**Scale Size, Proportions, Perception, Perspective, Compression, and Deception**
An Investigation into Apparent Size (Angular Size) Based on Distance - Start Date: August 25, 2024

A folder titled “temp-building” was created on Thursday, July 25, 2024 at 10:06 AM. This information provided the start date for this investigation and research into this topic.

This document was started on August 25, 2024. This topic had been actively on my mind for a month.

I just couldn’t seem to understand the information that I had gathered.

Much of what I’d learned did not appear to work correctly in the “real world”.

**A Real World Test**
I measured the width of the air fryer on the kitchen counter and the distance from the air fryer where I wanted to look at it, with a ruler, to verify that the math was correct.

I never had trigonometry so I was at a loss when it came to using tangents and converting angles to tangents.

Much, much later, I found the Google calculator. It can be found by typing google calculator in Google as a search term. By pressing the tangent key and then entering the degrees of the angle, I was able to get the tangent number, which proved to be the key.

There were a plethora of attempts and tries to understand what was going on, as well as links to various Websites on my spreadsheet titled “HO Scale Inches.ods”, which has 4 sheets. The sheet titled “angular-distance” has the information that I am referring to.

**My Research Included the Following Videos**
https://www.youtube.com/watch?v=INVkFPeS2Ko
Not useful and a bit confusing.

https://www.coe.edu/faculty-staff/james-wetzel/astronomy/angular-size#:~:text=If%20we%20can%20measure%20the,and%20something%20we%20can%20measure. (Yes, this is the link, but pages doesn’t seem to like the period at the end, and that period is there in the link.)
While the information was somewhat useful, it did not lead me to how tall Taylor Swift would appear at various distances.

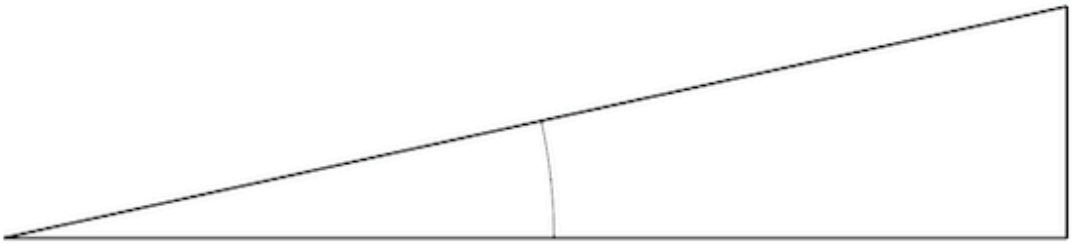
https://www.1728.org/angsize.htm
This is an Angular Size Calculator found on the Web, but I never really learned how to use it.

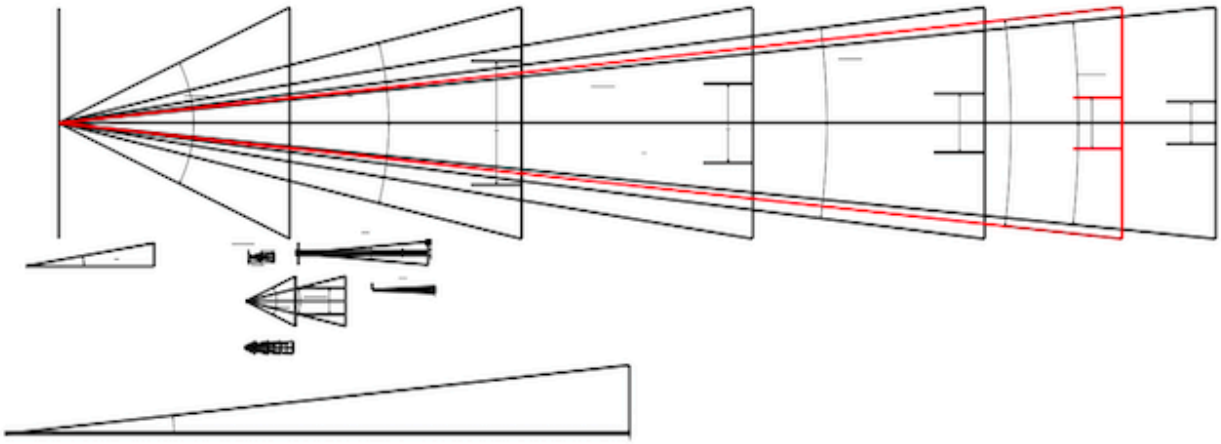
https://www.youtube.com/watch?v=fZoMKNrAzrI
This video lead me off into the area of drawing in perspective, which turned out to be not useful for what I was trying to learn, but it ate up a couple of days.

https://www.physicsforums.com/threads/real-height-and-apparent-height.614333/
This did not help at all.

https://www.reddit.com/r/askmath/comments/ddn5nu/increase_size_proportionally/
This did not help at all.

https://www.quora.com/How-much-smaller-do-things-appear-as-they-get-further-away#:~:text=%C2%B7%205y-,How%20much%20smaller%20do%20things%20appear%20as%20they%20get%20further,very%20nearly%20half%20the%20size.
The post by Brian Mess really, really helped.





I created a TurboCad CAD drawing titled “angles and sizes.tc2” that really helped in my final understanding.

**More Angle and How Vision Works Research**
I spent weeks of on and off research about how various types of lenses work, including the eye. While I thought it was useless at the time, the eye lens information did finally prove useful.

I also spent time on how the height of trees were measured, and again, that was useless.

I had a statement on the spreadsheet that read, “The apparent height of an object can be calculated using the formula: apparent height = real height / (distance to object ÷ distance to observer).”
https://www.physicsforums.com/threads/real-height-and-apparent-height.614333/#google_vignette
Found next to 2. on the page.

Somewhere, and I’ve lost that information, I realized the Height / Distance yields a tangent.
For example:
If Taylor Swift is 5.5’ tall and she is 50’ away the tangent is 5.5 / 50 = a ratio of 0.11
Taylor’s actual height (5.5’) is multiplied by the ratio (0.11) and yields 0.605’ or 7.62”
https://www.coe.edu/faculty-staff/james-wetzel/astronomy/angular-size#:~:text=If%20we%20can%20measure%20the,and%20something%20we%20can%20measure. (Yes, this is the link, but Pages doesn’t seem to like the period at the end, and that period is there in the link.)

I made a scale drawing on the CAD drawing but reduced the height and distance by 10 on the CAD drawing.
The angle is 6.3-deg. That’s a tangent of 0.11040102781.
The drawing shows her height as 0.11’ the same as above.

The air fryer is 18.5” wide and a distance I used was 103.5” away from it.
18.5 / 103.5 = 0.178744”
The CAD drawing shows the angle as 10.1-deg and the resulting tangent is 0.17812713017 very similar to the preceding 18.5:103.5 ratio above.
There must be something wrong as that is a very small number and doesn’t work when measured with a ruler.

Because this didn’t seem correct, I remeasured this morning and found it to be 18.5” wide the distance was 85” NOT 103.5. Rats!!!
18.5 / 85 is 0.2176471
The ratio (0.2176471) is then multiplied by the actual height (18.5) yielding an apparent height of 4.02647135”
On the CAD drawing I got a ratio of 0.21803526043 and that yields an apparent size of 4.033652318”, or about the same.

While writing the paragraphs about Taylor and the Air Fryer, I'd messed up and forgotten that the ratio (tangent if you will) is multiplied by the actual height and got ridiculous results.

I did more work on the CAD program and then it dawned on me that ratio had to be applied to the actual height.

The Air Fryer didn't work out as well as expected when I used the ruler, but it was close. 4" is too wide with the ruler.

Not being satisfied with the distances I was getting, I remembered, from my eye research that the human eye has a near point.

The following is taken from the AI Overview on Google for the search "using near point of the eye".

"The near point of the eye is the closest distance at which an object can be placed in front of the eye and still form a focused image on the retina. It's the minimum distance at which an object can be seen without strain.

For a normal human eye, the near point is about 25 centimeters (10 inches) in adulthood. However, the near point can vary depending on age, and may be closer in infancy and farther in old age. For example, the near point may be about 10 centimeters in infancy and 33 centimeters in old age. For some older people, the near point can increase to several meters."

While AI generated, the information aligns well with other sources.

I decided that I needed to add that 10" to the distance of the object and hold the ruler 10" away from my eye to get a good focus.

During much earlier research, I bought a Walthers' Brick Cape Cod House plastic kit. Unfortunately, I used Walther's noted sizes for the structure when first learning about Apparent Size.  This lead into a bit of confusion.

I decided to redo the front panel of the Walthers' Brick Cape Cod House.

Since I had the kit, I measured the front wall of the house and found it to be 3.98" wide and 2.72" high.

I created a new CAD Drawing titled "Cape Cod House.tc2".

I wanted to look at its apparent size at twice the distance as the wall was wide.

3.98 x 2 = 7.96" to which I added 10" for the near point.

A line was drawn 17.96” long. The vertical line was 7.96” A diagonal was created between the end points and the angle was found to be 23.9-degrees. The tangent of 23.9-deg is 0.44313900362 time 7.96 = 3.527386469” as the apparent height.

I set the sprue with the wall on it vertically, 8” from the edge of my work bench and tried to see if 3-1/2” was what I saw as the width.

Unfortunately, it looked like it was about 2-3/4”.

Next I drew the triangle with out the near point taken into consideration.
The angle was 45-deg, of course. Tangent of 45-deg. Since I did not take trig, I was unaware that the tangent of 45-deg was 1 and 1 is not going to work. :-(

It said that “older” folks might have a near point at 33cm which is about 13”.

13” + 7.96” = 20.96” which was used for the next CAD triangle.
The angle was found to be 20.8-deg. The tangent was 0.37986436549 * 7.96 = 3.023720349”.

This seemed very close to working. While the 8” onto the workbench top was exact, and the ruler was held there, the distance to my eye from the ruler could not be perfectly measured, and everyone’s eyes are going to be a bit different.

Based on the numbers I saw on the ruler and estimating, using the ruler from the workbench to where my eye was, I figured my near focal point was 15”.

A new triangle was CAD drawn using 15” as the near point. The distance used was now 22.96”. The angle was 19.1-deg. Tangent was 0.34628104733. The apparent height was 2.756397137.

I tried the “real” world again. This time it should appear 2-3/4” wide. This time it was as close to perfect, 3-3/4” as I would expect.

Next I redid the Air Fryer. I added 15” to the 85” distance for 100”.
18.5/100 = 1.85 * 1.85 (just happenstance this time) = 3.42”
After quickly working the numbers, as in the previous examples, the suggested width on the ruler was 3.43” with the ruler held over the counter and me looking at the ruler and Air Fryer at about 15” from the ruler. Again, this was reasonably close, but I just can’t seem to get the same numbers in the “real world”.

**08/26/24**
Things didn’t go well this morning.

I retested my near point and it does seem to be 10”, which means that I need to hold the ruler about 10” in front of me, therefore 10” must be added to the distance to allow for the NP of the eye.

The Air Fryer worked out okay, but the front wall of the Brick Cape Cod house didn't. It turned out that the apparent height would be 0.467", but more importantly the length for that would be the original height/width of 3.98".

3.98" away is less than the NP of 10".

At that moment, it appeared that the distance to a small object must be well greater than the focal point. The distance I used was 34", 24" from my ruler when held 10" from my eyes to measure.

~~I tried to find where I read that there is a limit on this working if the object is very small~~. I find this not true, based on the experiments/testing I did today.

https://www.quora.com/How-much-smaller-do-things-appear-as-they-get-further-away#:~:text=%C2%B7%205y-,How%20much%20smaller%20do%20things%20appear%20as%20they%20get%20further,very%20nearly%20half%20the%20size.
Nicolas Smith

I'm using a version of his eye drawing on my CAD 08-26-24.tc2.

It seems promising, more so than the previous answers.

Video 1: Measuring Near and Far Point
https://www.youtube.com/watch?v=yBhCgIJtgKY

I tried measuring the NP as described in the video and got; Left 22" (55.9cm), Right 25" (63.6cm) and both "24" (61cm).

I changed the Air Fryer to using my Left eye and using the 15" (38.1cm) NP, measured yesterday and it looked right at 3.25" (8.25cm) as suggest on the 08-26-24.tc2 spreadsheet.

The whole process was being thrown off by my astigmatism.

The 08-26-24.tc2 CAD drawing demonstrated, to me, the apparent height of an object is the height of the object divided by the distance from it and then that number is multiplied by the distance from the viewer's NP with regard to the measuring device. See my CAD drawing to verify this.

While looking at some videos on my computer, I measured my NP from the screen to my eyes while looking through the bottom part of my bifocals. Both eyes were used and it was roughly about 10 inches.

I repeated the same test as this morning, using the bottom part of my bifocals, and found out that 10 inches seems about right.

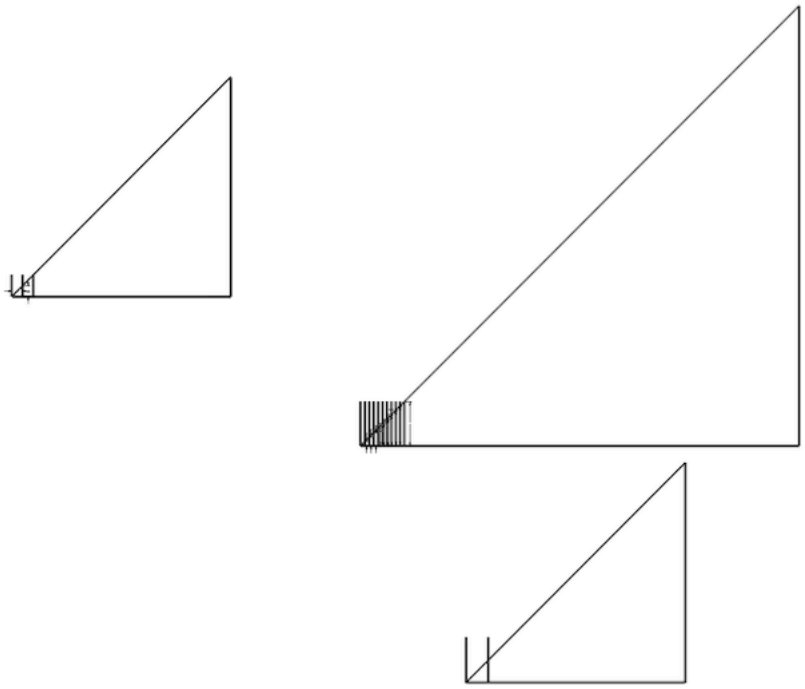
Using the Air Fryer test again, and making sure to look through the bottom section of my lens, it looked almost perfect. I got about 2-1/4” and the math indicated about 2-1/8”.  Good enough for me.

**08/27/24**

I woke up with the tree video on my mind. It’s on this Web page.
https://unofficialnetworks.com/2022/06/20/measure-tree-using-yardstick/

I knew that he was using a right angle of equal length sides. His measured shoulder to wrist/hand was 30”, therefore he held the yardstick at 30 inches and sighted the tree. The angle is 45-deg. The tangent of 45-deg is 1, that meant that the ratio was 1/1 or just 1. His distance from the tree was its height.

I was going to measure our pine tree in the front yard and calculate its height. I found my stride length. My measured stride for 5 steps was 118”, meaning the average stride was 23.6”. Unfortunately it was lightning out, so I didn’t do it.



I created a new CAD drawing titled “tree.tc2”. I changed the 60’ tall tree to 720” and be in the same units as the measuring device. I divided both by 10, so the actual height used was 72” and and apparent height was 3”. The distance was also 72” as this was a square.

Unfortunately, I had the units set to meters when I created “tree.tc2”. I deleted it.

I changed the units of the CAD program to inches and recreated it using the units divided by 10. It is titled “tree2.tc2”.

Yesterday, I realized that the object must be larger than the focal length of the eye. That’s a problem with my 3.98” wide wall of the Cape Cod house kit.

See the drawing on tree2.tc2 labeled “this worked” as I tested it on the workbench.

I don’t understand why the value I got, about 1.25” was about the same value as the tangent of 7.1 deg or 0.12455658436 times 10. Where did the 10 come from?

It turned out that the “10” was serendipitous.

I redrew the drawing using a focal length of 12. 12 x the tangent equaled the apparent height. In this case 12 x 0.11747300139 = 1.409676017
Alternately, 3.98/31.94 = 0.117265763 which is slightly different. 12 x 0.117265763 = 1.407189156, but they are still pretty close.

Next I redid the Air Fryer on this same spreadsheet.

Using just the info from the drawing, I got the apparent size of just shy of 2” and that proved correct. Here is the math:
18.5/95 (10” for the focal length) = 0.1947368
0.1947368 times the focal length of 10 equals **1.947368**

The angle was 11-deg with a tangent of 0.19438030913
Once again the calculated tangent, based on degrees, was slightly different, but not by much. 0.19438030913 * 10 = **1.9438030913**

I redid the drawing to stand closer to the Air Fryer as 58.5” with a 10” focal point.
That didn’t work, as I could not get my body where it needed to be.
I erased that drawing.

Next I used 25” as the distance with a 10” NP point.
The drawing, which I redid, suggested about 7.4 as the apparent size”.
The math:
18.5 / 25 = 0.74 * NP length of 10 = 7.4

36.5-deg with tangent being 0.73996107502, very close to the ratio answer.

One more try. Refrigerator 36” at a distance of 85”. This is just a coincidence. I measured that distance twice.

I get an AP of about 6”, but that is not what it works out to be, which is xxx.

This caused me to redo the distance of Air Fryer. It measured 104.5”. That means all the other air fryer values were wrong!

18.5 / 104.5 = 1.770335 x 10 = about 1-3/4” That was so right on.

I redid the CAD drawing for the Air Fryer.

It now appeared to me that my NP might be about 14” when looking through the bifocals. But I just tried measuring using the computer and it might be 13. Using 13 with the wall worked out well, but it is hard to hold the ruler really steady.

**08/28/24**
I went downstairs and remeasured the distance to the sprue that was already in place between two 1-2-3 blocks at the rear of the workbench. I remeasured and found the sprue at 22” from the edge.

I set my chin, up to my neck on the front of the workbench, as that put my eyes at close to zero mark on the ruler.

I took two measurements like that with the ruler held 10” for ~1-1/4” and 13” for 1-9/16”. My glasses were held up so I was looking through the bottom bifocal. I also did a measurement where the ruler was held at the edge of the table and I back away to get the ruler in focus. 1-5/16” was what I saw.

After awhile, I remeasured with my head on the bench again, using my bottom bifocal and got 10”-1.25” and 13” 1.75”.

With these observations, it occurred to me that it is not crucial as to the distance the ruler is held. That distance just needs to be subtracted and it’s size noted.

10 / 1.25 should equal 13 / x.  Therefore 10x should equal 13 * 1.25. 10x = 16.25, 16.25/10 = x 1.625 or 1-5/8”. That is very close to what I got at 13”; 1-9/16 (1..5625) and 1-3/4” (1.75”). Not sure why this did not occur to me sooner, but it didn’t.

For the third time I measured at the 13” mark, chin on workbench and both eyes through bottom bifocal. I got 1-9/16” (1.5625”).

A new drawing of the house side with the peak was created on the CAD drawing page titled tree2.tc2. Data was also put near this drawing. This really changed everything in my thinking.

AppH = (Actual Height / Measured Distance) times (Measured Height with device and a known distance between the viewer and the measuring device)
EXAMPLES:
AppD using measuring device=(2.72/22)*10=0.1236364*10=1.236364 when viewed at 10 (inches) in this instance)
AppD using measuring device=(2.72/22)*13=0.1236364*13=1.26072732 when viewed at 10 (inches) in this instance)
Both of those proved to true from the testing this morning.

That also means that at the full 22”, it would appear to be only 0.1236364”, which is really where this all started. Duh!

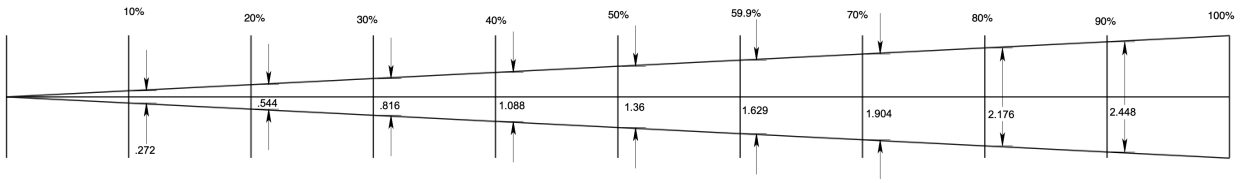
2.72/0.1236364= 21.999994 times smaller or 0.1236364/2.72=0.0454547 of the original.

Therefore the side of this house would be 0.0453333 at 60” (5’).
2.72/60=0.0453333
2.72*0.0453333=0.1233066 high. That’s about 1/8” high.

2.72/60=0.0453333
10*0.0453333=0.453333
2.72/63=0.0431746
13*0.0431746=0.56125698

This caused a problem with my thinking as they are not the same.

A new thought. **THIS IS IMPORTANT AND USEFUL INFO**
I created this diagram on 08-28-24.tc2.




It clearly shows that the dimension size of the object used it reduces by 10% of that dimension for its distance using the object’s dimension. That’s awkward.

I used the measured height of the side of the Walthers’ Brick Cape Cod House kit; 2.72” to create the diagram. But it is proportionally the same for any dimension of the actual object.

I started a new tab on the spreadsheet HO Scale inches.ods. The tab is titled proportional-distance.

**08/30/24**

I made a HUGE error on the Spreadsheet, HO Scale inches.ods. in the tab titled proportional-distance.

I looked at the dormer side wall of the Brick Cape Cod House.
cap-cod-small-dormer2.tc2 was done in millimeters.
I made a new spreadsheet converted to inches for the Spreadsheet data.
dormer wall proportions.tc2

I spent well over 7 hours trying to figure it out why it was not working when compared to the spreadsheet with the error on it, but I finally did get the error corrected the in data.

I also proved that the error was corrected by measuring the actual dormer wall.

It occurred to me that physical measuring, of quite small distances, is quite difficult. The typical Imperial ruler's smallest unit shown is 1/16", but some are available with 1/32" separation.

A metric measuring device for measuring distance, that can be handheld, is usually divided into millimeters.

1" = 25.4mm, which means that there are just about a little over two and-one-half mm in an inch. Millimeters seems to be the smallest units to use, practically, for most people.

There are units smaller than a millimeter in the metric system, but they are not really practical for use by modelers.

**A Bit on 3D Printing**
Fused Deposition Modeling (FDM) 3D Printing info & Tinker CAD, I have tinkerCAD sheet

Fused deposition modeling (FDM), also known as fused filament fabrication (FFF), is the most widely used type of 3D printing at the consumer level. FDM 3D printers work by extruding thermoplastic filaments, such as ABS (Acrylonitrile Butadiene Styrene), PLA (Polylactic Acid), through a heated nozzle, melting the material and applying the plastic layer by layer to a build platform. Each layer is laid down one at a time until the part is complete.

FDM 3D printers are well-suited for basic proof-of-concept models, as well as quick and low-cost prototyping of simple parts, such as parts that might typically be machined. However, FDM has the lowest resolution and accuracy when compared to SLA or SLS and is not the best option for printing complex designs or parts with intricate features. Higher-quality finishes may be obtained through chemical and mechanical polishing processes. Industrial FDM 3D printers use soluble supports to mitigate some of these issues and offer a wider range of engineering thermoplastics, but they also come at a steep price.

Fused deposition modeling is ideal for:
Basic proof-of-concept models
Simple prototyping

Nozzles can range from: Multi-aperture Diameter Available: 0.2mm*2, 0.3mm *2, 0.4mm*12, 0.5mm*2, 0.6mm *2, 0.8mm*2, 1.0mm *2

https://store.creality.com/products/mk8-nozzles-kit-24-pcs?spm=..product_4618de9b-5d8f-4530-bb9b-55e8ac36c66b.product_club_1.1&spm_prev=..page_4252089.header_1.1
and
Multi-aperture Diameter Available: 0.25mm，0.4mm*2，0.6mm，0.8mm
https://store.creality.com/products/mk-st-nozzle-kit-5pcs-set?spm=..product_4618de9b-5d8f-4530-bb9b-55e8ac36c66b.product_club_1.1&spm_prev=..page_4252089.header_1.1

Dave uses a 0.4mm nozzle. That limits the minimum size width to about 0.5mm when printed from a TinkerCad model.

While there are smaller nozzles, they take a lot longer to use to create the same size object and are prone to clogging.

**Practical Minimums for Different Scales**
Don't forget that 1 by lumber is 0.75" / 87 = 0.0086207" = 0.2189658mm
0.5mm = 0.019685" * 87 (**HO Scale**) = 1.712595" minimum 3D print. That means that the narrowest window line, like a muntin, has to be over 1-11/16" wide to 3D print. That's very large for a muntin.

Paper thickness (caliper) can be found on the tab "examples" on the HO Scale Inches.ods.

A 3/4" thick board, like used to trim many windows of full-scale US wood structures, is 0.0086207" in HO Scale.
3/4" / 87 = 0.0086207"
That is close to 1/128" (0.0078125"), which is impossible to 3D print. It is about the thickness of card stock that I use (0.0085").

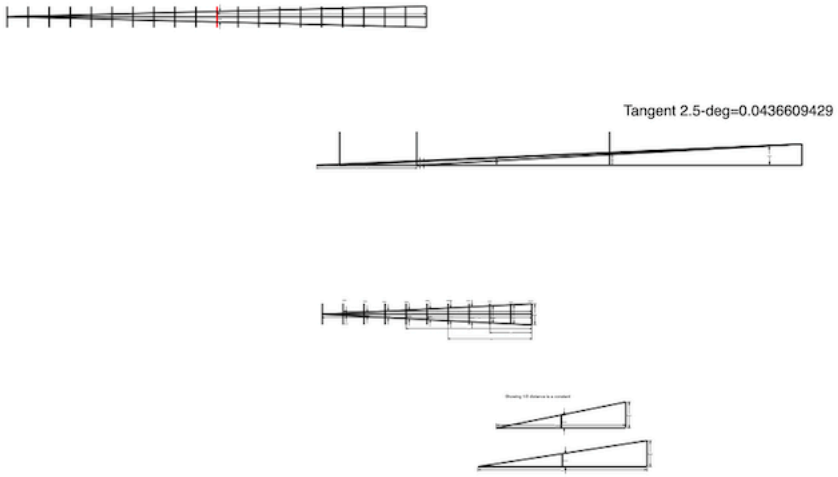
0.5mm = 0.019685" * 64 (**S Scale**) = 1.25984" minimum 3D print. That means that the narrowest window line, like a muntin, still has to be over 1-1/4" wide to 3D print.

A 3/4" thick board, like used to trim many windows, at full-scale, is 0.0117188 in S Scale.
3/4" / 64 = 0.0117188"
That is a little less than 1/64" (0.015625"), which is impossible. It is close to poster board thickness (0.01050).

0.5mm = 0.019685" * 48 (**0 Scale**) = 0.94488" minimum 3D print. That means that the narrowest window line, like a muntin, still has to be a bit less than 1" wide to 3D print.

A 3/4" thick board, like used to trim many windows at full-scale, is 0.015625" in O Scale.
3/4" / 48 = 0.015625"

That is a 1/64” (0.015625”), which is impossible. It is close to poster board thickness (0.01085”).




**08/30/24**
I made another CAD drawing on 08-28-24.tc2 of the height of the side wall (2.72”) at twice the length (54.4”). When I saw 50% work on this new drawing I added new data on the spreadsheet that shows the relationship with 20 sections, which is twice as many as the first section.
HO Scale Inches, tab: proportional distance

**08/31/24**
**THE PROBLEM**
I was using linear distances, therefore the distances were different whether the width was chosen or the height.

When looking at an object (side of a building, both the height and width need to included. That is the area.

The width of the Brick Cape Cod side view is 3.367” and height to where the peak angle starts is 1.245” for an area of 4.191915 sq.in. (LxW). The width of the base of the peak is the same 3.367” and height of the peak is 1.496”. It is a triangle. Its area is 3.367 x 1.496 and then divided by 2. Area of the peak triangle is 2.518516 sq.in. The total area is the two areas added together; 6.710431 sq.in.

The total height is 1.496” + 1.245” = 2.741”

To change the area to a linear measurement the square root of the area is used. The square root of 6.710431 sq.in. is 2.590449961”.

To find the size at 50% of the original, use the square root of 6.710431, which is 2.590449961” * 0.5 (50%) = 1.295224981”. That number is then squared to create the area of the new side. 1.295224981^2 = 1.67760775 sq.in.

The width and height stay proportional to the original width and height.

new viewing width = original width x percentage

new viewing height = original height x percentage

In this case, width times the height IS NOT THE AREA. The top area is a triangle and bottom area is a rectangle. It is important to remember that!

I verified with the bench set up using 60% as that would fit crosswise on the work bench. Distance at 60% was 20.72, width ~2" and height about 1-5/8".

I need to verify again, as it seemed right, but something is wrong.

**09/01/24**
I looked more at whether my formula is working.
Formula: percent smaller equals percent of object and distance is in the square distance of the original object.

Decided this morning that using the square root of the object is not useful unless the object were to be a square.

I did a verification using the width of the Brick Cape Cod side. The numbers used were; Distance to side wall - 16-13/16", Distance to where the ruler is held which is 1/2 the distance - 8-7/16", apparent size remains a constant - 1-11/16".

~~I thought that the numbers came from the proportional-distance tab of the HO Scale Inches.ods spreadsheet when 3.267" was used as the measured width of the sidewall of the house, but that doesn't seem to be the case this morning.~~

That statement was WRONG. I realized the any distance can be used and at 1/2 that distance the apparent remains the same. I drew two more CAD drawings on 08-28-24.tc2.

This is really the key to what I was looking for.

I measured the following muntins in the kit windows.
Dormer 0.5mm = 0.019685" x 87 = 1.712595" ~1-23/32"
#12, #29 & #7 = 0.56mm = 0.220472" x 87 = 1.9181064" ~1-29/32"
#11 = 0.60mm = 0.023622" x 87 = 2.055114" ~2"

All of those were too wide for muntins, and it throws everything else out of proportion for the window. See below.

**Some Real Data on Muntins**
From Cape Cod Review.pages
"Interior muntin bars are available in the following sizes: 3/8", 5/8", & 1"
In HO that is 0.004310345", 0.007183908" & 0.011494253"
In HO that is 0.109482763mm, 0.1824712632mm & 0.2919540262mm

“External Plant on Bars”
7/8”, 1-1/4” & 2-1/2”
In HO that is 0.010057471”, 0.014367816” & 0.028735632”
In HO that is 0.2554597634mm, 0.3649425264mm, 0.7298850528mm

I used the CAD drawing using area.tc2 to create and print a full size to a 50% size side wall.

Really good video for windows with small muntins.
Scratch building cheap and easy window frames - the sticky label technique for model window frames
https://www.youtube.com/watch?v=_pU0WqGSH3Y
Chandwell (I like Michael Scott a lot)

He notes using 0.3mm, which is 0.011811” x 87 which equals just about 1” in HO scale (1.027557” to be exact). Near the beginning of the video he notes that the frame elements are 1/3mm wide. He later notes zero point three millimeters wide, 0.3. That is ~1.75” wide in UK N scale, 1:148

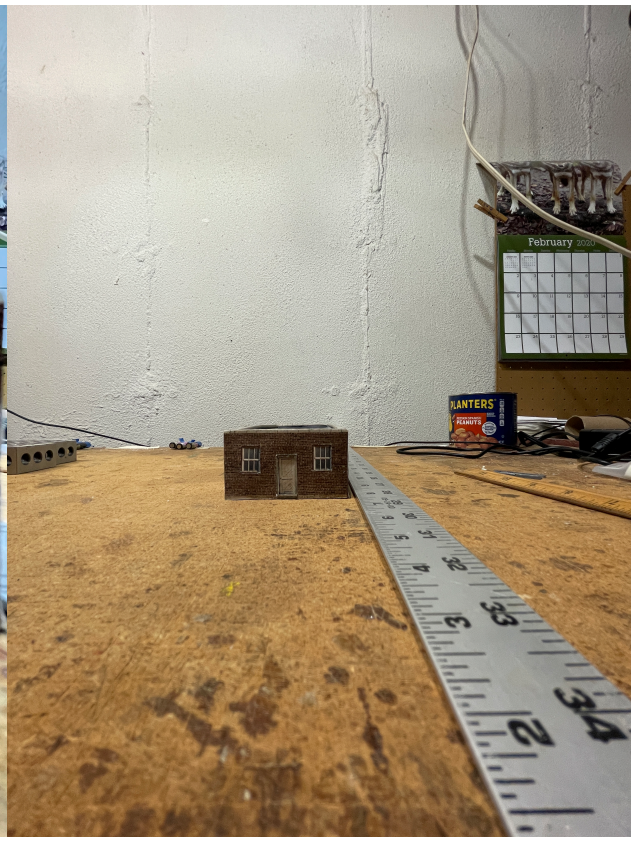
Tim Fairweather on  Model Rail Buildings - Mostly Card & Paper
https://www.facebook.com/groups/573038996168181/user/1032851910/

Marklinofsweden notes the “window” problem:
Model Windows for miniature houses - Detailed guide DIY
https://www.youtube.com/watch?v=sCJEvnYjNV4
He paints 1mm muntins. Might be useful for other color muntins. How small can they be?

Two ways of making prototypic miniature windows
https://youtu.be/yXaTwVshN2Q
Resin 3D printing and painting on clear plastic using a drawing tool

I took photos of one of my structures at 90% and 50%. While the vertical alignment of the photos wasn’t that good, they do show the relative/apparent size pretty well. The height of the wall is 1.6563” or 1-21/32”, note the 3 in 1.6563 was rounded up from the more accurate 1.65625.


The photo on the right is 8.2815” from camera. That’s 90%.




The photo on the left is 1.6563” from the the camera. That’s at the 50% point.

Actually, that’s not true. I had to set the iPhone photo to 0.5x or 50% of the full size. While the comparison photo ratios would still be the same. The photos are actually twice as small as they should appear.

I created a better comparison by doubling the size of both photos and making a special pages page titled both-photos times 2.pages.

**09/03/24**
After rewatching the Chandwell and Marklinofsweden videos again, I wanted to know what adhesive would work to “glue” the clear plastic “backing”, for the window glazing, onto cardstock when affixed to the inside of a structure.

I looked up Greg Cassidy’s Liquid PSA Demo and Ron’s Trains and Things Model Railroad Adhesives - How To Choose the Right One.
Liquid PSA Demo - https://youtu.be/-xAHZLhftQU
Model Railroad Adhesives - How To Choose the Right One
https://youtu.be/M6pNiNLtRTM

I found the links under my heading Adhesives on my Website.
https://theampeer.org/HO/TOOLS-GLUES.html

A Fraction to Decimal Conversion Chart
https://www.thegeekpub.com/wp-content/uploads/2022/02/Fraction-to-Decimal-Conversion-Chart-PDF.pdf