

A MATTER OF SEMANTICS



In the industry for more than 25 years, I am now considered a veteran. However, I'm still trying to find the answer to an old question. There still seems to be substantial confusion on what the minimum screen size is for viewing an image with data/graphics.

I was reading the revised edition of ICIA's "Basics of Audio and Visual Systems Design." On pages 2.3 - 2.5, Kim Milliken writes, "the minimum height for the smallest symbol should subtend not less than 10 arc minutes." However, this book later discusses a totally different minimum requirement for what the human eye/brain can intelligibly resolve. On pages 9.7- 9.10, it discusses essentially the same issue (intelligible visual resolution), but with dramatically different results. It states two different measurable factors: "the eye can distinguish line pairs that subtend an angle with the eye of as little as one-minute of arc" and "the eye has no difficulty in distinguishing objects that subtend an angle of three-minutes of arc." At minimum, we are now hearing a differential that's only 33 percent of what Kim was referring to — or, put another way, 66 percent smaller! These two sections of the same book seem to have a strong differential that could dramatically affect how an AV system should be designed.

In an article written by Derek Meares and Steven J. Thornburn on pages 26-29 of the December issue of *Pro AV* magazine, the authors refer to a somewhat different formula: the 468 rule. Although I found the article very interesting, it raised this same question.

Later in that same issue, Tim Kridel quoted Sam Miller of ViewSonic as saying, "the typical healthy human eye can see things that subtend one minute of arc or larger," on page 47.

Can someone please refer me to an authority to obtain accurate information?

— Ian Smith, president, Interactive Audio Visual

The short-form response is, I think we are all on the same page — the difference is with semantics. The 468 rule came from Milliken. The one-minute and three-minute arc came from military fighter pilot research as to what a pilot could detect. The 10-minute arc is based on 20/40 vision (20/20 is five-minute of arc).

— Steven J. Thornburn, Thornburn Associates

Let me follow up on Steve's comments with more information that may help clear your confusion. You're concerned there are two different standards being advocated for minimum character height and therefore minimum screen height — one that uses 10 feet of arc for symbol legibility and another that notes the human eye can typically distinguish objects three feet of arc apart. Both of these are noted in different sections of "Basics of Audio and Visual Systems Design."

Both are correct, they simply refer to two different things. The human eye can resolve line pairs of one foot and three feet of arc as noted, but this is simply the ability for a viewer to resolve the lines as two distinct items — not to distinguish what those objects or symbols represent. If the lines were spaced closer together (e.g., 0.5 feet of arc), your eye would not be able to distinguish the lines as discrete. Instead, they would merge together as one. Of course all of this is based on an individual's visual acuity, so this will vary somewhat when broadening this to the general public.

Think about it. If I asked you to stand at 20 feet and resolve two horizontal lines on a wall, you could probably do that when the

lines are separated at angles of one to three feet of arc. But if those lines were replaced with two horizontal rows of the letter "e," separated at angles of one to three feet of arc, you could tell me there were two lines of something but they would be too small to determine what the letters were (depending on how big they were drawn). If the letters were then increased in size so they were 10 feet of arc from top to bottom, you could then tell me they were the letter "e" with some concentration, and, when looking at them closely under ideal conditions, straight in front of the wall. As Thornburn mentioned, this is equivalent to having 20/40 vision (remember your doctor's office has ideal conditions for viewing the Snellen eye chart, no off-axis viewing, darkened room, etc.). If we then take this to a level where visual comfort and quick comprehension are of concern (i.e., a presentation environment), then the size of the letters would need to increase.

Also, what happens when the image has very few letters, such as in a movie. Do we really need to have the image that large? That's where the 468 rule comes in. It's a rule of thumb that takes into account the minimums noted above, and then creates a simple way to size images for presentations that takes into account the content that may be shown. The 4X part of the rule is really the only part that should come close to the numbers that Milliken discussed, because it assumes inspection or detailed viewing of information. However, it even takes into account less than ideal viewing conditions, off-axis viewers, viewers with less than 20/20 vision, poor contrast, etc. We also must note that the 6X viewing option that is most commonly used for PowerPoint assumes reasonably large point size fonts are used. Typically we recommend 18-point font as the minimum for PowerPoint presentations. Taken together, the 468 rule is in keeping with the other information you mention, they are simply the building blocks that help define the minimum visual requirements for resolving lines and the minimum for resolving symbols that are needed as a basis to develop a good rule of thumb.

Keep in mind the 468 rule may not apply for all projected images, just for all "presentation" environments. In areas like an IMAX theater where immersion in the image is important, or a football stadium where the intent is to provide background video where the viewer is not concentrating on watching a movie, the rules are different. In reviewing the ICIA publication, I don't see any particular inconsistencies. I agree that in a textbook format, all of these items could be tied together better to provide a comprehensive explanation. Keep in mind, the text does mention the 468 rule as the "de facto" standard on page 1.6. Milliken doesn't call it the 468 rule per se; we have just taken the liberty of doing that to better imprint it in readers' minds. **AV**

— Derek Meares, Thornburn Associates

THE CONFSSIONAL AND POP QUIZ

Just got this month's issue of *Pro AV*, and wanted to comment on a few things. In Mark Mayfield's editorial (January 2004, "The Confessional"), he says that the "[projection and display] manufacturers think the only difference is in the channel through which the product is delivered."

At NAB, I had many private meetings with companies who have consolidated their pro AV and consumer marketing and sales teams internally because that's just the way the world is. The consumer (everything from big box houses to specialty stores and the Internet) is where all the action and volume sales are. Need proof? Just look at Gateway and what they have done with plasma, and Dell with projectors. Some companies told me that the traditional pro AV channel can't be supported like it used to be. Things change; you may not think this is a viable business model, but it's where the market is going.

Additionally, in your pop quiz on page 12, the questions are too vague, particularly #2 — "LCD technology employs three glass panels." Are you referring to LCD projection technology, or LCD monitor technology? (In any case, the answer of using red, green, and blue is correct.) Also, some of the rear-projection microdisplays made by Clarity Visual Systems employ one large LCD panel with embedded microfilters — not a three-panel solution, but still projection.

In question #4, there are single-LCoS solutions out there. Check out Philips' scrolling color system for LCoS RPTVs. Also, JVC had an aborted shot at doing a holographic color filter with a single LCoS panel a couple years back — it was called the D'Anilia RPTV. The grids on the holographic filters were abysmal. It died a quick death. But it's entirely possible to have a single reflective microdisplay, and it has been done.

— Pete Pinman, Nuam Consulting Inc.

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