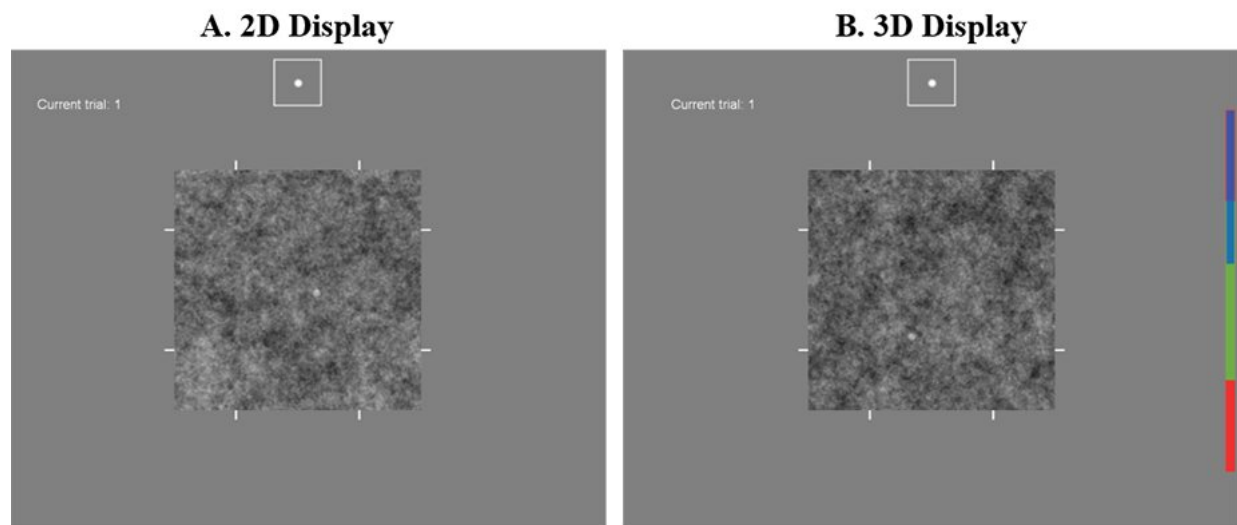


# Medical imaging: Displaying 3D images in 2D formats makes it easy to miss large targets in clinical settings

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2D and 3D localization displays. A reference image of a noiseless target is displayed at the top of the window (in the box), and the trial number is shown in the upper left side of the window. The color bar on the right side (B) indicates the depth in a 3D volumetric "stack" with scrolling controlled using a mouse pointer. The targets can be readily seen inside the search region indicated by hash marks at the edge of the images. These targets are shown at enhanced contrast for display purposes. Credit: Abbey, Lago, and Eckstein (Fig. 2), doi 10.1117/1.JMI.8.4.041206

Three-dimensional, or volumetric, images are widely used in medical imaging. Such images faithfully represent the 3D spatial relationships present in the body. Yet 3D images are typically displayed on a two-dimensional monitor, which creates a dimensionality mismatch that must be resolved in a clinical setting where practitioners must search a 2D or a 3D image to find a particular trait or target of interest.

To learn more about this problem, Craig K. Abbey, Miguel A. Lago, and Miguel P. Eckstein, of the Department of Psychological and Brain Sciences at University of California, Santa Barbara, used techniques from the field of vision science to examine how observers use information in [images](#) to perform a given task. Their research, published in the *Journal of Medical Imaging*, evaluates [human performance](#) in localization tasks involving searching a 2D or a 3D image to find a target that is masked by noise. The addition of noise makes the task difficult, similar to reading images in a clinical setting.

The images in the study were simulations intended to approximate high-resolution X-ray computed tomography (CT). The images were generated in 3D and viewed as 2D "slices," and the [test subjects](#) in the experiment were able to freely inspect the images, including scrolling through 3D images. Abbey explains, "Many techniques for image display have been developed, but it is not uncommon for volumetric images to be read in a [clinical setting](#) by simply scrolling through a 'stack' of 2D sections." The study aimed to compare components of reader performance in 3D images to 2D images, where scrolling is not possible, to see if subjects are capable of integrating multiple slices into a localization response identifying a target of interest.

A total of eight experimental conditions were evaluated (2D versus 3D images, large versus small targets, power law versus white noise). The team evaluated performance in terms of task efficiency and classification image technique, which shows how observers use noisy

images to perform visual tasks, such as target localization.

Abbey says, "The somewhat surprising finding of the paper was that the classification images showed almost no evidence of combining information over multiple sections of the image to localize a target that spans multiple sections of the image. The observers are essentially treating the volumetric image as a stack of independent 2D images. This leads to a dissociation in which observers are more efficient at localizing larger targets in 2D images, and smaller targets (that don't extend over many volumetric sections) in 3D images."

The findings warrant further investigation, but they support and help to explain the need for multiple views in 3D image reading, and they provide useful information for modeling observer performance in volumetric images.

**More information:** Craig K. Abbey et al, Comparative observer effects in 2D and 3D localization tasks, *Journal of Medical Imaging* (2021). [DOI: 10.1117/1.JMI.8.4.041206](https://doi.org/10.1117/1.JMI.8.4.041206)

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