

On the Firing Line (Fifty-third in a series)

Where Are You Looking? – Part 2

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**“I have a team full of shooters with a world class hold;
And almost none of them can deliver the shot!”**

In the previous article, we explored two important aspects of the sight picture for target pistol shooters, both resulting in seemingly large white spaces instead of what are mistakenly thought to be “precise” references. We now take this theme to rifle, with rather surprising results. Pistol shooters should carefully read this article just as rifle shooters should have carefully read the previous article. Both articles hold insights for both disciplines.

The quote at the beginning of this article is from a national team rifle coach several years ago. He was commenting to me on the ability of many of his athletes to confidently, decisively, and consistently deliver quality shot performances under pressure. Each athlete had their own challenges and reasons.

One challenge that many of them shared, and that almost none of them or their coaches understood, was that their front apertures were too small. The vast majority of intermediate and advancing shooters, and many elite shooters, have selected a size that is too small for them, especially if they have a great hold. Interestingly, and in contrast, a number of athletes and coaches, and a few elite shooters, use what appear to others to be huge front apertures.

What is going on here, and why do we make the assertion that most have their aperture too small?

First, we must explore why smaller apertures, consistent with one’s ability to hold the rifle steady, are thought to be best. As an athlete improves their ability to hold the rifle ever more steadily, they may choose on their own or be encouraged by others to reduce their front aperture size. In all cases, the size is generally recommended to be large enough to contain the hold so that the bull is not disappearing outside the front aperture ring. As a result of this advice, once an athlete develops a really tight hold, they may well choose an extremely tight aperture.

The reason given for small apertures in these cases is visual precision. Without a doubt the smallbore ten ring, and ten dot for air rifle, are very small and consistently hitting them demands a very high degree of precision on a repeatable basis. The “engineers” among us want measureable precision. Thus they choose the bottom of the black or thin line of white pistol holds and tight front apertures on rifles.

The good news is this provides an opportunity for improved visual precision. The bad news is this causes lots of eye movement and it increases the sensation of movement of the hold. These themes should be familiar from the previous article.

With tight front apertures, one is tempted to “check” all around the white ring between the bull and the front aperture ring to ensure it is even. This is done by following the ring in a circle or by bouncing around in sort of a star pattern. Additionally, the athlete is constantly trying to discern the very small white ring to evaluate their aim, thus straining the eye.

As an aside, a few years ago triangular apertures were made available on the market. An “engineer” had the bright idea that a triangle provided only three places to check, instead of the

entire ring. While that was true, it encouraged, indeed required, eye movement. Sure enough the apertures were a failure because holds opened up and results were worse than before. This was no surprise to athletes and coaches who understand the need for, and power of, the Quiet Eye.

When the eye is moving, the gun is moving more than it otherwise would. When the mind is thinking, the gun is moving more than it otherwise would. Yes, subtle eye movements and increased brain activity each cause the hold to open up.

The tight front aperture also magnifies the apparent movement of the gun. This erodes the athlete's confidence and destroys their ability to follow a high performance style of shot process. Trigger jerking and/or flutter finger become quite common in this situation. Many a severe, apparently incurable, triggering problem has been solved through nothing more than an appropriately chosen increase in the front aperture size.

The result of tight apertures is the perception of increased hold motion, eroded confidence, added eye strain, increased brain processing (visual and otherwise), significant and debilitating triggering issues, and a greatly increased difficulty in shooting. When the hold looks bad to the athlete, it may as well be horrid.

A penny's worth of gain through perceived aiming "precision" comes at the cost of a dollar's worth of performance degradation in several other critical areas.

Ten years ago, in the third article in this series, we explored the challenges an Olympian and very dominant rifle shooter was having in decisively delivering shots. The primary technical issue for that athlete was a front aperture that was too small.

The appropriate size front aperture is not very tight. See Figure 1 of a typical front sight with a generously sized front aperture and a target bull. (The rear sight is not shown.) This diagram does not represent a specific target with a specific front aperture, meaning that it is not necessarily to scale. It does clearly illustrate two important factors: 1) a wide ring of white between the bull and the front aperture ring (which could be even wider than shown here), and 2) a very thin front aperture ring. More on these topics in a moment.

When introduced to an aperture of appropriate size, many a rifle athlete has been stunned at the almost immediate transformation in their shooting. Others have taken a short time to warm up to the sometimes dramatically changed sight picture, but ultimately are very pleased with how it feels to deliver the shot and with the results.

Observant readers will notice that no actual aperture sizes have been given thus far. "What size apertures do I need for air rifle and for smallbore rifle?" There is no single correct answer! ...except this answer: "It depends."

One must know the value of several variables in order to determine the correct answer. What size is the aiming bull? How far away is the target? How far is it from the surface of the athlete's eyeball to the aperture inside the front sight globe? (We do not touch the athlete's eye when measuring. We measure off to the side.)

Even knowing these variables, what is optimal? How do we know? We must answer this question first, in order to determining actual sizes.

Many years ago, Precision Shooting, in one of their magazines or annuals, published an article that discussed research on front aperture size. It turned out that the width of the white ring between the front aperture ring and the aiming black must cover at least 3 minutes of angle (MOA) from the shooter's point of view. (Unfortunately, the reference to the article could not be located by press time.)

About 50 to 60 years ago, the Soviets studied many aspects of rifle sights and sighting systems, among other things, in great detail. Front aperture size, aperture ring thickness, and interestingly, front aperture insert color, were among the numerous factors studied.

For shooting outdoors, they found light pink apertures to be most effective. Now you know why Anschutz sells that color! They also found that very thin front aperture rings were the most effective. Air events were not studied as they were not part of Olympic shooting at that time.

Sadly, the paper(s) with the results of the research activities cannot be found and apparently were never published in the UIT Journal. (Maybe since it would divulge their “secrets”?) However, references to the studies shed some light. Taking the published statements and translating them in terms of MOA, one gets identical results to the above article. This correlation got my attention!

Given the paucity of solid references, the correlation between the two items available, and the initially counter-intuitive aspects of this topic, empirical observations and test activities were performed over a number of years, in many different situations, with athletes of widely differing experience and skill levels – beginners to Olympians. In all cases, apertures selected to give 3 MOA or more of white ring width had a profoundly positive effect. Athletes were not told what size they were shooting with as we randomly changed sizes (ranging from absurdly small to absurdly large, and everything in between), though they could obviously see that the sizes differed throughout the session. A “step” function was observed, whereby using an aperture that was smaller than 3 MOA, even if the aperture diameter was only 0.1 millimeters too small, had a strongly negative impact on shooting performance and athlete confidence. Interestingly, apertures as much as 0.5 millimeters (or more) larger than required to give 3 MOA of white ring had essentially identical results to the 3 MOA size apertures.

Remember the minority of coaches and athletes, and those few elite athletes, with the really “big” apertures? Now you know one of their “secret” keys to success.

What about the common advice to change aperture sizes between positions? What about the advice to try a smaller aperture in order to decrease the hold area? Tread very lightly lest you return to the mine field!

In the case of an elite athlete with an extremely small hold area in the sling positions, one might consider a slightly smaller aperture. The hold area must be considerably smaller than in the standing position and the athlete must not already have any issues with decisiveness or clean triggering. Even then, careful experimentation is required.

In the standing position, some athletes have developed extremely small holds. (E.g. hold area contained well inside the diameter of a pellet on the air rifle target.) Again, very careful experimentation is required.

In both of the above cases, more often than not, the athlete and coach, in search of what they believe is good visual precision, talk themselves into using an aperture that is too small, rather than obeying all the signs to the contrary.

However, an increase in size for a shooter with a looser hold (e.g. a newly beginning shooter’s standing position) is certainly appropriate.

One is well advised in almost every case to stick with the 3 MOA rule as the bare minimum size. One may use an even larger aperture, 0.5 millimeters or more, with no problem. To go smaller, even by 0.1 millimeter, is fraught with serious peril. This has been observed over

and over, even with many elite athletes. Yes, there are exceptions. Regardless, it is very, very rarely safe to assume you are one of those exceptions. Refer again to the Olympic athlete in the third article in this series; only a handful of current athletes in this country shoot as well as that athlete and a 3 MOA or larger aperture was needed even in that case.

Why must the white space be 3 MOA or more?

If the band of white between the front aperture ring and the aiming black is too thin, there is so much “flicker” that it overwhelms the perception of the ring of white, making it more difficult for the mind to center the sights, and increasing the visual processing load in the brain. There are likely additional visual processing factors also involved.

Tight front apertures encourage “checking” with eye movement. The tighter the ring, the more the perception of movement is magnified, eroding the athlete’s confidence. The wider the front aperture ring, the smaller the aiming mark appears. Thin front aperture rings and unobstructed apertures (no cross bars) help reduce the perception of “grey bull” some shooters experience.

In pistol, using a wide rear notch in order to have wide gaps of white on either side of the front sight is very beneficial, especially when one is looking at the right spot. This is imperative in the rapid fire events and stages, and is very important in the precision events and stages. All the same theories apply.

Theory is of limited value without practical application. Let us now finally translate the 3 MOA rule into actual rifle front aperture sizes.

The question may be reduced to a single answer chart requiring one simple measurement, shown in Table 1. Measure the distance in inches from the surface of the athlete’s eyeball to the aperture inside the front sight globe. (Please remember, do not touch the athlete’s eye when measuring. Measure off to the side.) The chart uses eye distance in inches since that is the most commonly available measuring unit in the USA, and the apertures are listed in millimeters since that is the most common sizing unit used in most target rifle apertures. In some cases, two sizes are shown for a given distance. In those cases, it is best to choose the larger size of the two, especially if the eye distance is “. . .and a half” inch. Remember to always re-measure and adjust the front aperture size if you move the front sight forward or back as you refine your rifle setup and position to assure that you still have the correct size aperture.

As with many of the articles and ideas in this series, one’s perception and beliefs are tested by some of the ideas in this and the previous article and one is asked to consider ideas that seem counter-intuitive or are even thought to be wrong by some. The best athletes are the ones who work the hardest and have the most open minds. Results are results. Enjoy!

The “On The Firing Line” series is published by the national governing bodies for Olympic shooting in Japan and the USA, and has been adapted for archery as “On the Shooting Line” published by USA Archery. Olympic Coach Magazine, the National Association of Soccer Coaches, and others have referenced selected articles. The entire series is available online at www.pilkguns.com.

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(Biographical information as of August 2014)

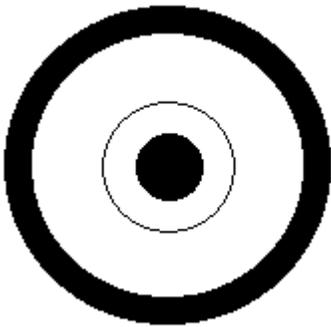


Figure 1 – Rifle Front Sight & Target – Note the very thin front aperture ring and the wide white ring between the aperture ring and the aiming black. Ideally, the front aperture should be floating as shown (no crossbars) and should usually be a very light salmon (pink) color. This diagram is not to scale, and the inner white ring is often even wider.

**Minimum Rifle Front Aperture Size
Millimeters
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Eye Dist. Inches	ISSF Air 10m	ISSF SB 50m	USAS SB 50ft	USNRA SB A-36 50ft	USNRA SB A-17 50ft	USNRA SB A-7 50ft
28	3.5	2.9	2.8	2.7	3.0	3.1
29	3.6	3.0	2.9	2.8	3.1	3.2
30	3.7	3.1	3.0	2.9	3.2	3.3
31	3.8	3.2	3.1	3.0	3.3	3.4
32	3.9	3.3	3.2	3.1	3.4	3.5
33	4.0	3.4	3.3	3.2	3.5	3.6/3.7
34	4.1/4.2	3.5	3.4	3.3	3.6/3.7	3.7/3.8
35	4.3	3.6	3.5	3.4	3.7/3.8	3.9
36	4.4	3.7	3.6	3.5	3.9	4.0
37	4.5	3.8	3.7	3.6	4.0	4.1
38	4.6/4.7	3.9	3.8	3.7	4.1	4.2
39	4.7/4.8	4.0	3.9	3.8	4.2	4.3
40	4.9	4.1	4.0	3.9	4.3	4.4
41	5.0	4.2	4.1	4.0	4.4	4.5
42		4.3	4.2	4.1	4.5	4.6/4.7
43		4.4	4.3	4.2	4.6	4.7/4.8
44		4.5	4.4	4.3	4.7	4.9
45		4.6	4.5	4.4	4.8	5.0
46		4.7	4.6	4.5	4.9	
47		4.8	4.7	4.6	5.0	
48		4.9	4.8	4.7		

Table 1 – Minimum Rifle Front Aperture Size – Millimeters – Use of apertures smaller than listed, even by only 0.1 mm, cause numerous triggering, confidence, and shot process problems.