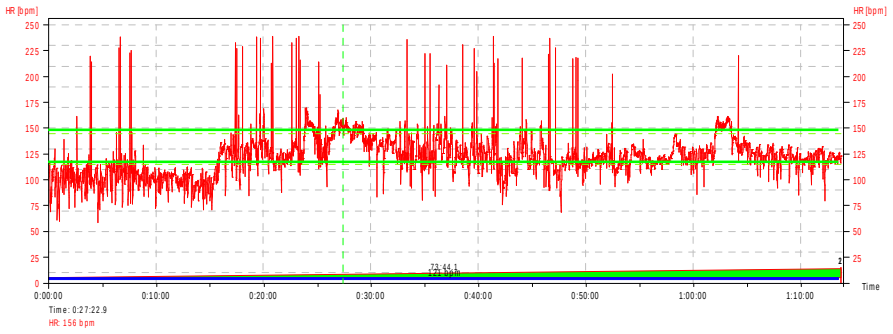
Physical Exertion

Person		Date	10/14/2004	Heart rate average	125 bpm	Limits 1	145 - 183
Exercise		Time	6:32:08 AM	Heart rate max	177 bpm	Limits 2	80 - 160
Sport	WCC Police Academy	Duration	1:15:59.7			Limits 3	80 - 160
Note	690 calories. warm up,pull ups,1/2 mile team,russian twist,speed/agility			Selection	0:00:00 - 1:15:55 (1:15:55.0)		

WCC Police Academy, Ann Arbor Michigan. Physical fitness session 2004.

Figure 4

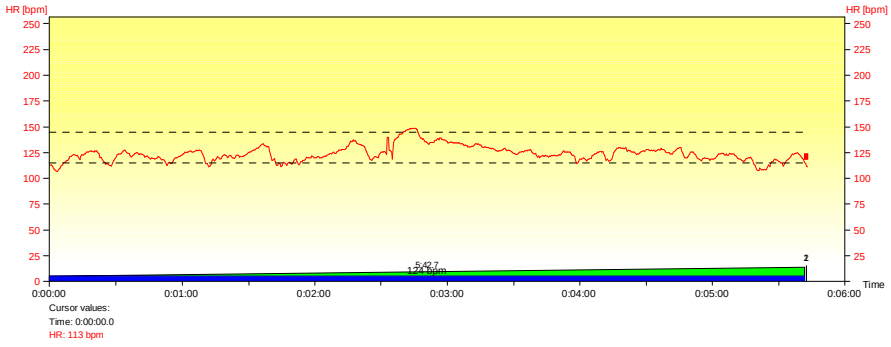
Simunition Scenario Cadet



Person		Date	5/29/2003	Heart rate average	121 bpm	Limits 1	115 - 145
Exercise	Scenarios	Time	11:03:09 AM	Heart rate max	239 bpm	Limits 2	80 - 160
Sport	WCC Police Academy	Duration	1:13:44.9			Limits 3	80 - 160
Note	Domestic			Selection	0:00:00 - 1:13:44 (1:13:44.9)		

Figure 5

Simunition Scenario 5 yrs.

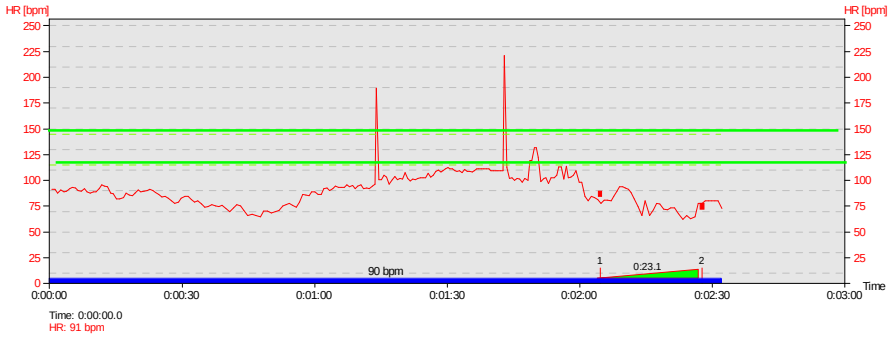


Person		Date	10/10/2003	Heart rate average	124 bpm	Limits 1	115 - 145
Exercise		Time	1:15:59 PM	Heart rate max	149 bpm	Limits 2	80 - 160
Sport	Simunition Scenarios	Duration	0:05:43.3			Limits 3	80 - 160
Note	Workplace violence, shots fired, malfunction, suspect engaged.			Selection	0:00:00 - 0:05:42 (0:05:42.8)		

Compare this HR curve to the 15-yr officer, relative to the 115 – 145 range…

Figure 6

Simunition Scenario 15 yrs.

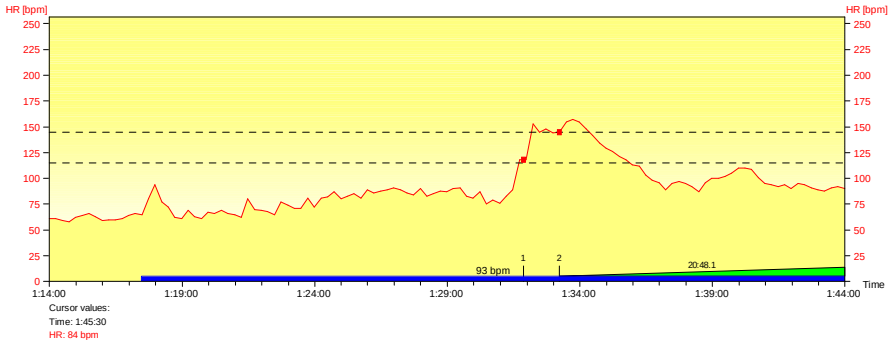


Person		Date	10/19/2002	Heart rate	90 / 221	Limits 1	115 - 145
Exercise		Time	10:12:39 AM	Max. HR	183	Limits 2	146 - 157
Sport	Simunition Scenarios	Duration	0:02:32.2			Limits 3	157 - 183
Note	F/A w/bat, verbal non-compliance then compliance			Selection	0:00:00 - 0:02:32 (0:02:32.2)		

Notice the HR range 115 – 145, and where the officer's HR curve is relative to this range…

Figure 7

On Duty with Physical Exertion

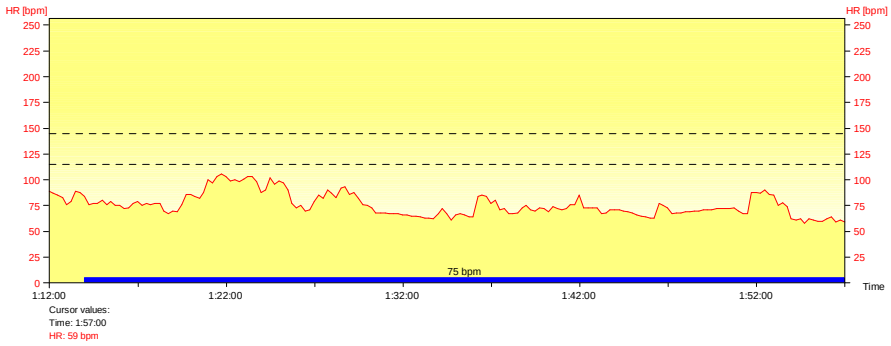


Person		Date	6/11/2004	Heart rate average	93 bpm	Limits 1	115 - 145
Exercise	6/11/2004 9:22 PM	Time	9:22:48 PM	Heart rate max	157 bpm	Limits 2	158 - 177
Sport		Duration	1:54:03.3				
Note	1936 Saxon party, forcible arrest, mob followed, kicked advancing person			Selection	1:17:30 - 1:44:45 (0:27:15.0)		

Loud party, fight, arrest, mob followed officers to patrol car, kicked advancing suspect

Figure 8

On Duty w/o Physical Exertion



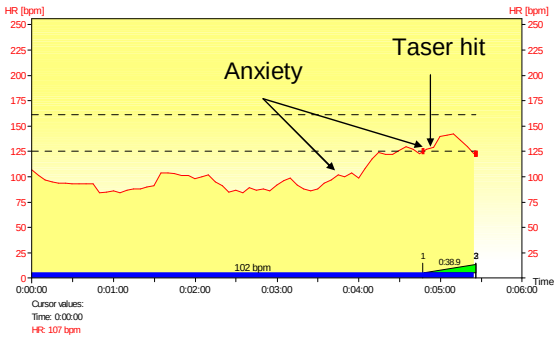
Person		Date	6/22/2004	Heart rate average	75 bpm	Limits 1	115 - 145
Exercise	6/22/2004 10:54 PM	Time	10:54:41 PM	Heart rate max	106 bpm	Limits 2	158 - 177
Sport	AAPD Patrol Car shift	Duration	4:56:12.0			Limits 3	80 - 160
Note	Domestic, woman w/knife, taser + verbal commands, dropped knife, secured, investigated.			Selection	1:14:00 - 1:57:00 (0:43:00.0)		

Domestic w/knife, taser w/verbal commands, dropped knife, secured, investigated

Figure 9

Observations con't

- Separating HR elevation due to physical exertion from HR elevation due to anxiety i.e. taser hit
- How to separate HR elevation due to stress from physical exertion



Person		Date	3/30/2003	Heart rate aver.	102 bpm	Limits 1	125 - 161
Exercise	3/30/2003 9:47 PM	Time	9:47:18 PM	Heart rate max	142 bpm	Limits 2	119 - 156
Sport	Running	Duration	0:05:26.3			Limits 3	80 - 160
Note	Taser zap			Selection	0:00:00 - 0:05:25 (0:05:25.0)		

Figure 10