Central Thickening Is a Mathematical Description of Pattern "Evenness"

There are no "even" shotgun patterns; they are all "hot" in the center to varying degrees.

The universal tendency of pellets to congregate primarily in the center of patterns is all but invisible to us. A pattern may look quite even, but counting pellets will often tell us that it is twice as pellet-dense in the center as nearer the edges. Central thickening allows us to attach a number to the degree a pattern is concentrated in the center and so enables us to compare all patterns using the same yardstick.

High-percentage patterns (think "full choke" patterns shot at trap distances, or "open choke" patterns shot at close range) are relatively hotter-in-the-center than are more diffuse patterns. But *all* are denser in the center in terms of pellets per square inch than they are in the outer reaches. The metric for "pattern hotness" is "central thickening." It is the ratio of the percentage of pellets in the inner 20″ circle of the pattern to the percentage of pellets in the 20″ to 30″ outer ring.

How it is calculated: $$\textit{Central Thickening} = \frac{\textit{Pattern \% in inner circle}}{\textit{Pattern \% in outer ring}}$$

So if 65% of the pellets were in the inner circle, and 35% were in the outer ring:

$$\textit{Central Thickening} = \frac{65}{35} = \mathbf{1.86}$$

Typical central thickening values for full chokes at 40 yards average around 1.8 or 1.9, but there can be a lot of variability; some more open individual patterns may calculate out to 1.6 or less, tighter ones may give results of as much as 2.1 or more. Central thickening values for modified chokes at 34 yards are similar to full chokes at 40 yards.

What is "Central Thickening" good for? Why should it interest us?

Central thickening is inexorably linked to pattern percentage. That is, when you know pattern percentages of ten targets, you know what typical range of central thickenings this group of targets will exhibit.

- **Understanding central thickening and calculating a few examples will help you keep your thinking straight.** It can tell you if that new combination of hull, primer, wad, and powder you chanced on really is miraculous — or is in fact no different from the rest?
- **Understanding central thickening will help you sort through information that is unlikely to have any basis in fact.** Consider these assertions which you have surely have heard at the club or read online or in magazines

  "This brand of gun or choke-tube offers a more even pattern than the competition."
  "Green Dot® tends to higher central densities than Red Dot® when loaded to similar velocities."
  "Xtra-lite® powder produced the most even patterns in all of shotgunning."

Central Thickening offers a way to test these claims and countless others.

Tests of the three assertions above (and dozens more) will appear here over time, and may suggest to you another claim you have always wanted to test. You have all the tools you need to answer the question already:

1. **Shoot the patterns**; draw the circles.
2. **Count the pellets** in the inner 20" circle and the outer 20-30 ring.
3. **Do the math** and get the answer.
   (Note: Shotgun-insight.com offers a far easier and better way, and is the only realistic way in my opinion.)

Once you have calculated the central thickening of your set of patterns you can be pretty sure that you will be the only one at the club, perhaps the only one in the whole state, who isn't just guessing about pattern evenness.You'll stop believing the improbable and buying stuff that can't possibly do what its maker promises. These experiments, though a lot of work, are *fun* to do! Besides, knowing something based on first-hand knowledge is reward in itself.

Addendum

Though it is not at all necessary to calculate "pellets-per-square-inch" to make full use of central thickening, it is interesting to see just how hot-centered full-choke patterns are at trapshooting distances. To make valid pellet-density comparisons, we have to correct for the fact that the outer 20″ to 30″ ring is 25% larger than the inner 20″ circle. The result is that the outer ring is "thinner" in pellets-per-square-inch (relative to the center circle) than the central thickening calculation might indicate.

To compare relative pellet densities, multiply your central thickening value by 1.25 (an increase of 25%).

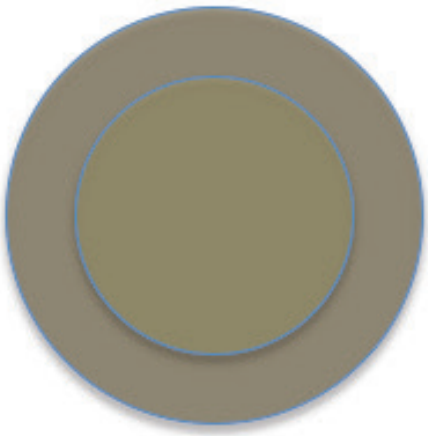
The Math

*Area of entire 30" circle = **π x radius²** = 3.14 x 15² = 707 sq.in.*

*Area of inner 20" circle = **π x radius²** = 3.14 x 10² = 314 sq.in.*

Outer ring = Entire circle – inner circle = 707 – 314 = 393 sq.in.

$$\frac{\text{Outer Ring}}{\text{Inner Circle}} = \frac{393}{314} = 1.25 \text{ or } 25\% \text{ larger}$$



Application

The early example on page 1 with 65% of the pellets in the center and 35% in the outer ring produced a central thickening of 1.86. Applying the correction for unequal areas — 1.8 times 1.25 — we determine that the inner circle is 2.3 times as dense in pellets-per-square-inch as the outer ring.