Wearable Computing, 3D Aug* Reality, Photographic/Videographic Gesture Sensing, and Veillance

Steve Mann
University of Toronto
Toronto, Ontario, Canada
www.eyetap.org

Ryan Janzen
University of Toronto
Toronto, Ontario, Canada
veillametrics.com

Steve Feiner
Columbia University
New York, NY, USA
graphics.cs.columbia.edu

Jayse Hansen
Meta Company
San Mateo, California
jayse.tv

Soren Harner
Meta Company
San Mateo, California

Stefano Baldassi
Stanford University
Stanford, California

Mir Adnan Ali
University of Toronto
Toronto, Ontario, Canada
www.eyetap.org

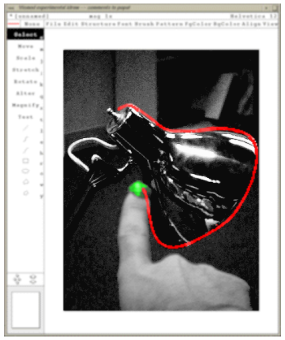

Figure 1: "SixthSense" Gesture-based 3D AR Wearable Computing, S. Mann, 1997[5]

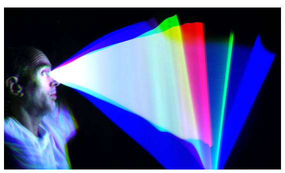

Figure 2: "Soul Portraits". The eye is the window to the soul and this ayinograph ("sightpainting") is a new kind of expressive portrait that also happens to embody a new kind of eye test whose results are immediately comprehensible. It is also a new easthetic and artistic form. Each participant can make an ayinograph, useful for custom-calibration of wearable computing and 3D AR Spaceglases.

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Abstract

Wearable computers and Generation-5 Digital Eye Glass easily recognize a user's own gestures, forming the basis for shared AR (Augmediated Reality). This Studio-workshop presents the latest in wearable AR, plus an historical perspective with new insights. Participants will sculpt 3D objects using hand gestures and create Unity 3D art+game objects using computational lightpainting.

Participants will also learn how to use 3D gesture-based AR to visualize and understand real-world phenomena, including being able to see sound waves, see radio waves, and see sight itself, through abakographic user-interfaces that interact with "sightfields" (time-reversed lightfields). Participants will also surveilluminescent devices that change color when watched by a camera. Long exposure photographs made with such devices generate "sightpaintings" that show what a camera can "see".

Author Keywords

Wearable Computing, Gesture-based 3D AR, Abakography, Ayinography ("sightpaintings").

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

Figure 3: Abakographic User Interfaces allow us to **sense sensing** and **visualize vision** itself. Priveillance (privacy, surveillance, and sousveillance) becomes a new medium of artistic experession.

Wearable Computing: 3D Gesture-based AR

Wearable Computing is a quickly growing field, especially when combined with AR (Augmediated/Augmented Reality) [7] Vision-based wearable computing is known as Personal Imaging [5], e.g. *Synthetic Synesthesia of the Sixth Sense* (abbreviated *Sixth Sense*) [3]. See Fig. 1.

We present the theoretical and philosophical foundations and axioms of 3D gesture-based Wearable Computing, along with hands-on demonstrations in which participants build their own 3D mobile and wearable computing environmnts using various approaches and systems, such as Qualcomm's Vuforia, Meta-View's Spaceglass SDK, Unity 3D (Unity Technologies), and Mann's VideoOrbits [6]. We will also introduce meta-sensory tools in the world of 3D vision-based AR, including abakography and ayinography == tools that were introduced as a form of visual art in the 1980s [1, 2]. See Figs. 5 and 4.

Participants will learn how to reproduce some of these results from the early days of wearable computing in the 1970s, e.g. how to find hidden cameras using a vacuum-tube-based video feedback abakographer, as well as how to do this using Meta Spaceglasses and more modern equipment.

Each participant will have the opportunity to make their own "Soul Portrait^{TM}" (ayinograph^{TM}) == a self-portrait that allows you to see sight itself, i.e. if the eye is the window to the soul, then this is a new way of seeing ourselves (as well as a useful eye test that we can see and understand more clearly than the Latin text and numbers of a traditional eye test). See Fig. 2. Artistically, this work touches on issues of priveillance (Privacy, Surveillance, and Sousveillance). See Fig 3.

Abakographic User Interfaces

Abakographs [8] are 3D (three-dimensional) photographs made by moving one or more light sources through space during an actual or simulated long-exposure 3D photograph. They are free of self-occlusion, and therefore lend themselves well to simple image-based rendering to create virtual, mediated, and augmediated 3D gesture-controlled worlds and interactive environments. We present visual art forms in which abakographs are situated in a photographic or videographic AR world using Digital Eye Glass. Example applications include visual art, sensory visualization, gaming, and physical fitness in which players wearing DEG (Digital Eye Glass) attempt to sense each other, and sense the sensing of each other.

The word "photography" comes from the Greek words "phos" ("light"), and "graphis" ("stylus" or "paintbrush"). Literally, the word "photography" means "drawing or painting with light" [4, 9].

Abakography focuses on this "drawing with light", where we use physical motion of light sources over a real or simulated long exposure derived from one or more photographs or frames of video, supplemented in some cases, with additional sensor information (3D camera, intertial measurement units, etc.). In this work, we computationally extend the concept of *light painting*.

Participants will learn how to make hand gestures in mid-air using tactile feedback from real physical objects.

We will introduce abakography as a 3D AR user-interface == a form of sculpting that uses real physical objects, such as an array of light sources.

Figure 4: Historical context: abakographic "paintbrush" with wearable computing and sensors to visualize radio waves, sound waves, etc.: wearable computing and computational photography [1, 2].

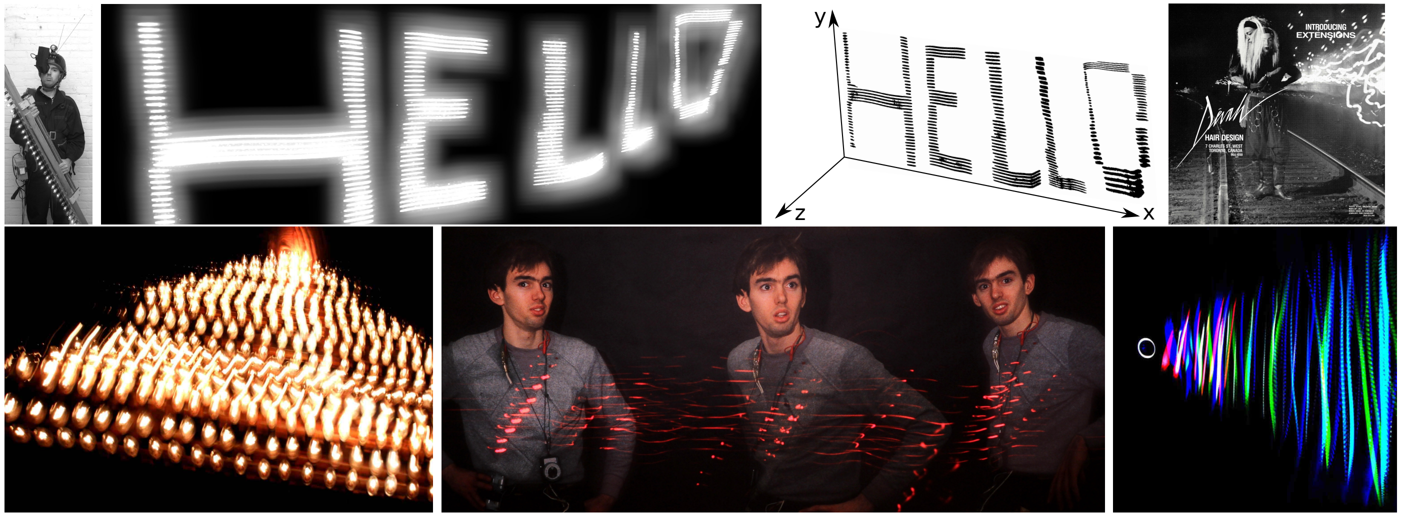

Figure 5: Historical context: long exposure photographs for artistic intervention, to sense sensing, and visualize vision. Cygraphy™(Cybernetic Photography). "Hello World" abakograph and abakogram examples. Top right: using the SWIM (Sequential Wave Imprinting Machine) to visualize circularly polarized radio waves, used in commercial photography, 1985. Bottom left: S. Mann, self portrait, sightfield of right eye (left hand held over left eye, right hand on SWIM) This "sightpainting" visualizes what the eye can see. Bottom middle: wearable computer LED shirt used to visualize sound waves and sweep for audio bugs through long-exposure photography and acoustic feedback in the early 1980s. Bottom right: video bug sweeper using video feedback to locate hidden cameras and visualize their sightfields. Red indicates strong surveillance field, green medium, and blue, weakly present.

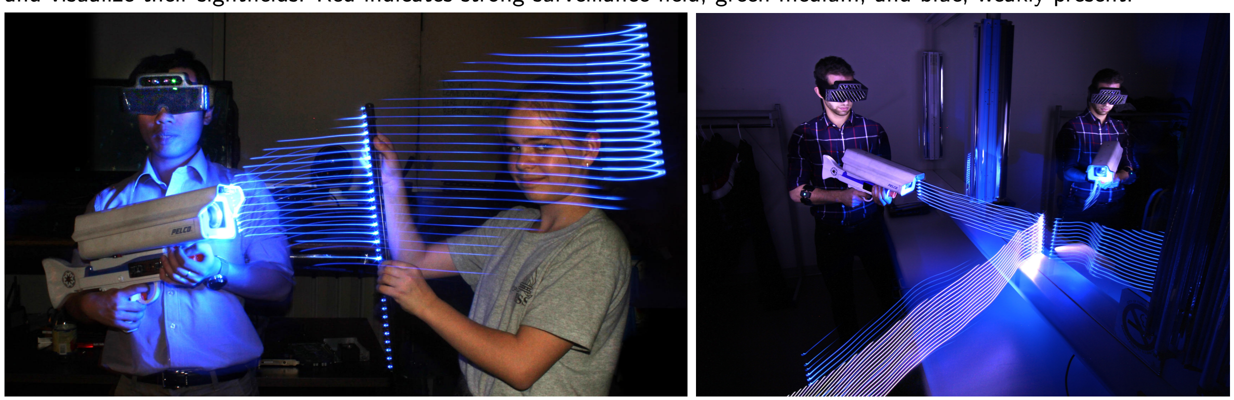

Figure 6: CameraGun game: Left: A player attempts to shoot with the camera gun, but the other player wins by being "quick on the draw" with a bugbroom to sweep for bugs and "rat out" the person with the camera gun. Right: Shooting into a mirror allows for some more advanced game play. Players need to anticipate multiple reflections and the effect they might have when the trigger is pulled.

Vuforia, Meta SDK, and Gaming

Vuforia and Unity provide extensive gaming opportunities. Each participant will have an opportunity to construct their own abakographs, and various gameplay possibilities will be presented. One such example is the CameraGun, a gun that is a camera. It gives rise to a game based on sensing sensing itself (i.e. sensing the capacity of sensors like the camera). A player wins by "shooting" an opponent with the camera, (i.e. a recognizable picture of their face is taken), but the shooter loses points if they are caught taking a picture, i.e. if the opponent detects that a "shot" has been fired from the camera. Thus the surveilluminescent light stick serves as a shield to protect from the camera in this sense, as it will "rat out" an opponents attempt at "shooting" with a camera. See Fig. 6.

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