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BIOMECHANICS OF LETHAL FORCE ENCOUNTERS –

Officer Movements

By Bill Lewinski, Ph.D.

It is my intent to investigate the dynamics and biomechanics (the mechanics of biological and muscular activity) that occur in officer-involved shootings in a series of research studies. The first of the series started with measuring subject behavior in shooting situations (The Best of the Police Marksman, Vol. II. See page 5). The next phase starts with determining and measuring the fundamentals of shooting motions that officers perform in lethal force encounters. I am aware that officer behavior in shooting situations can be much more complex than the elementary mechanics of drawing and firing or moving and firing that are measured in this study.

However, the reaction times, sight times, and movement times need to be studied, because often they are the only things officers do in shooting situations. Sometimes they form the components of more complicated motions and need to be fractioned out if we are to more fully understand the more complex motions. For instance "lag time" is comprised of a variety of things including movement time. Until we understand and measure the variety of biomechanical motions that officers perform in lethal force encounters, it’s difficult to isolate the more complex and profound psychological dynamics, such as perception and judgment time. These other elements, of course, need to be studied and it is my intent to do so, after the physical elements are measured.

The primary purpose of this study is to measure the time it takes to do certain motions. This is not the definitive study on the movements and times of officers in lethal force encounters. However, it is very comprehensive. While the complete research design and a full analysis will not be presented here, it is important to know that a variety of measurements were taken on 68 officers from different sections of the Los Angeles Police Department. Testing was done at one of

All of the following data is measured in hundredths of a second. All of the motions were reactions to a buzzer from a PACT timer.

1. Finger on trigger - simple, unsighted, reaction time -.35
2. Finger on trigger with a sight picture, reaction time -.38
3. Finger on frame - simple, unsighted, reaction time -.45
4. Finger on frame with a sight picture, reaction time -.54
5. Time to fire a second round in a series of three (with sight picture) -.38
6. Time to fire a third round in a series of three (with sight picture) -.36
7. Weapon in low-ready position (45 degree angle) with the finger on frame - raise the weapon, acquire sight picture, fire one round -.83
8. Weapon in tactical or a high/low-ready position with the finger on frame - raise the weapon, acquire sight picture, fire one round -.83
9. Time to move the weapon from the low-ready position to a position on target -.64
10. Time to acquire a sight picture after moving the weapon from between 6 to 22 inches to a position on target -.18
11. Close-ready to a sight picture and fire 1.0
12. Belt-tuck to a sight picture and fire 1.0
13. Hollywood high guard to a sight picture and fire 1.1
14. Bootleg position to a sight picture and fire 1.3
15. Bootleg position to close contact (combat tuck) position and fire -.92
16. Draw and fire one round (start position was from hand at the side of the body near the holster, weapon in holster, either snapped or unsnapped.)
   a. Level One Holster - off duty (snapped) - 1.87 (unsnapped) - 1.71
      on duty (snapped) - 1.71 (unsnapped) - 1.61
   b. Level Two Holster - (snapped) - 1.92 (unsnapped) - 1.72
   c. Level Three Holster - (snapped) - 2.00 (unsnapped) - 1.78
17. Draw and fire one round from close contact/combat tuck position
    (start position was from hand at the side of the body near the holster, weapon snapped in holster.)
    a. Level One off duty - 1.50
    b. Level One on duty - 1.31
    c. Level Two - 1.51
    d. Level Three - 1.70
18. Shotgun - from port to point and fire - 1.28
19. Shotgun - from low-ready to point and fire - .98
20. Shotgun - from high-ready to point and fire -.84
It is significant however that one of the fastest draws and the slowest draws occurred from a level 3-duty holster and were directly linked to the amount of practice the officer had with that holster.

This study is dense with information and offers some interesting data. For example:

If a weapon is pointed at a target, it takes 3/100ths of a second to confirm or set the sight picture, before the officer pulls the trigger, if the officer already has his finger on the trigger. If the officer has the finger indexed or on the frame and the weapon is pointed at the target, the time to confirm or set the sight picture is 9/100ths of a second before he completes the trigger pull.

I think it is fascinating that the time to move from a low-ready position and a tactical low-ready position to a sight position and fire one round is the same for both actions. This appears to defy logic, but it is the case. This is because developing momentum and acquiring a sight picture are the two time-expensive components of both of these motions. Once the officer’s arm and weapon develops momentum, moving a distance of 6 to 22 inches was not a significant element in the overall time of either motion. So much effort and time is invested in getting the motion started and then stopping it as the weapon comes on target, and then taking the time to get a sight picture and pull the trigger, that the time to travel up to 22 inches is actually negligible in the overall measurement of either motion.

Another incidental observation is the amount of time it takes to draw from a variety of holsters. It is significant however that one of the fastest draws and the slowest draws occurred from a level 3-duty holster and were directly linked to the amount of practice the officer had with that holster.

It is my observation from the data that the fastest draw occurs from a level one duty holster. But, more significantly, the greatest factor in the speed of the draw is the amount of time the officer spends practicing with that holster. For instance, the average time to draw and fire one round with a sight picture from a level 1-duty holster is 1.71 seconds. One of the officers with a level 3-duty holster was able to draw and fire one round in 1.37 seconds.

Another illusion is that the unsnapped holster is a faster draw than a snapped holster – certainly, many officers have proven this to be true. However, quite a few officers using all levels of holsters actually drew slower from an unsnapped than a snapped holster. The really skillful officers drew at approximately the same time or slower from an unsnapped holster as they did from a snapped holster. For instance, the officer who pulled and fired one sighted round from a snapped level 3 holster in 1.37 seconds, also pulled and fired one sighted round from an unsnapped holster in 1.42 seconds. Many officers said they did the same biomechanical motion, whether the holster was snapped or unsnapped, thus negating the benefit of unsnapping the holster. Other officers said it took them longer to draw from an unsnapped holster because the weapon didn’t quite sit in the holster as solidly as if it were snapped in, and was subsequently harder to grasp.

Therefore, the time for confirming the grip on the weapon negated the time advantage of unsnapping the holster. The more unskilled officers were clearly the ones who drew faster from the unsnapped holster. Ironically these...
A gain of 6–11% in speed in the draw could easily be made up by simply practicing drawing the weapon. . .

is also the time difference between shooting in a combat tuck/close contact position from a bootleg position, and also shooting in a close contact/combat tuck position with a holstered weapon, in level 1 duty holster position. Therefore we can conclude that it doesn’t matter which motion the officer makes with the weapon, it is generally 4/10ths of a second faster out of the bootleg position than out of the holster. The reader might also note that any motion from the bootleg position (even the close contact/combat tuck firing position) is obviously much slower than even the 45 degrees, academy trained, low ready position. Again, as with the snapped versus unsnapped holster issue, the officer needs to seriously consider the tactical advantage of a gain of 4/10ths of a second versus the tactical advantage of having the weapon in a secure holster.

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