Image Size vs. Viewing Distance

What we can really see!

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“Proper” Image Size

• The question of the “proper” image size versus viewing distance has been asked for over four decades in the audio visual industry. Up to this point in time there has not been an exact single formula that has undergone true scientific scrutiny.

• The big variable in all of this is the viewing criteria and the fact that different viewing needs require different viewing distances, screen sizes as well as font sizes.

• Years ago the commercial audio visual industry has settled upon a “general rule” they call the 4-6-8 Rule. It simply states that there are three viewing criteria where images are to be viewed at a maximum:
  • Critical decision making- 4X height
  • Basic decision making - 6X height
  • Passive viewing - 8X height
The InfoComm DISCAS Task Group

- InfoComm is tackling this outstanding issue under the umbrella of their standards program.
- InfoComm is an accredited ANSI Standards Developer and their mission is to create industry wide standards that can be used as a basis for audio visual design and systems integration.
- In this regard they employ a task group methodology to identify, explore, examine, and research topics of vital concern to the industry and develop standards.
- A carefully selected group of subject matter experts, representing all segments of the industry and proven expertise on the topic are selected and then the work begins.
- The typical amount of time to complete a standard is from two to three years.
- The dedication and commitment of each volunteer task group and the InfoComm Standards organization is shown in the final results.
- The following list is the DISCAS Task Group.
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<th>The DISCAS Task Group</th>
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<tr>
<td><strong>Greg Jeffreys</strong></td>
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<td>Paradigm Audio Visual Ltd.</td>
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<td><strong>Michael Bialas, CVE, ITIL</strong></td>
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<td>Anadarko Petroleum</td>
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<td>Christie Digital Systems</td>
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<td><strong>Dick Tollberg, CTS-D</strong></td>
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<td>AVI-SPL</td>
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For the last two years, InfoComm and their ANSI Standards Group has been working on a new and more exact standard.

It is called Display Image Size for 2D Content in Audiovisual Systems (DISCAS) is part of the InfoComm suite of visual standards.

The goal of DISCAS is to create a scientific standard, based on human vision, to define the screen size for a given audiovisual system based on audience viewing distance.

To define the maximum viewing distance, the DISCAS standard is based on three viewing categories, for how the system will be utilized.
DISCAS Viewing Categories

- **Analytical Viewing**
  - The viewer can make critical decisions by the ability to analyze details within the displayed image. The viewer is analytical and fully engaged with these details of the content (e.g., architectural/engineering drawings, forensic evidence, medical imaging, photographic image inspection).

- **Basic Viewing**
  - The viewer can make basic decisions from the displayed image. The decisions are not dependent on critical details within the image, but there is assimilation and retention of information. The viewer is actively engaged with the content (e.g., information displays, presentations containing detailed images, classrooms, boardrooms multi-purpose rooms, product illustrations).

- **Passive Viewing**
  - The viewer is able to recognize what the images are on a screen and can separate the text or the main image from the background under typical lighting for the viewing environment. The content does not require assimilation and retention of detail, but the general intent is understood. There is passive engagement with the content (e.g., non-critical or informal viewing of video and data).
Basis for DISCAS

- DISCAS is based on human visual acuity, for which the measuring standard is the Snellen Eye Chart.
- This chart establishes 20/20 human vision, not as perfect or average, but “normal” visual acuity.
- The formulae that make up DISCAS use 20/20 as the baseline, understanding how we see in minutes of arc, and translating that into detail on the screen as represented by line pairs.
- From this, we can extrapolate the maximum viewing distance for the audience to perceive detail based on pixel size.
Basis for DISCAS

- These diagrams are the root of the DISCAS standard.
- For 20/20 vision the Snellen E must be equal to 5 arc minutes in height when viewed at 20 feet.
- This yields a detail level equal to 1 arc minute.
- In order to discern that you are looking at an E, you must be able to see 2 arc minutes.
- One for the black arm of the character, the other for the white space

Letter on Snellen Chart representing 20/20 vision
This diagram illustrates some of the math that Task Group member Dick Tollberg has worked out for the DISCAS group.

It shows the distances and angles involved to develop a multiplier that can be applied in a formula to calculate the distance at which an optotype fits within 5 arc minutes of vision at any given distance, considering the resolution of the display.
The following calculation shows how the formula is used to calculate the acuity factor, the multiplier created to define viewing distance. The ADM factor for 2 minutes of arc is 3438.

Pixel Height = a
Line Pair Height = 2 * a
Visual Acuity = 2 * A
Viewing Distance at Stated Acuity = b
\[ \tan(A) = \frac{a}{b} \]
\[ b = a / \tan(A) \]
\[ \frac{1}{\tan(\text{Visual Acuity}/2)} = 3438 \text{ for 2 Minutes of Arc} \]
As an example, the following formula shows how a maximum viewing distance is calculated for Analytical Decision Making.

- Maximum Viewing Distance = Pixel Height * ADM Acuity Factor
- Pixel Height = Image Height / Vertical Resolution
- ADM Acuity factor: The acuity factor is calculated by calculating the distance required to resolve a line pair. (two pixels)
As noted earlier, the InfoComm Standards Task Group on DISCAS has been working on this for just over two years.

Stay tuned for the final results and formulas that are expected to be published by InfoComm 2014.

The Task Group promises that the final formulas will be understandable and easy to use!
For More Information

If you would like more information, please contact the Digital Signage Experts Group:

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