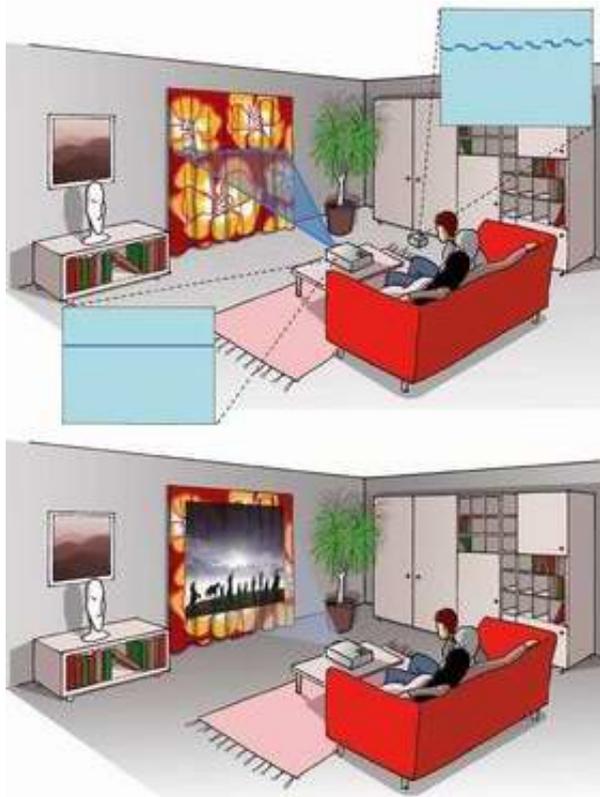# Smart projectors do not require artificial canvases

24 January 2005

can display (b) a geometry- and color-corrected image on a curtained window.

"We have developed a fully automatic image correction technique that supports projections of real-time graphics or video content onto everyday surfaces. The output appears as being projected onto artificial (white and planar) canvases. The actual surfaces, however, can be geometrically complex, arbitrarily textured and colored," said Prof. Oliver Bimber.

How it works

Researchers developed a correction methods implemented in software that amend all geometric and color distortions caused by absence of white canvas. The system automatically determines all parameters required for real-time geometric pre-distortion and color correction of video frames delivered by PAL/NTCS compliant devices like DVD players or game consoles, or real-time monoscopic or stereoscopic graphics.

Video projectors will play a major role in future home entertainment and education applications – ranging from movies and television, over computer games, to multimedia presentations. However, we have to give up living space and ambiance to set up artificial canvases that have to be as large as the desired image.

A **Smart projector**, developed by Bauhaus University (Germany) researchers, is able to display correct images onto arbitrary existing surfaces, like wallpapered wall or window curtains without artificial canvas.

Image: Smart projector concept. The temporarily detached modular camera component (a) calibrates the projector unit by mimicking the observers' target perspective so that the projector

Image: Projecting images onto environmental surfaces. (a) A scruffy corner serves as the projection surface. (b) The uncorrected image. (c) The projector system corrects the image's geometry and, finally, (d) its color. Displayed content: The Jackal , Universal Pictures.

Neither the geometry of the surface nor internal or external parameters of projector and camera have to be known for calibrating the system. This makes the concept extremely robust and easy to use.

From now on, the projector unit corrects incoming video signals geometrically and photometrically in real-time and images appear as being displayed onto a plane white canvas.

"We introduce a real-time image correction method that allows the projection onto arbitrary surfaces which exist within the particular environment, such as papered walls, colored window curtains, textured table-tops, natural stone walls, etc. This technique is fully automatic and can be implemented in hardware to become a part of off-the-shelf projectors," said O. Bimber. "Beside the home-entertainment and portable presentation domains, theme-parks, artistic presentations and museums are further areas that will be affected by such a technology."

Image: Projection onto a pitched roof area. The image sequence shows (a) the wallpapered surface, (b) the projection with uncorrected colors, (c) color correction projected onto a white piece of paper, and (d) the color-corrected image on wallpaper. All projections are geometry corrected.

Furthermore, such a method allows the setup of ad-hoc immersive stereoscopic projections in everyday environments allowing an at-hoc presentation of 3D data (e.g. in your office / meeting room, etc.) It has the potential to make special purpose displays, such as CAVEs and other immersive or semi-immersive projection devices unnecessary.

Related links:

Publication:
Bimber, O., Emmerling, A., and Klemmer, T. [Embedded Entertainment with Smart Projectors](#) IEEE Computer (cover feature), pp. 56-63, January issue 2005

Videos can be found at:
http://www.uni-weimar.de/~bimber/Pub/SP_MDR.mpg
http://www.uni-weimar.de/~bimber/Pub/SmartProjector.mpeg
http://www.uni-weimar.de/~bimber/Pub/SP_PS2.mpeg
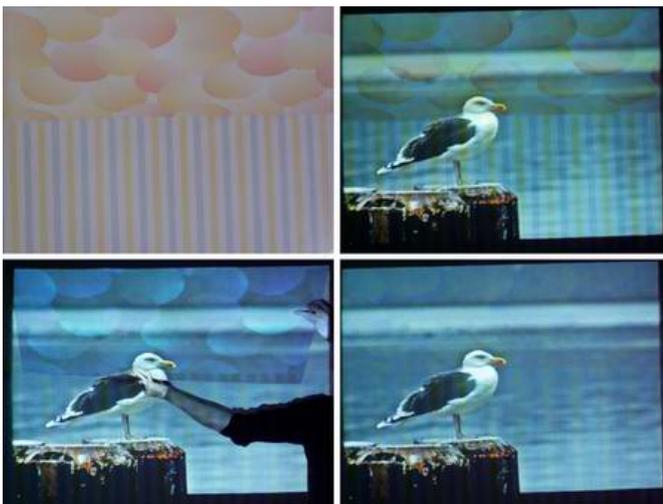
Source: Bauhaus University (Prof. O. Bimber)

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