Officer Survivability From the Inside Out: Physical & Psychological Effects of Combat Stress

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Physicians Section

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Operating Environment

• Encounter circumstances, environment & subject behaviors frequently require LE officers to:
  – Anticipate resistance
  – Identify, distinguish subject behaviors & cognitively process incoming stimuli
  – Formulate the perception & respond under time pressures
  – Make split-second decision making
  – Make judgments under varying and severe environmental & confrontational variables
  – Respond with limited reaction time or time for reflection
  – Respond under the impact of numerous stressors, and
  – Justify the force decision

- Objective reasonableness under the Fourth Amendment
- Court established 4 criteria to review claims of excessive force:
  - Severity of crime at issue,
  - Suspect posed an immediate threat to the safety of officers or others,
  - Suspect attempted to evade arrest by flight (Dangerousness), &
  - Suspect actively resist arrest
- **Split-second decision making** must be considered
- **“Situational variables”** & rapidly evolving dynamics of the circumstances considered”
- Analysis based on the **“totality of circumstances”** (Environmental)
- Reasonableness must be judged from the **“Perception”** of the officer & not from 20/20 vision hindsight
Stress

• Multifaceted phenomenon comprising diverse reactions toward tangible or mentally evoked threats

• Cannon (’29): Fight or flight response

• Selye (’36, ‘59, ‘78): Non-specific response of the body to any demand made upon it

• McGrath (‘70): Environmental demand on person, perception of the stimuli, and mental/physical response

• Triggers a number of psychophysiological reactions
  – Cognitive
  – Biological
  – Psychological
  – Psychoendocrinological
Stress & SNS Activation

• Individual responses to stress initiate Sympathetic Nervous System (SNS) discharge (Cannon, ‘29; Selye, ‘78; Cater, ‘98; Ratey, ‘01; Sapolsky, ’04)

• Sensory stimuli received, triggers a cascade of chemicals through the body in order to prepare the body to respond to the stressor (s) [fight or flight response]

• Impact on cognitive process

• Heart rate, blood pressure, perspiration, muscles tension, pupils, improved blood flow, breathing, etc.

• Impact on deterioration of fine motor skills

• Impact on Vision, Auditory, Distortion of perception

• Potential impact on physical response
Combat/Survival Stress

• Physiological, behavioral, and psychosocial reactions experienced before, during or after combat

• Generally in Law Enforcement, a response to a lethal force perception which initiates an SNS discharge

• Related to “Fight or Flight”

• Context of performing Law Enforcement duties

• Officer believes in danger of imminent threat of serious personal injury

• Officer believes responsible for protecting another

• Creates potential tactical implications
Stress, Perception & Performance

- **Cognitive Processing & Perception**, James (1890); Gibson (‘50); Epstein (‘94) & Arthwhol (‘02)

- **Stress Response To Perceived Threat**, Cannon (‘29); Selye (‘36, ‘59 & ‘78); Carter (‘98) & Ratey (‘01)

- **Vision**, Easterbrook (‘59); Breedlove (‘95); Willems, Allen, & Stein (‘99)

- **Reaction Time (Action v. Reaction)**, Welford (‘80); Sanders (‘98); Hontz (‘99); Lewinski (‘00 & ‘02)

- **Decision Making & Performance**, Janis & Mann, ‘77; Salas, ‘96; Klein, ‘98; Sanders, ‘98; Hsieh, 02 & Dror, ‘07

- **Recall**, Anderson & Pichert (‘78); Hobson (‘88); Siddle & Grossman (‘95), Artwhol (‘02); Gielsman (‘10); Lewenski (‘02)
Research on Perceptual Distortions in LE

- Nielsen (‘81); Solomon & Horn (‘86); Campbell (‘92); Arthwhol & Christsen (‘97); Hoing & Roland (‘98); Klinger (‘99/’09); Ross & Siddle (‘03); Hoing & Lewinski (‘06); Ross, Murphy & Hazlett (‘12)

- Research collectively found:
  - Cognitive Processing & Perceptual distortions
  - Physiological responses
  - Peripheral narrowing
  - Auditory exclusion
  - Time distortions
  - Depth perception
  - Misperceptions
  - Threat focus
  - Reaction time
  - Recall fragmentation
  - Performance
Simulators & Lethal Force

- Military, medicine, airlines, firefighting, sports, etc.
- In LE, provides suitable, realistic training and deadly force training.
- Can replicate field encounters
- Allows more practice trials
- Training of novices & experts
- Commit errors w/out fatal consequences
- Enhance shooting accuracy
- Reduce the number of shots fired
- Decrease # of unjustified shootings
- Provides feedback
- Prompts visual, auditory, tactile and physiological reactions in officers
- Research consistently show simulator training effective means of teaching cognitive & motor skills
Simulators, SIT, & Law Enforcement Research

- Boyd (’92): n=207, 90% enhanced decision making
- Greasley & Barolw (’98) Emergency driving; EVOC
- Helsen & Starkes (’99): N=24, decision making 89% but shooting accuracy only 56%
- EKU, CJ prgm. (’02): N=181; 95% increased shooting accuracy & judgment (used PRISM)
- Scharr (’03) N=36 probation off.; FATS decision making; 86% believed effective in making quick decisions
Simulators, SIT, & Law Enforcement Research

- Atkins, & Norris (FLETC, 2003): Scenario-based & SIT—N=100 & 7 scenarios
- Police operations (Godshaux, 2004)
- Bennell & Jones (CA, ’05): 84% of agencies agree FATS scenarios realistic
- Siddle/Siddle (’05) (used PRISM) N=45; assessed stressors
- Lewinski/Blocksridge (’06): N=48 scenario, sims
- Ross, Murphy, Hazlett (‘12): Perception & Misperceptions of in lethal force in virtual simulators (N=150)
- Armstrong, Clare, & Plecas (‘14) N=132; lethal force simulator & heart rate (RCMP)
Purpose of the Study

• Using a virtual simulator system with induced stressors of police officer respondents confronting a lethal force encounter activate a measurable SNS discharge?
• Possible to identify and assess officer perceptions of induced stressors?
• Will officers incorrectly perceive manifest events during the scenarios?
• Are there measurable associations between self reported perceptions, misperceptions, and physiological changes?
Methods

- Meggitt Training Systems contracted two Western Illinois University and two University of South Florida Ph.D. to assist with the research
- New simulator system designed
- Constructed lab: 20’ x 18’ w/white screen 16’ x 10’, video surveillance system HD; 5.1 surround sound system; lighting; dispatch; vortex air and hostile fire cannons
- Development and production of scenarios
- IRB approval from University of South Florida
- Experimental design
- Randomized of 150 officers
- 1 of 3 scenarios
- Officers were financially compensated as required by the IRB
Respondent Demographics

- 5 municipalities & 3 Sheriff departments (Tampa, FL area)
- Gender= 80% males
- Race= Caucasian 75%; 11% AA; 8% Hispanic, & 6% mixed race
- Average age=35 (range= 22 to 64)
- 3 to 20 years LE experience (x= 8 yrs.)
- 93% agencies=151 to 500 sworn
- 87% some college; BS; or MA
Mobile Eye & Biometric Rigging
Mobile Eye & Biometric Rigging (Cont.)
Mobile Eye & Biometric Rigging (Cont.)
Process Overview

- Arrival to departure 1.5 hours
- Informed consent & background information
- Bio-physiological equip. & Mobile Eye-tracker
- Baseline data
- Word recog./memory test
- Saliva taken 3 x
- Scenario & complete questionnaire w/in 30 min.
  - Directed & Unobtrusive
  - Perception & Memory
- Post survey return following 2 sleep cycles
Scenarios

• #1. Motorcycle stop—no stress (n=52) < 2 min.
• #2. Workplace violence—no/low stress (n=25) 5 min.
• #3. Workplace violence, stressors (n=73) 5 min.
• Dispatcher used w/respondents 10-code
• All scenarios videotaped
• Each respondent given:
  – Police uniform shirt
  – Radio
  – Bluefire® Glock firearm
  – Mobile Eye® tracker
  – Bio-physiological equip.
  – Saliva Collection Pre/Post 3x
# Self-Reported Perceptions of Experienced Stressors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1 Motorcycle %</th>
<th>Group 2 WPVLS %</th>
<th>Group 3 WPVS %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario Stressful</td>
<td>40</td>
<td>66</td>
<td>86</td>
</tr>
<tr>
<td>Need to Apprehend</td>
<td>21</td>
<td>84</td>
<td>84</td>
</tr>
<tr>
<td>Safety to self/others</td>
<td>40/24</td>
<td>72/68</td>
<td>82/80</td>
</tr>
<tr>
<td>Threatened</td>
<td>34</td>
<td>58</td>
<td>71</td>
</tr>
<tr>
<td>Fear</td>
<td>22</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Demanding</td>
<td>24</td>
<td>59</td>
<td>66</td>
</tr>
<tr>
<td>Heart Rate Increased</td>
<td>13</td>
<td>58</td>
<td>68</td>
</tr>
<tr>
<td>Vision Distortion</td>
<td>12</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Auditory Distortion</td>
<td>10</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Breathing Difficulty</td>
<td>10</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>Reacted by Exp.</td>
<td>57</td>
<td>55</td>
<td>60</td>
</tr>
<tr>
<td>Reacted by T/P</td>
<td>65/45</td>
<td>68/49</td>
<td>70/50</td>
</tr>
<tr>
<td>Respond to subject</td>
<td>65</td>
<td>68</td>
<td>75</td>
</tr>
</tbody>
</table>
Perceived Stressor Scale – Linear Trend moving from Motorcycle to Workplace Violence

EXPERIENCE STRESSORS (0-14) COMPARED ACROSS OTS SCENARIO TYPES (Post-test)

Scenarios place in their ordinal level of intensity based upon actual stimuli and stressors during a scenario.
## Selected Scenario Misperceptions of Stressors

<table>
<thead>
<tr>
<th>Motorcycle (n=52)</th>
<th>% IC</th>
<th>% IC WPVLS (n=25)</th>
<th>Variable</th>
<th>%IC WPVS (n=73)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject’s clothes</td>
<td>61</td>
<td>36</td>
<td>Subject Description</td>
<td>47</td>
</tr>
<tr>
<td>Verbal threats</td>
<td>30</td>
<td>65</td>
<td># of Doors checked (4)</td>
<td>67</td>
</tr>
<tr>
<td>Initial perception</td>
<td>39</td>
<td>76</td>
<td>Perception of lighting</td>
<td>83</td>
</tr>
<tr>
<td>Reached across bike</td>
<td>65</td>
<td>53</td>
<td>Others contacted (3M/3/F)</td>
<td>61</td>
</tr>
<tr>
<td>Had 2 weapons</td>
<td>79</td>
<td>76</td>
<td>Shots fired by Subj. in Bldg.</td>
<td>82</td>
</tr>
<tr>
<td>Rounds fired by subj.</td>
<td>72</td>
<td>60</td>
<td>Shots fired by Subj. outside</td>
<td>71</td>
</tr>
<tr>
<td>Duration of scenario</td>
<td>36</td>
<td>50</td>
<td>Subj. assault 2M/1F</td>
<td>68</td>
</tr>
<tr>
<td>Threaten to cut throat</td>
<td>59</td>
<td>64</td>
<td>Duration of scenario</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75</td>
<td>Recall # of rounds fired by off.</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65</td>
<td>Subj. fired from chest level</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>---</td>
<td>Sounds in Bldg.</td>
<td>54</td>
</tr>
<tr>
<td>27% IC Perception</td>
<td>30%</td>
<td>32%</td>
<td>Recall improved by 25% in all 3 groups w/in 48 hrs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>32%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Motorcycle ↔ Alpha- Amylase → Workplace VS
Motorcycle ↔ IL6 → Workplace VS
<table>
<thead>
<tr>
<th>Event</th>
<th>Time in Seconds</th>
<th>Heart Rate</th>
<th>Abdominal Respirations</th>
<th>Chest Respirations</th>
<th>Skin Temp. Centigrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Officer exits vehicle</td>
<td>25</td>
<td>114</td>
<td>13.54</td>
<td>13.81</td>
<td>32.91</td>
</tr>
<tr>
<td>Speak w/security</td>
<td>46</td>
<td>121</td>
<td>13.3</td>
<td>13.61</td>
<td>32.84</td>
</tr>
<tr>
<td>Enters bldg.</td>
<td>59</td>
<td>125</td>
<td>12.74</td>
<td>12.23</td>
<td>32.82</td>
</tr>
<tr>
<td>Checks door in hallway</td>
<td>80</td>
<td>133</td>
<td>13.31</td>
<td>12.61</td>
<td>32.81</td>
</tr>
<tr>
<td>Magazine thrown</td>
<td>110</td>
<td>135</td>
<td>13.71</td>
<td>13.01</td>
<td>32.72</td>
</tr>
<tr>
<td>Sees employee in office</td>
<td>147</td>
<td>138</td>
<td>12.71</td>
<td>12.47</td>
<td>32.71</td>
</tr>
<tr>
<td>Sees suspect</td>
<td>155</td>
<td>148</td>
<td>12.81</td>
<td>12.01</td>
<td>32.71</td>
</tr>
<tr>
<td>Sees victim on floor</td>
<td>160</td>
<td>149</td>
<td>12.12</td>
<td>11.71</td>
<td>32.63</td>
</tr>
<tr>
<td>See 2\textsuperscript{nd} victim casualty scream</td>
<td>172</td>
<td>147</td>
<td>11.74</td>
<td>11.31</td>
<td>32.60</td>
</tr>
<tr>
<td>Visualizes suspect in hallway</td>
<td>185</td>
<td>149</td>
<td>11.91</td>
<td>12.01</td>
<td>32.61</td>
</tr>
<tr>
<td>Sees/Hears woman screaming</td>
<td>188</td>
<td>149</td>
<td>13.01</td>
<td>11.71</td>
<td>32.61</td>
</tr>
<tr>
<td>See suspect running again</td>
<td>193</td>
<td>145</td>
<td>13.01</td>
<td>12.12</td>
<td>32.53</td>
</tr>
<tr>
<td>Sees suspect exit/hears alarm</td>
<td>202</td>
<td>152</td>
<td>12.41</td>
<td>12.21</td>
<td>32.54</td>
</tr>
<tr>
<td>Officer exits bldg./sees subject</td>
<td>215</td>
<td>150</td>
<td>12.10</td>
<td>11.61</td>
<td>32.50</td>
</tr>
<tr>
<td>Truck passes by</td>
<td>248</td>
<td>145</td>
<td>11.81</td>
<td>12.71</td>
<td>32.31</td>
</tr>
<tr>
<td>Suspect stops/officer behind</td>
<td>267</td>
<td>144</td>
<td>12.01</td>
<td>12.21</td>
<td>32.51</td>
</tr>
<tr>
<td>Back-up; in line of sight—right</td>
<td>275</td>
<td>140</td>
<td>12.73</td>
<td>12.05</td>
<td>32.51</td>
</tr>
<tr>
<td>Officer shoots/Friendly fire</td>
<td>281</td>
<td>139</td>
<td>14.01</td>
<td>12.81</td>
<td>32.51</td>
</tr>
</tbody>
</table>
Heart Rate by Time (seconds)
Abdominal & Chest Respirations

```
<table>
<thead>
<tr>
<th>Time In Seconds</th>
<th>Respirations</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>13.8</td>
</tr>
<tr>
<td>46</td>
<td>13.6</td>
</tr>
<tr>
<td>59</td>
<td>12.2</td>
</tr>
<tr>
<td>80</td>
<td>12.6</td>
</tr>
<tr>
<td>110</td>
<td>13.0</td>
</tr>
<tr>
<td>147</td>
<td>12.5</td>
</tr>
<tr>
<td>155</td>
<td>12.0</td>
</tr>
<tr>
<td>160</td>
<td>11.7</td>
</tr>
<tr>
<td>172</td>
<td>12.1</td>
</tr>
<tr>
<td>185</td>
<td>12.2</td>
</tr>
<tr>
<td>193</td>
<td>11.7</td>
</tr>
<tr>
<td>202</td>
<td>12.2</td>
</tr>
<tr>
<td>215</td>
<td>12.7</td>
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<tr>
<td>248</td>
<td>12.2</td>
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<tr>
<td>267</td>
<td>12.8</td>
</tr>
<tr>
<td>275</td>
<td>12.2</td>
</tr>
<tr>
<td>281</td>
<td>12.2</td>
</tr>
</tbody>
</table>
```

Chest

Abdominal
Bio-Marker Results

• Gender did not show a significance difference

• Cortisol in MC, no change from baseline but elevated in WPVS @ 30 min

• Alpha-amylase & IL-6 were correlated @ 10 min \[ r = 0.47 \] and @ 30 min \[ r = 0.41; \ P < 0.001 \]

• Yrs. of police service correlated w/AA \( r = 0.41; \ P < 0.001 \)

• Data show dynamics and physiology of salivary biomarker responses to different stressful stimuli & hypothalamic-pituitary-adrenal axis in WPVS

• Alpha amylase levels suggest that SNS activated
Conclusions

• Found an Inverted U association with stressors, intensity of stressors, and physiological factors
• Alpha-amylase correlated w/perception of stressfulness of the scenario, emotion; & demand
• Showed a slight decline in respirations as intensity of & pace of stressors increased
• A slight change in skin temperature (blood flow) as intensity & pace of stressors increase, speculate related to SNS activation
• Results validate training design
Training Implications

• Goal is realism in training:
  ✓ (Ratey,’01): Contextual conditioning-max learning
  ✓ Reality-based (City of Canton v. Harris, ‘89)
    Zuchel v. City & Co. of Denver, Co (1993) $330,000
  ➢ Use of force training should present students with confrontation problems to solve
  ➢ Scenario based/ Reality Based
  ➢ Design premise on SNS activation
  ➢ Objective is to build officer expertise, keep them in the mode of training → provide “brain upgrades”
Simulation Training

• Does not eliminate classroom or range

• Moves beyond and allows transfer of knowledge and skills to actual field encounters

• Provides officers exposure to extreme stressful encounters & perform during SNS activation

• Builds expertise, master threat assessment & cue into assault cues
Simulation Training

- Immersion components
- Stress Inoculation
- Emotions, Affect, & Startle response
- Dynamic Scenarios (Fidelity issues):
  - Fast paced & Realistic
  - Variation/uncertainty [link to embedded cues]
  - Design to activate SNS
  - Reaction time issues
  - Scenario duration
  - Force to adapt to the changing circumstances
  - Problem Oriented
  - Command presence & One & Two officer response scenarios
Force Justification Training

- **TFI → EDPRT:** Enhances decision-making, performance, memory, C + E reporting, & testimony

- Scenario based focuses on:
  - Behavioral assessment
  - Threat assessment
  - Threat cues recognition, Contextual cues, missing cues
  - Pattern matching
  - Teach officers to “Read The Play”

- Conflict resolution
- Breath control
- Night-time shooting
Implications of OIS & Human Factors Research

- Training focus on Perception Guided Instruction (PGI)
- Situational awareness
- Suspect behaviors:
  - **Embed stimuli cues** which activate SNS (SIT)
  - Effect sensory aspects of students
  - Threat assessment/Assault cues; pattern & contextual cue recognition
- Environmental/Circumstance replication (Sensory)
  - Lighting; Auditory; Vision; Dispatch; Shoot back cannons
- Vision & Eye Scanning
- Breath control
Simulation Training

• Achieve multiple skill sets & multi-tasking

• Assists in skill maintenance & re-training

• Provides feedback

• Looking for “Sully Effect”

• Builds competence and confidence

• Creates winning field performance

• Perfect Practice Makes Perfect