Within the context of the annual SIGGRAPH conferences, the International Resources Committee produces audio guides and written transcripts of works shown at the Emerging Technologies. Presented in different languages, these allow the works to become accessible to our international visitors, as well as anybody who is unable to attend the conferences. Hosted on various sites (including SIGGRAPH.org and iTunes), the files also serve as archival reference for future interest and investigation. We hope you enjoy this description of fabulous technology works.

SIGGRAPH **2017**: **Emerging Technologies**
English

Produced by: Jing Wang (International Resources Committee)
Provided by: Jeremy Kenisky (SIGGRAPH 2017 Emerging Technologies Chair)

See, learn, touch, and try the state of the art in human-computer interaction and robotics. Emerging Technologies presents work from many sub-disciplines of interactive techniques, with a special emphasis on projects that explore science, high-resolution digital-cinema technologies, and interactive art-science narratives.

Adaptive Dynamic Refocusing: Toward Solving Discomfort in Virtual Reality

适应动态重新聚焦，解决虚拟现实中的不适感。

Pierre-Yves Laffont, Ali Hasnain
Lemnis 技术公司

This approach to reducing discomfort in virtual reality eliminates the vergence-accommodation conflict, a fundamental flaw that affects all commercial headsets available today.

It replaces traditional lenses in a head-mounted display with a focus-adjustable optical system that provides accommodation cues consistent with the true depth of an observed object. In addition, it takes into account the visual prescription of the user to enable virtual reality without eyeglasses.

这种减少虚拟现实中的不适的方法消除了调节冲突，这是一个影响当今所有商业耳机的根本性缺陷。

它利用可调节式光学系统提供与观察物体的真实深度相一致的线索来取代了传统头戴式显示器的镜头。另外，它重视了用户的视觉指示，使其无需眼镜就能实现虚拟现实。

Altered Touch: Miniature Haptic Display With Force, Thermal, and Tactile Feedback for Augmented Haptics

改变触觉：带有力，热和触觉反馈增强触觉的微型触觉显示器

Takaki Murakami, Tanner Person, Charith Lasantha Fernando, Kouta Minamizawa
庆应义塾大学

This fingertip haptic display with integrated force, tactile, and thermal feedback in a miniature form-factor can be worn easily and used with augmented reality applications without affecting existing tracking technologies.

It can be used to alter the haptic properties of real objects by rendering projected visual and haptic feedback. The system consists of a custom force-display mechanism (Gravity Grabber) to render vertical forces, shearing forces, high-frequency tactile vibrations, and a Peltier module for thermal display.

The integrated haptic display module weighs less than 50 grams, can be easily interfaced to a PC with just one micro USB cable, and works independent from additional hardware. The Altered Touch display could be expanded to design a haptic glove that can interact with both virtual and augmented worlds.

这个带有力，热和触觉反馈增强的微型触觉显示器，很容易佩戴，并且可以增强现实应用中的使用，而不会影响现有的跟踪技术。

它可以通过渲染投射的视觉和触觉反馈来改变真实物体的触觉属性。该系统由一种自定义的力显示机制(重力)来呈现垂直力、剪切力、高频率的触觉振动，以及 Peltier 的热显示模块。

集成的触觉显示模块重量不到 50 克，可以很容易地用一个微型 USB 线接口连接到一台 PC，并且可以独立于其他硬件工作。改变的触摸显示屏可以扩展为设计一种触觉手套，它可以与虚拟世界和增强世界互动。

AoEs: Enhancing Teleportation Experience in Immersive Environments With Mid-Air Haptics

AoEs：在沉浸式环境中通过空中触觉增强心灵的传送体验

Ping-Hsuan Han, Chiao-En Hsieh, Yang-Sheng Chen, Jui-Chun Hsiao, Yi-Ping Hung
国立台湾大学

Kong-Chang Lee, Sheng-Fu Ko, Chien-Hsing Chou
淡江大学
Kuan-Wen Chen
National Chiao Tung University
国立交通大学

Many research groups have shown that haptics feedback is an important method of enhancing immersive experiences with head-mounted displays. However, haptics feedback from various natural environments (for example, deserts and snow), requires many devices in the real environment to simulate the sun, airflow, humidity, and temperature.

Area of Elements (AoEs) is a new haptics technology that augments multiple tactile sensations in immersive environments, users receive visual, auditory, and tactile feedback via a steerable mid-air haptics device and a head-mounted display.

许多研究小组已经证明，触觉反馈是一种用头戴式显示器增强沉浸式体验的重要方法。然而，来自各种自然环境(如沙漠和雪)的触觉反馈，需要许多设备在真实环境中模拟太阳、气流、湿度和温度。

元素区域(AoEs)是一种新的触觉技术，它可以在沉浸式环境中增强多种触觉，用户通过可操纵的空中触觉设备和头戴式显示器接收视觉、听觉和触觉反馈。

atmoSphere: Designing Cross-Modal Music Experiences Using Spatial Audio With Haptic Feedback

大气：利用触觉反馈设计交叉式音乐体验

Haruna Fushimi, Daiya Kato, Youichi Kamiyama, Kazuya Yanagihara, Kouta Minamizawa, Kai Kunze
庆应义塾大学

atmoSphere uses spatial audio and haptic feedback provide immersive music experiences. Through its combination of spatialized music and a sphere-shaped device that provides haptic feedback, users imagine large sound environments and feel haptic sensations in their hands.

大气使用空间音频和触觉反馈提供沉浸式的音乐体验。通过将空间化的音乐和提供触觉反馈的球形设备结合在一起，用户可以想象巨大的声音环境和触觉的感觉

Bottomless Joystick 2

无底的操纵杆 2

Yuichiro Katsumoto
新加坡国立大学

With a motor-powered gimbal mechanism, a counterweight, and an inertial measurement unit, this interface makes a virtual anchoring point in midair, where it provides a haptic sensation similar to that of a conventional joystick.

该接口采用一种发动机驱动的平衡装置，一种平衡力和一种惯性测量装置，在空中制造了一个虚拟的锚定点，它提供了一种与传统的操纵杆类似的触觉感觉。

Cardiolens: Remote Physiological Monitoring in a Mixed=Reality Environment

有氧镜头：在混合现实环境中的远程生理监测

Daniel McDuff
微软研究所
Christophe Hurter
法国国立民航学校

Cardiolens is a novel system that allows users to view “hidden” physiological signals (blood flow and vital signs) in real time by simply looking at the people around them.

In Cardiolens, a commercially available augmented reality headset is modified to both measure and visualize physiological signals. A front-facing camera captures ambient light reflected from the subject's face and analyzes the light to compute blood-volume pulse and vital signs.

有氧镜头：是一种新的系统，它允许用户通过简单地观察周围的人，实时地查看“隐藏”的生理信号(血液流动和生命体征)。

在有氧镜头上，一种可商用的增强现实头戴设备被修改，用于测量和可视化生理信号。一个前置摄像头捕捉从拍摄对象脸上反射的环境光，并分析光线来计算血流量脉搏和生命体征。

Demo of FaceVR: Real-Time Facial Reenactment and Eye-Gaze Control in Virtual Reality

面部 VR 的演示:虚拟现实中的实时面部重现和眼球凝视控制

Justus Thies, Marc Stamminger,
德国埃尔朗根-纽伦堡弗里德里希·亚历山大大学
Michael Zollhoefer, Christian Theobalt
马克斯·普朗克计算机科学研究所
Matthias Nießner
慕尼黑工业大学 斯坦福大学

This novel method for gaze-aware facial reenactment in virtual reality applies a robust algorithm to real-time facial motion capture of an actor who is wearing a head-mounted display (HMD). It also features a new data-driven approach for eye tracking from monocular videos and incorporates photo-realistic re-rendering in real time, which allows artificial modifications of face and eye appearances.

在虚拟现实中，这种基于视觉的面部重现的新方法应用了一种健壮的算法，可以实时地捕捉佩戴头戴式显示器(HMD)的演员的面部动作捕捉。它还提供了一种新的数据驱动方法，可以在单目视频中进行眼球跟踪，并实时结合照片逼真的再现，从而允许人工修改脸部和眼睛的外观。

DIY Position Tracking Add-On for Mobile AR/VR

移动设备/虚拟现实技术的 DIY 位置跟踪插件

Fangwei Lee
Realiteer 公司.

This DIY add-on integrates position tracking on mobile VR devices to enable a wide variety of activities that require hand manipulation. It enables distribution of therapeutic content that involves embodiment and hand-eye coordination to mobile VR users.
Attendees can build their own controllers and participate in mindfulness exercises.

这款DIY配件集成了移动虚拟现实设备上的位置跟踪功能，可以实现多种需要手动操作的活动。它支持向移动虚拟现实用户提供体现和手眼协调的治疗内容。

与参 会者可以建立自己的控制器并参与正念练习。

GVS RIDE: A Novel Experience Using Head-Mounted Display and Four-Pole Galvanic Vestibular Stimulation

GVS 之旅:使用头戴式显示器和四极电流刺激的新奇体验

Kazuma Aoayma, Daiki Higuchi, Kenta Sakurai, Taro Maeda, Hideyuki Ando
大阪大学

GVS RIDE induces tri-directional acceleration and enhances virtual acceleration (lateral, anteroposterior, and yaw rotation) to deliver realistic experience using four-pole Galvanic Vestibular Stimulation (GVS) and a head-mounted display (HMD) in synchronization.

GVS 的行程可以诱导三向加速，并增强虚拟加速度(横向、前位和偏航旋转)，利用四极电流刺激(GVS)和头戴式显示器(HMD)同步，提供真实的体验。

HangerON: A Belt-Type Human Walking Controller Using the Hanger Reflex Haptic Illusion

HangerON:一种带悬挂式反射式触觉错觉的腰带式人类行走控制器

Yuki Kon, Takuto Nakamura, Hiroyuki Kajimoto, Rei Sakuragi, Hirotaka Shionoiri, Seitaro Kaneko
电气通信大学

This walking maneuvering method uses the Hanger Reflex, an illusory phenomenon caused by haptic stimulus, to manipulate walking direction.
Mounted on the user's waist, it causes a rotating left-right movement to manipulate walking direction. The demo includes three applications of the method: normal walking navigation that automatically achieves a destination, remote control of one user by another user, and user-controlled walking.

这种行走的操纵方法使用了悬挂反射，一种由触觉刺激引起的错觉现象，来操纵行走方向。

由于

安装在使用者的腰部，它会产生一个旋转的左右运动来操纵行走方向。演示包括了三种方法的应用：正常的步行导航，自动实现目标，一个用户的远程控制，以及用户控制的步行。

HangerOVER: HMD-Embedded Haptics Display With Hanger Reflex

HangerOVER：有悬挂式反射的嵌入式触觉显示屏

Yuki Kon, Takuto Nakamura, Hiroyuki Kajimoto, Yasuyuki Yamaji, Taha Moriyama

电气通信大学

Using the Hanger Reflex (in which the head rotates unintentionally when appropriate pressure distribution is applied to it), its Head Mounted Display-embedded haptics display provides both tactile and force.

As it accompanies illusory external force and motion, it can be used to express events in VR environments, such as being pushed and punched by a game character. The device is composed of air-driven balloons that can express touch, pressure, motion, force, and vibration. It not only improves the immersive VR experience, but it also extends game creators' freedom of expression.

使用悬挂式反射(在适当的压力分配时，头部会无意识地旋转)，它的头部安装了显示嵌入式的触觉显示，提供了触觉和力量。

由于它伴随着虚幻的外力和运动，它可以用来在虚拟现实环境中表达事件，比如被游戏角色推和打。该装置由空气驱动的气球组成，可以表达触摸、压力、运动、力和振动。它不仅改善了沉浸式虚拟现实体验，而且还扩展了游戏制作者的表达自由。

Hapbeat: Single DOF Wide-Range Wearable Haptic Display

Hapbeat:单自由度可穿戴式触觉显示屏

Yusuke Yamazaki, Hironori Mitake, Ryuto Oda, Hsueh-Han Wu, Shoichi Hasegawa
东京技术学院

Minatsu Takehoshi, Yuji Tsukamoto, Testuaki Baba
东京城市大学

The device transmits forces to a wider area of the body than conventional vibrators, and while vibrators have a limited linear stroke, motor rotation is not restricted. In contrast to conventional vibrators, Hapbeat moves only light coreless rotors and a string. For sound listening, these features are turned into sensations of strong low-frequency air movements from drums or cannons and high-fidelity vibrations of acoustic instruments.

该装置将力传递到比传统振动器更大的范围内，而振动器有一个有限的线性行程，马达的旋转是不受限制的。与传统的振动器相比，Hapbeat 只移动了没有光的转子和一根弦。对于声音的聆听，这些特征被转化为来自鼓或炮声的强烈低频空气运动的感觉，以及声乐器的高保真振动。

HaptoCloneAR: Mutual Haptic-Optic Interactive System With Superimposed 2D Image

HaptoCloneAR:与叠加的 2D 图像相互作用的交互视觉交互系统

Kentaro Yoshida, Yuuki Horiuchi, Seki Inoue, Yasutoshi Makino, Hiroyuki Shinoda
东京大学

The system enables two users sitting side by side to interact mutually with haptic feedback. It optically clones 3D volumetric images with a pair of micro-mirror array plates, and it uses displays and half mirrors to superimpose artificial images on 2D displays.

One user sees a cloned image of the opposite user's face behind a virtual floating screen. When the cloned or superimposed images converge, airborne ultrasound tactile displays deliver haptic feedback at the exact contact position. The result is effective augmented reality without glasses or gloves.

该系统使两个用户并排坐在一起，与触觉反馈相互作用。它用一对微镜阵列板来克隆三维立体图像，并利用显示器和半面镜将人工图像叠加在二维显示器上。

我们的用户看到另
一个虚拟的浮动屏幕后的用户的脸部的克隆图像。当克隆或叠加的图像聚合在一起时，机载的超声波触觉显示在精确的接触位置提供触觉反馈。其结果是没有眼镜或手套的有效增强现实。

Infinite Stairs: Simulating Stairs in Virtual Reality Based on Visuo-Haptic Interaction

无限阶梯:虚拟现实中基于视觉-触觉相互作用的模拟楼梯

Ryohei Nagao, Keigo Matsumoto, Takuji Narumi, Tomohiro Tanikawa, Michitaka Hirose
东京大学

Infinite Stairs is a novel visuo-haptic technique that simulates the sensation of walking up and down stairs in a virtual environment, even though users walk on a flat surface in a real space. The haptic stimuli provided by a small bump under users' feet correspond to the edge of the stair in the VE, and the visual stimuli of the stairs and shoes, provided by the HMD, evoke visuo-haptic interaction.
Infinite Stairs enables users to experience any type of virtual stairs, including Penrose stairs, in a virtual reality setting.

无限阶梯是一种新型的视觉-触觉技术，它模拟了在虚拟环境下上下楼梯的感觉，即使用户在真实空间的平面上行走。

在使用者的脚上的一个小隆起所提供的触觉刺激，与VE的楼梯的边缘相对应，而由HMD提供的楼梯和鞋子的视觉刺激，唤起了视觉-触觉的相互作用。

无限的楼梯让用户可以体验任何类型的虚拟楼梯，包括Penrose的楼梯，在虚拟现实环境中。

Membrane AR: Varifocal, Wide-Field-of-View Augmented Reality Display From Deformable Membranes

薄膜 AR:可变焦距，来自可变形膜的视野增强的增强现实显示器

David Dunn, Cary Tippets, Kent Torell
北卡罗来纳大学教堂山分校
Petr Kellnhofer
马克斯·普朗克计算机科学研究所
Kaan Akşit, Karol Myszkowski, David Luebke, Henry Fuchs
NVIDIA 研究所

Piotr Didyk
萨尔布吕肯大学，马克斯·普朗克计算机科学研究所

This augmented-reality display combines combining hyperbolic half-silvered mirrors and deformable membrane mirrors to create virtual imagery at a desired depth level within a wide field of view with the promise of a more comfortable user experience.

这一增强现实显示器结合了双曲半镀银的镜子和可变形的膜镜，在广阔的视野范围内创造虚拟图像，并承诺提供更舒适的用户体验。

MetaLimbs: Multiple Arms Interaction Metamorphism

MetaLimbs:多臂交互变质作用

Tomoya Sasaki, MHD Yamen Saraiji, Kouta Minamizawa
庆应义塾大学
Charith Lasantha
费尔南多庆
Masahiko Inami
东京大学

MetaLimbs adds two robotic arms to the user's body and maps the global motion of legs and feet relative to the torso. It also maps local motion of the toes. Then it maps these data to arm and hand motion, and to fingers gripping the artificial limbs, adds force feedback to the feet, and maps the feedback to the manipulator's touch sensors. Arm functions can be customized to achieve new kinds of interactions from an egocentric point of view.

MetaLimbs 为用户的身体添加了两个机械手臂，并将腿和脚的全角度运动与躯干相对应。它还能绘制出脚趾的局部运动。然后，它将这些数据映射到手臂和手的动作，以及手指抓住假肢的手指，将力反馈添加到脚上，并将反馈映射到机械手的触摸传感器上。可以自定义手臂功能，以实现以自我为中心的新交互方式。

Mid-Air Interaction With a 3D Aerial Display

一个 3D 空中显示器在空中交互

Seth Hunter
因特尔公司
Dave MacLeod, Derek Disanjh
MistyWest

Jonathan Moisant-Thompson, Ron Azuma
因特尔公司

This volumetric display enables mid-air interaction with 3D renderings without requiring a head-mounted apparatus. The display is specifically suited to the properties of a micro-mirror reimaging glass, to position a 15cm volume at a comfortable height and allow viewers to reach in and around the display.
It employs interaction techniques that provide haptic feedback and mitigate occlusion conflicts between the hand and the virtual volume during direct manipulation.

这种体积的显示器可以在不需要头戴设备的情况下，在空中进行3D渲染。这种显示器特别适合于微镜再成像玻璃的特性，可以在舒适的高度上放置15厘米的体积，让观众可以在显示器周围接触。

它采用交互技术，提供触觉反馈，并在直接操作的过程中减少手与虚拟音量之间的遮挡冲突。

Non-Line-of-Sight MoCap

非视距动作捕捉

Jonathan Klein, Matthias Hullin, Christoph Peters
波恩大学

Martin Laurenzis
圣路易的法赫德学院

The first non-line-of-sight sensing system that offers real-time tracking of objects hidden from the camera by an occluder. It uses an off-the-shelf intensity camera instead of expensive time-of-flight hardware.
Viewers can freely move the occluded object around in the hidden scene, while the camera setup on the other side of the wall reconstructs the object position and orientation in real time.

这是第一个非视线感应系统，它提供了一个被遮挡物从相机中隐藏的物体的实时跟踪。它使用的是一个现成的强度相机，而不是昂贵的飞行时间硬件。

观众可以在隐藏的场景中自由移动被遮挡的物体，而在墙的另一边的摄像机则可以实时地重建物体的位置和方位。

Real Baby - Real Family: Age-Controllable VR Avatar From 2D Face Images

真正的婴儿-真实的家庭:来自 2D 脸部图像的年龄控制虚拟现实化身

Rex Hsieh, Yuya Mochizuki, Takaya Asano, Marika Higashida, Akihiko Shirai

神奈川理工学院

Real Baby - Real Family is an entertainment VR baby-avatar-generation system that includes visual, audio, and haptic feedback; a physical baby form; and a virtual baby whose face is generated by combining two photos of the players. The project simulates a complete baby-nursery experience.

真正的婴儿-真正的家庭是一种娱乐虚拟现实婴儿的系统，包括视觉、听觉和触觉的反馈，一个身体的婴儿形态，以及一个虚拟的婴儿，他的脸是由两张运动员的照片合成的。该项目模拟了一个完整的婴儿托儿所体验。

Submerged Haptics: A 3-DOF Fingertip Haptic Display Using Miniature 3D Printed Airbags

水下触觉:一个用微型 3D 打印安全气囊进行的 3 个指尖触觉显示

Yuan-Ling Feng, Charith Lasantha Fernando, Jan Rod, Kouta Minamizawa

庆应义塾大学

AeroFinger is a novel method of creating wearable fingertip haptic displays. It is made of 3D-printed rubber-like material so that the display size, strength and shape can be customized by the user. It is very lightweight, uses no electro-mechanical actuation to render the three-degree-of-freedom force-feedback sensation, and small enough to fit on the fingertip.

AeroFinger 是一种创造可佩戴指尖触觉显示的新颖方法。它是由 3d 打印的橡胶材料制成的，这样显示屏的尺寸、强度和形状都可以由用户定制。它是非常轻的，不使用电子机械的驱动来呈现三自由度的力反馈感觉，并且小到可以在指尖上安装。

Touch Hologram in Mid-Air

触摸全息图在半空中

Julien Castet, Cédric Kervegant, Felix Raymond, Delphine Graeff

浸没式情景应用程序

This demonstration adds a method for touching the objects, based on a touch development kit from Ultrahaptics, the only mid-air tactile feedback technology. It provides a touch feeling without any mechanical equipment in the visualization area (which would be inconsistent with the hologram concept). Touch Hologram in Mid-Air is unique in giving physical presence to intangible objects.

这一演示为触摸物体添加了一种方法，这是基于超触觉的触觉开发工具，这是唯一的空中触觉反馈技术。它提供了一种触摸感觉，没有任何机械设备在视觉区域(这与全息图的概念是不一致的)。在空中，触摸全息图是独一无二的，它赋予了无形的物体。

TwinCam: Omni-Directional Stereoscopic Live-Viewing Camera-Reducing Motion Blur During Head Rotation

TwinCam:在头部旋转时，全方位的立体视景影像减少运动模糊

Kento Tashiro, Yasushi Ikei
东京城市大学
Toi Fujie Tokyo
城市大学

Tomohiro Amemiya
NTT 通信科学实验室
Koichi Hirota
电气通信大学

Michiteru Kitazaki

丰桥技术大学

This omni-directional stereoscopic live viewing camera system was developed to reduce motion blur and latency during head rotation of remote users wearing a head-mounted display. Two omni-directional cameras are mounted on a movable rig to provide real-time parallax.

这种全向立体实时观察摄像系统是在头戴式显示器的远程用户头部旋转过程中减少运动模糊和延迟的。两个全向摄像机安装在可移动的平台上，以提供实时视差。

Varifocal Virtuality: A Novel Optical Layout for Near-Eye Display

可变焦距:近眼显示器的一种新颖的光学布局。

David Luebke
NVIDIA 研究所,NVIDIA 公司

Kaan Akşit, Ward Lopes, Jonghyun Kim, Josef Spjut, Peter Shirley
NVIDIA 研究所
Marty Banks, Steven Cholewiak, Pratul Srinivasan, Ren Ng
加州大学伯克利分校

Gordon D. Love

英国杜伦大学

Augmented reality (AR) has recently gained momentum from a variety of available optical see-through near-eye displays (NEDs), including the Meta 2 and the Microsoft Hololens. But they are still limited. Their graphics images are at a constant virtual distance from the eye's accommodation mechanism, while the vergence of the two eyes working in concert places the virtual object(s) at a distance other than the accommodation distance.

This project employs a novel wide-field-of-view (FOV) optical design that can adjust accommodation depth dynamically so that the presented virtual scene is at the correct accommodation distance with computational blur to match the vergence.

增强现实(AR)最近从各种光学透明的近视眼显示器(NEDs)中获得了动力，包括Meta 2和微软Hololens。但它们仍然是有限的。他们的图形图像与眼睛的调节机制保持着一定的距离，而两眼协调工作将虚拟物体(s)放置在距离以外的距离之外。

该项目采用一种全新的宽视野(FOV)光学设计，可以动态调整焦深度，使所呈现的虚拟场景与计算模糊匹配，与计算模糊相匹配。

Wired Muscle: Generating Faster Kinesthetic Reaction by Interpersonally Connecting Muscles

连线肌肉:通过相互连接的肌肉产生更快的动觉反应

Jun Nishida, Kenji Suzuki
筑波大学

Shunichi Kasahara
索尼计算机科学实验室，Inc.。

Wired Muscle connects muscle activities between two persons using electromyogram measurement and electrical muscle stimulation to generate responsive movements that are faster than those generated by the visual information-based process.

The system detects the muscle activity of a person by the EMG and triggers the EMS to drive the muscle of the other person to induce corresponding counter movements. Some participants perceive that the kinesthetic reaction was performed by their own will even though the muscle movement was electrically driven by prior stimuli.

连线肌肉通过肌电图测量和电肌肉刺激来连接两个人的肌肉活动，从而产生比视觉信息过程所产生的反应更快的动作。

该系统通过EMG检测一个人的肌肉活动，并触发EMS驱动另一个人的肌肉来诱发相应的反运动。一些参与者认为，即使肌肉运动是由先前的刺激引起的，他们也会按照自己的意志来进行运动。