VirTra - Virtual Interactive Coursework Training Academy™ (V-VICTA™)

HUMAN FACTORS IN FORCE ENCOUNTERS

VirTra

MODULE BREAKDOWN

- Module 1A and 1B - Human Factor Concepts
- Module 2A and 2B - “Stop Time”
- Module 3A and 3B - “Shoot and Turn”
- Module 4A and 4B - “Knife Charge”
- Module 5A and 5B - “Prone Subject”
- Module 6A and 6B - “Vehicle Contact”
- Module 7A and 7B - Review and Test

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MODULE BREAKDOWN

- This course is set to be run in three formats:
  - 8-hour day – 7 classroom hours with a one-hour lunch
  - 7 one-hour blocks (combine module “A” and module “B”)
  - 14 half-hour blocks to be run in an extended briefing format

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MODULE BREAKDOWN

- The current PowerPoint is to supplement the “Human Factors in Force Encounters” lesson plan and not replace it.
- A strong working knowledge of the associated lesson plan is required to provide the training.

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MODULE 1: HUMAN FACTORS CONCEPTS

Module 1A

HUMAN FACTORS

- How does the mind (brain)…
  - …collect
  - …process
  - …and use information?
- How is the body…
  - …directed by that information?
  - …influenced in performance?

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STRESS AND AROUSAL

- Stress and arousal are critical to understanding performance

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STRESS

- “Like beauty, stress is in large part in the eye of the beholder.”

- Occurs when it appears that
  - Demands > ability to meet demands, when safety is at stake

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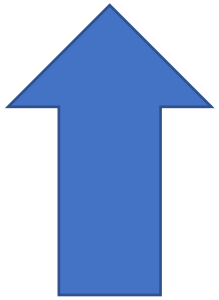
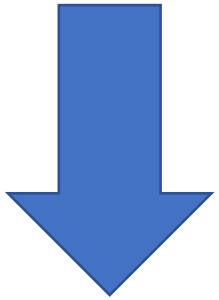
STRESS

Heart rate, blood pressure, pupil size, muscle tension



STRESS

- Narrows the attentional process
  - Perception
  - Memory



AROUSAL – FEAR AND STRESS

- “Arousal” is when
  - Senses are stimulated to perception
  - Stimulate to action or to readiness

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AROUSAL

- Fight, flight, freeze
- Consciousness, attention and alertness
- Yerkes-Dodson

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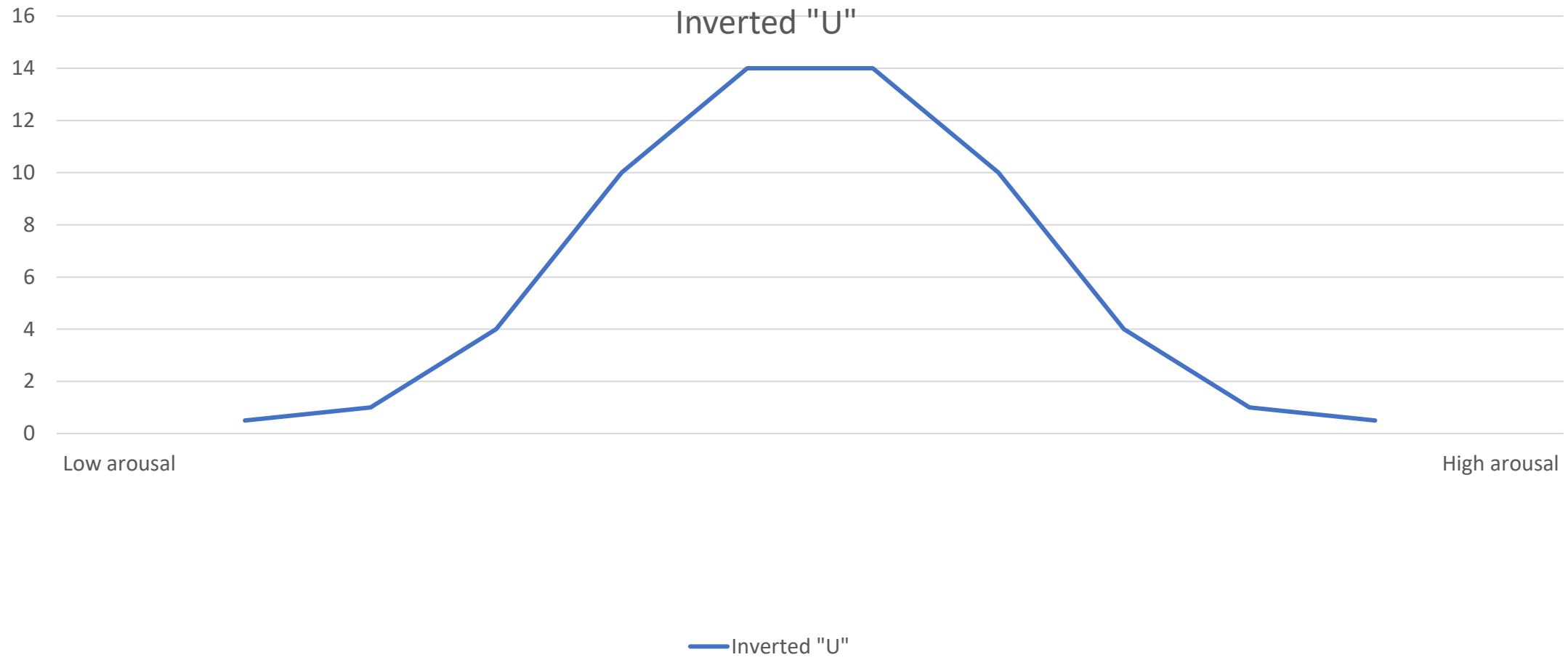
YERKES-DODSON



MODULE 1: HUMAN FACTORS CONCEPTS

Module 1B

PERCEPTION

- Complex interaction involves
  - Receiving of photons in light via our eyes
  - Collection and transmission via the optic nerve
  - Mind processes based on past experience

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WHAT AFFECTS PERCEPTION?

- Quality/complexity/interference of signal
  - Light
  - Sound
- Attention (Directional Antenna)
  - Internal vs. External
  - Narrow vs. Broad

ATTENTION

- Attention is limited
  - If we focus on one thing, we do so at the exclusion of others
  - YOU CANNOT PERCEIVE THAT WHICH YOU DO NOT PROVIDE ATTENTION

AROUSAL/STRESS AND PERCEPTION

- Higher arousal allows us to focus intently on facets of events our mind establishes as important to our survival
- It does so at the detriment of other facets

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SCHEMA

- Mental model of the
  - Self
  - World
- General concept or entity which guides
  - Perception
  - Interpretation
  - Imagination
  - Problem-solving

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EXAMPLE OF SCHEMA

- A child sees and is greeted by a:
  - Four legged animal with fur, ears and a tail
  - The child says “Doggie”- experience and guidance from adults
  - Other animals can incorrectly be placed into this schema:
    - Horse
    - Cat
    - The child must learn a new schema based on and refined from the old one
- What are other schema?

PERCEIVE + PROCESS = PERFORMANCE

- Humans can not perceive two elements of equally high significance at the same time
- Better training can lead to better visual attention and acuity
- We can only respond to what we perceive
- Our perception determines our reality

MEASURING RESPONSE TIMES

- Reaction time (RT) - Interval of time that follows a suddenly presented, stimulus until the very beginning of the response.
- Movement time (MT) - Interval of time at the end of the RT to the completion of the response.
- Response time - The sum of RT + MT.

REACTION TIME

- Reaction time varies based on the signal:
  - Auditory stimulus .140s to .160s
  - Visual stimulus .180s to .220s
  - Choices increase RT- Hick's Law

REACTION TIME - IN ACTION

- You are standing on the firing line waiting for the target to turn or the buzzer to go off.
  - When it does your hand starts to move to draw your gun (RT).
  - Once the movement starts it finishes at the gun being fired (MT).
  - The response time is how long it took from the target turning or the buzzer going off to the gun being fired. (RT+MT=Response time)
- It is highly common for people to use the term reaction time when they really mean response time

HICK'S LAW

- RT increases a constant amount every time the number of stimulus-response alternatives is doubled.
  - Two choices add 50%
  - Four choices double it
  - Eight choices then multiply by 3

DECISION MAKING

- Heuristic- Mental shortcut/rule of thumb
  - No time to weight all of the options
  - No one to consult
  - Faulty input (misperception)=faulty output
  - Can be fallible

DECISION TRAINING

- Decision making in LE can be trained
- Professional athletics have been conducting decision training for a long time. The original research hard data comes from 1979.
  - Where to focus your attention
  - How to read body cues and movements
  - Environmental considerations

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DECISION TRAINING

- Stimulus-response vs. Decision-response
  - Firearms training is typically Stimulus-response
  - Shootings are decision-response

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MODULE 2: “STOP TIME”

Module 2A

TIME TO START AND TIME TO STOP

- If it takes time to start a action it takes time to stop as well.
- A stimulus has to be strong enough to perceive for us to respond.
  - If already engaged in an action it may go unnoticed
  - Needs to be clear and strong enough

- If we started to pull the trigger repeatedly at a threat signal the action of firing could mask the signal that would indicate it is time to stop shooting.

ATTENTION

- We can only “see” what we attend to. Without attention there is no perception.

- Attentional shifting takes time
  - 0.20s to 0.60s
  - Focus of attention on one aspect (sights) may require a dramatic change in another aspect (subjects behavior or body position) to draw attention to it.

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WHAT DOES THE RESEARCH SHOW?

- “Police Officer Reaction Time to Start and Stop Shooting: The Influence of Decision-Making and Pattern Recognition”
  - Lewinski, W., Hudson, W., Dysterheft, J. (2014)
  - Law Enforcement Executive Forum

RESEARCH

- Signal to start shooting was given with direction to shoot fast and accurate

- Signal to stop shooting was given
  - Took the average officer 0.12s to 0.46s to stop shooting after the signal
  - First trail was significantly longer
    - 0.35s (0.25s SD) average
    - 0.31s median
    - 0.33s Mode

RESEARCH

- Of the 102 officers tested only 6 of them did not fire a shot off after the signal was provided
  - The average was 1.06 (0.52 SD)

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MODULE 2: “STOP TIME”

PRACTICAL APPLICATION IN SIMULATOR

Module 2B

MODULE 3: “SHOOT AND TURN”

Module 3A

SHOOT AND TURN

- Old west films common theme.
  - Shot in the back is wrong
  - Shot in back means shooter was guilty

- Same arguments have been thrown at officers

OTHER POSSIBILITIES

- Dr. Bill Lewinski and Dave Grossi looked at over 600 police shootings. “The Suspect is Shot in the Back. Is Your Shooting Clean?”
  - They found only one case where officers claimed they were able to stop after they decided to fire
  - Officer still fired but he jerked his wrist sending the round into traffic
  - Subjects can turn quickly

MENTAL MARBLES

- Think of the mental program to pull the trigger as a marble released down a plastic pipe.
  - That marble carries the message to pull the trigger.
  - The pipe are your nerves
  - When it hits the end of pipe (nerves) the message is carried out
  - You can send another marble to stop, but it still arrives after the first

TURNING TIME

- Lewinski and Grossi established that the average person could turn 180 degrees
  - In .5s
  - Some were as fast as .33s (1/3 of a second)

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INTERACTION

- Time it takes officer to perceive threat and respond can coincide with a subject that either fires, fires and turns or turns and starts to run.

- The subject could turn and take 2-4 steps before the officer discharges their own gun.

INTERACTION

- When humans turn around quickly they use their arms to help complete the turn.

- An officer focused on a weapon in a subjects hand could see the weapon lift during the turn and interpret it as a threat.

MODULE 3: “SHOOT AND TURN”

CONDUCTED IN VIRTRA SIMULATOR

Module 3B

MODULE 4: “KNIFE CHARGE”

Module 4A

“21-FOOT ~~RULE~~” – IT’S A DRILL

- “How Close is Too Close?”-Dennis Tueller (1983) SWAT Magazine
  - Officer can draw and fire 2 rounds in 1.5s
    - Thumb break holster
    - Done with a Revolver

- Average person can run 21 feet in same time

WHAT WE KNOW

- Original data was collected with a stop watch
  - Human error with a stop watch starts
    - On the start
    - And the stop
  - Accuracy on data collection is in question

- Tueller has stated that “1.5 second time was a bit enthusiastic… most times were consistently between 1.5. to 2.0s.”

OTHER RESEARCH

- Lewinski et all (2015)to draw and fire ONE round:
  - Snapped holster 1.82s (0.31 SD)
  - Unsnapped holster 1.68s (0.27 SD)

MOVEMENT TIME

- Dysterheft et al (2013)- Sprint times of people at various distances
  - 30 feet in 2.06 seconds
  - 25 feet in 1.79 seconds
  - 20 feet in 1.57 seconds
  - 15 feet in 1.28 seconds

INTERACTION

- Cross comparison of that data shows that people can run about 25 feet in the same time that an officer can draw and fire one round.
  - In response to a simple auditory stimulus.
  - There is a greater delay in RT with simple visual stimulus. (0.04s-0.06s)
  - There is even a greater delay when decision making is involved

EFFECTIVENESS OF GUNFIRE

- How fast an officer can shoot and how fast a subject can move are only two aspects to evaluation of the risk of an edged weapon.
  - How accurate can the officer place those rounds?
  - How quickly do the placed rounds stop the behavior?
    - Projectile effects
    - Human variability

PROJECTILES

- Caliber effects wound channel
- Velocity effects kinetic energy and momentum
- Bullet mass is related to kinetic energy and momentum
- Bullet expansion effects wound channel

HITS ARE NOT GUARANTEES

- Sergeant Timothy Gramin hit a subject 14 times with .45 ACP and subject was sill fighting
- “FBI Miami Shootout” 1986 - Toxicology showed no chemicals in subject systems
- “North Hollywood Bank Robbery” - Body armor and barbiturates were factors

MODULE 4: "KNIFE CHARGE"

CONDUCTED IN VIRTRA SIMULATOR

Module 4B

MODULE 5: “PRONE SUBJECT”

Module 5A

PRONE SUBJECTS

- Officer's will commonly prone out subjects that are high or unknown risk.
- Where this may decrease their mobility it does not eliminate their potential lethality.
- This was demonstrated in "The Speed of a Prone Subject" by Lewinski et al. (2016)

“THE SPEED OF A PRONE SUBJECT” BY LEWINSKI ET AL. (2016)

- In this study subject were placed in a prone position and were measured on how fast they could bring a weapon to bear and fire it.

- Two measurements were taken
  - Movement time- time from first movement to weapon discharge
  - Object time- time that the weapon could first be even partially seen.

“THE SPEED OF A PRONE SUBJECT” BY LEWINSKI ET AL. (2016)

- These two measurements were evaluated at
  - Waist level drawing to the right side
  - Waist level drawing to left side
  - Chest level drawing to the right side
  - Chest left drawing to the left side
  - And Chest up positions

OTHER RESEARCH

- Cameras were placed from the target position (target angle)was as well as from the feet (feet angle).
  - Evaluation was then done frame by frame to capture movement times.

RIGHT SIDE WAIST POSITION

- Target Angle-
  - Movement time- 0.63 (0.17)
  - Object time- 0.41 (0.14)

- Feet Angle-
  - Movement time- 0.69 (0.24)
  - Object time- 0.30 (0.19)

RIGHT SIDE CHEST POSITION

- Target Angle-
  - Movement time- 0.59 (0.18)
  - Object time- 0.30 (0.16)

- Feet Angle-
  - Movement time- 0.63 (0.20)
  - Object time- 0.24 (0.14)

LEFT SIDE WAIST POSITION

- Target Angle-
  - Movement time- 0.71 (0.17)
  - Object time- 0.48 (0.16)

- Feet Angle-
  - Movement time- 0.77 (0.17)
  - Object time- 0.33 (0.14)

CHEST UP POSITION

- Target Angle-
  - Movement time- 0.52 (0.15)
  - Object time- 0.24 (0.11)

- Feet Angle-
  - Movement time- 0.55 (0.17)
  - Object time- 0.79 (0.98)

INTERACTIONS

- In a prone position, subjects were able to complete movement in average of
  - 0.52s to 0.77s.
  - Some in as little as 0.27s
- Officers can take 0.68s to draw and fire to a simple stimulus
- It takes the human brain to consciously perceive, evaluate and classify a visual cue 0.300s.

INTERACTIONS

- The averaged difference between the when weapon is first potentially detectible to when the weapon was actually fired was 0.25s.
- So from the weapon first possibly being seen to being fired is ¼ second.
- Even if the officer violated acceptable weapon safety rules and had their finger on the trigger, based on research it would take them 0.37s to fire the weapon with a simple visual signal.

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MODULE 5: “PRONE SUBJECT”

CONDUCTED IN VIRTRA SIMULATOR

Module 5B

MODULE 6: “VEHICLE CONTACT”

Module 6A

TRAFFIC STOPS

- Traffic stops are a staple of law enforcement
- This common procedure was evaluated by Charles Remsberg in “The Tactical Edge” (1986).
- He evaluated assaults on officers while conducting a traffic stop

TRAFFIC STOPS

- Assaults occurrence (Remsberg 1986)-
  - 17% while vehicle still in motion.
  - 28% after vehicle stopped but officer had not exited patrol car.
  - 22% while exiting or making approach.
  - 43% after making contact, while investigating, writing citation or returning to patrol car.

MINDSET – "HIGH RISK" VS. "~~LOW RISK~~"

- There is no "low risk" traffic stop only a "unknown risk."
- If it is not a "unknown risk" then it should most likely be classified as "high risk."
- Officers wont know if it was "low risk" until it is over.
  - Lack of knowledge on the occupants
  - Even known subjects can pose risk
  - Traffic violation is not usually a reliable indicator of risk

RISK MANAGEMENT – TRAFFIC STOPS

- Nature of the stop?
- What is in the vehicle?
  - People?
    - Attitudes
    - Actions
    - Abilities

RISK MANAGEMENT – TRAFFIC STOPS

- Animals?
  - Type?
  - Number?
- Environmental considerations?
  - Traffic
  - Logistical issues with location
  - High crime area

RISK MANAGEMENT – TRAFFIC STOPS

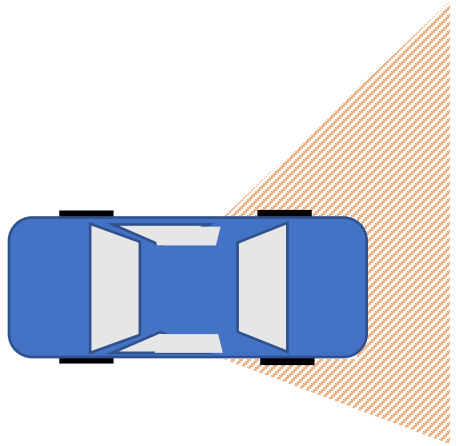
- Vehicle type and what can it do?
  - Motorcycle - quick accelerate, quick bail off
  - Passenger van - multiple occupants and angles
  - RV - multiple occupants, angles and elevation considerations
  - Semi-truck - Elevation and vision being obscured due to size

TRAFFIC STOPS

- Remsberg established “threat zones”.
  - Force Science Institute took that concept and looked at passenger side approaches to establish a Mitigation Zone (MZ).
- Force Science Institute researchers (Lewinski, W., Dysterheft, J., Seefeldt, D., Pettitt, r. 2013) looked at these factors in “The Influence of Officer Positioning on movement During a Threatening Traffic Stop Scenario”

MITIGATION ZONE (MZ)

- MZ was established as a point where officers are at a reduced risk because of vehicle construction and position to the driver.



MITIGATIONN ZONE

“THE INFLUENCE OF OFFICER POSITIONING ON MOVEMENT DURING A THREATENING TRAFFIC STOP SCENARIO”

- Subject armed with a Simunitions conversion kit was the driver of the vehicle.
  - Sworn officers were directed to conduct a traffic stop on a passenger vehicle with the subject.
  - Officers did not know subject was armed.
  - Different positions were evaluated.

“THE INFLUENCE OF OFFICER POSITIONING ON MOVEMENT DURING A THREATENING TRAFFIC STOP SCENARIO”

- Positions tested:
  - Drivers side 90-degree
  - Driver’s side 45-degree
  - Driver’s side 180-degree
  - Driver’s side behind B-Pillar 180-degree
  - Passenger side 45-degree

“THE INFLUENCE OF OFFICER POSITIONING ON MOVEMENT DURING A THREATENING TRAFFIC STOP SCENARIO”

- Vehicle occupant was able to present and fire a firearm at the officers in the range of 0.50s (SD 0.17) and 0.57s (SD 0.14) in all positions

- Officers reached the MZ the fastest from the 45-degree passenger side position. This was done in 1.5s (SD 0.52)

“THE INFLUENCE OF OFFICER POSITIONING ON MOVEMENT DURING A THREATENING TRAFFIC STOP SCENARIO”

- The fastest and officer could bring weapon to target and fire was from driver side 45-degree position
  - 1.99s (SD 0.59s)
  - This was 1.45s after the occupant had already presented the weapon and fired at the officer

“THE INFLUENCE OF OFFICER POSITIONING ON MOVEMENT DURING A THREATENING TRAFFIC STOP SCENARIO”

- Slowest was from the driver side behind the B-Pilar 180-degrees
  - Took 2.44s (SD 1.47)

- Officers that moved to MZ before attempting to draw their weapon were on average 0.39s faster than those who tried to draw and move.

MODULE 6: “TRAFFIC STOP”

CONDUCTED IN VIRTRA SIMULATOR

Module 6B

MODULE 7: "HUMAN FACTORS IN FORCE ENCOUNTERS REVIEW"

Module 7

FOUNDATIONS

- What is stress?
- What is arousal?
- How does perception get affected by stress and how does it effect performance?

FOUNDATIONS

- Name and define three time based performance measurements?
  - Reaction Time (RT)-
  - Movement Time (MT)-

- Response Time

“STOP TIME”

- If it takes time to start shooting, it takes time to _____ _____.
- How does attention affect our perception to change?
- How do the above ideas factor into a shooting?

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“SHOOT AND TURN”

- Motor programs once started are _____ stopped.
- The speed of a person to turn 180-degrees can be as little as _____.
- How does this interact?

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“KNIFE CHARGE”

- What can be said about action vs reaction?
- “The Tueller Drill” is what?
- What is the average officer draw time to a audible signal?
- How fast can a person cover 25 feet?
- How does effectiveness of gunfire relate to the danger of an edged weapon?

“PRONE SUBJECT”

- Prone subjects are limited in ability to run and are still _____.
  - How fast can weapon be presented?
  - Can a prone subject fire a concealed gun?
  - How fast can and officer fire an already drawn firearm?
  - How does this interact?

“TRAFFIC STOPS”

- Unknow risk vs “LOW RISK”.

- Traffic stop risk management involved asking
  - Why am I conducting the stop?
  - Who is in the vehicle?
  - Where is the stop best done?

- The MZ is mitigation zone

MODULE 7: “HUMAN FACTORS IN FORCE ENCOUNTERS TEST”

Module 7B

CONTACT INFORMATION

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