

Research on Ultra-Realistic Communications

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Outline

- Overview of NICT
- Towards Ultra-Realistic Broadcasting and Communications
- Ultra-HDTV (Super Hi-vision)
- 3DTV
- Multi-sensory Interaction System
- Data-rate of Future Video Systems
- Summary

2

Overview of NICT

National Institute of Information and
Communications Technology,
Japan

3

Outline of NICT

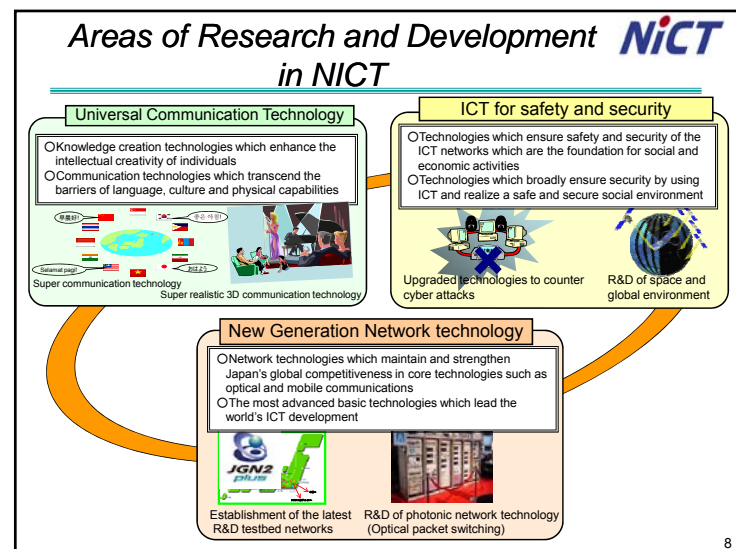
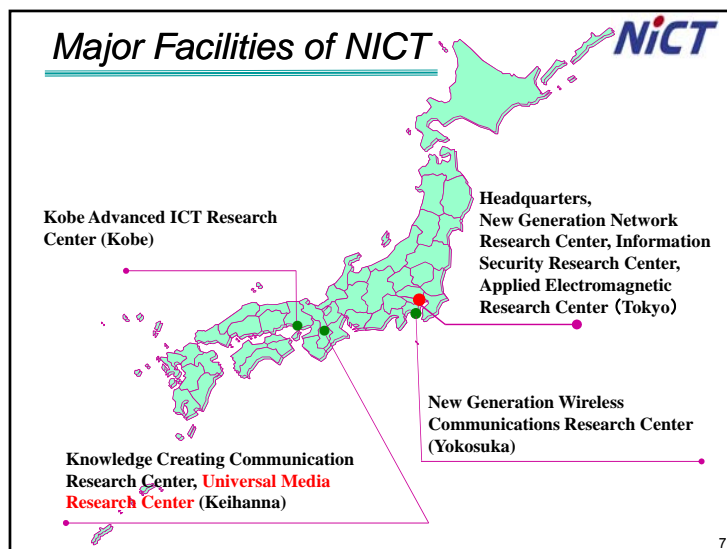
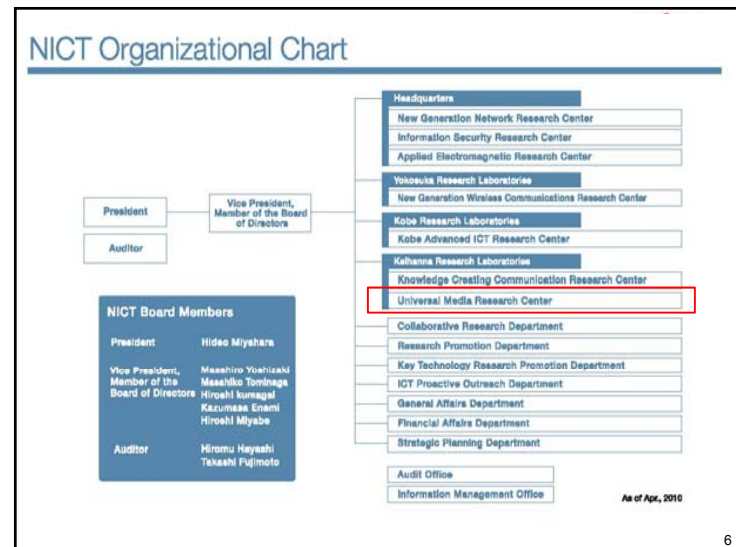
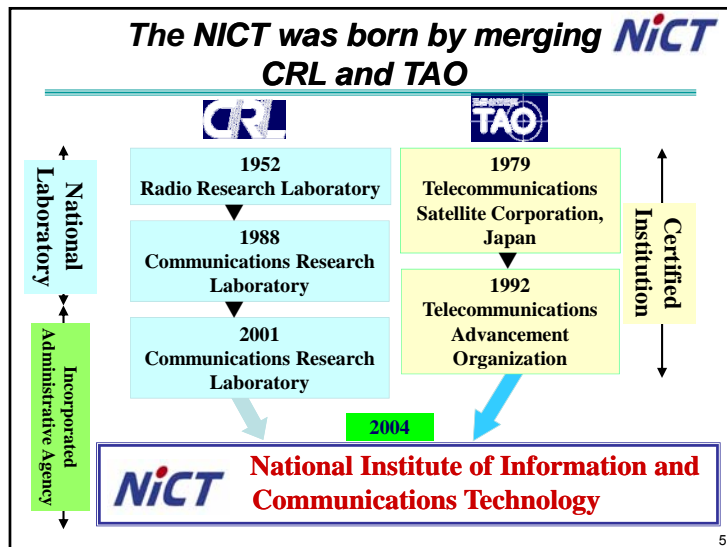
Main operations (Incorporated Administrative Agency, NICT Act)

- R&D of technology relating to information and communications technology (ICT) and radio waves
- Support for those conducting R&D in advanced telecommunication and broadcasting
- Promotion of enterprises within the telecommunication and broadcasting area

Budget & Personnel (FY2010)

- Budget : 35.13 billion yen
- Personnel: 873 (Total Researchers: 545, PhDs : 398)


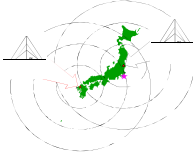
4




Public Services NiCT

Determination & Supply of Standard Time and Frequency

Hagane mtn. JJY LF station
(60 kHz, 200m high antenna)





Ootakadoya mtn. JJY LF station
(40 kHz, 250m high antenna)




Regular Observation of Ionosphere & Space Environment Info. Service

Space weather forecast center



Type Approval & Calibration of Wireless Equipment

Standard site for antenna calibration

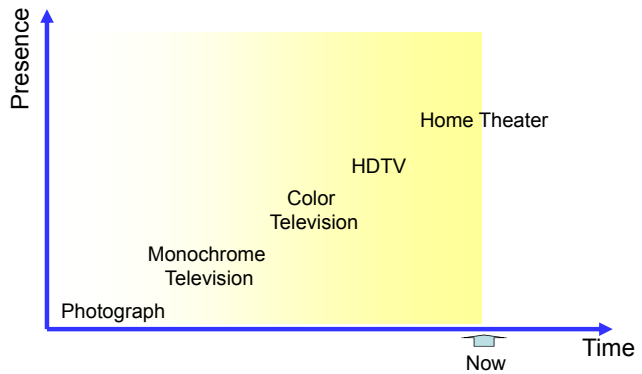


9

Towards Ultra-Realistic Broadcasting and Communications NiCT

10

Developments of Television Services NiCT



11

My Home Theater System NiCT

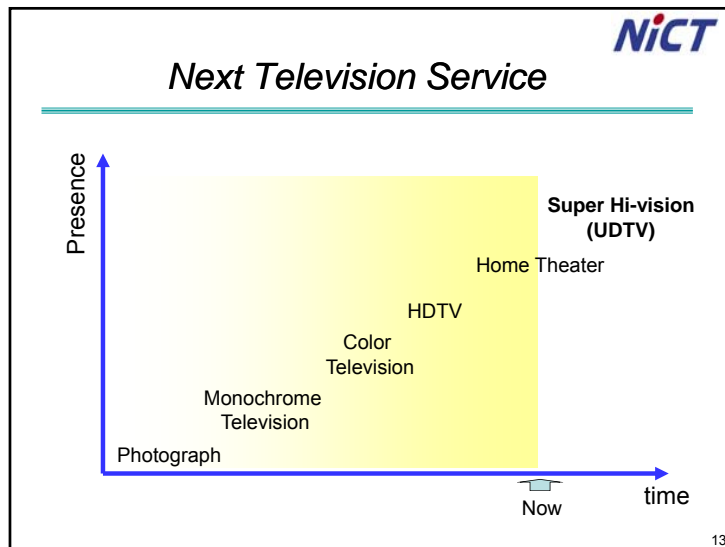


90-Inch Large Screen



HDTV Projector, Audio Amp and HDD Recorder

12



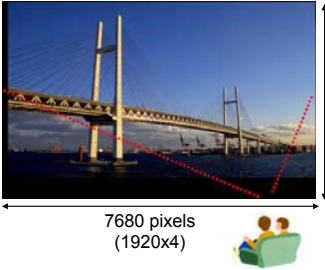
Ultra HDTV (Super Hi-vision)

Research in NHK Science and Tech. Research Labs. (NHK STRL)

14

Super Hi-Vision (UDTV)

- Ultra-high-definition, Wide-screen System with 4320 Scanning Lines)
- Future TV System with Greater Sensation of Reality



4320 Lines
(1080 x4)

7680 pixels
(1920x4)

ITU-R Recommendation BT.1769 (LSDI: Large Screen Digital Imagery)

15

Image formats of SDTV, HDTV, D-Cinema and Super Hi-Vision

SDTV

720 lines x 480 pixels
7 x Picture Height

HDTV

1080 lines x 1920 pixels
3.0 x Picture Height

Super Hi-Vision

4320 lines x 7680 pixels
100deg.

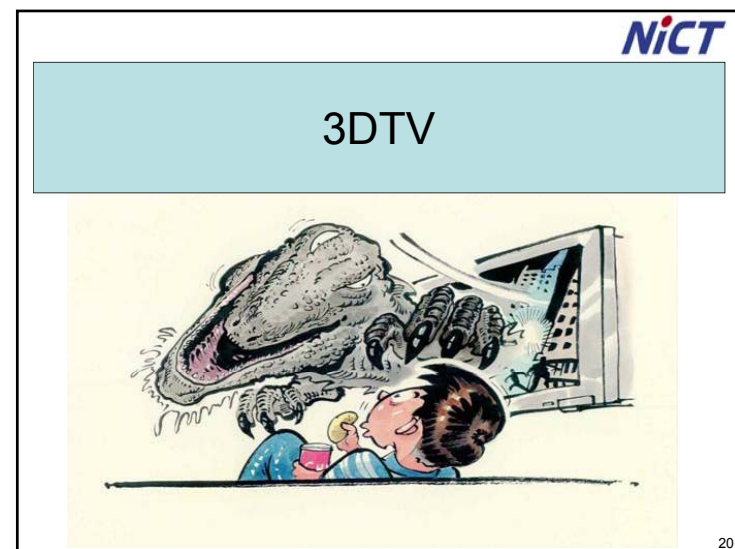
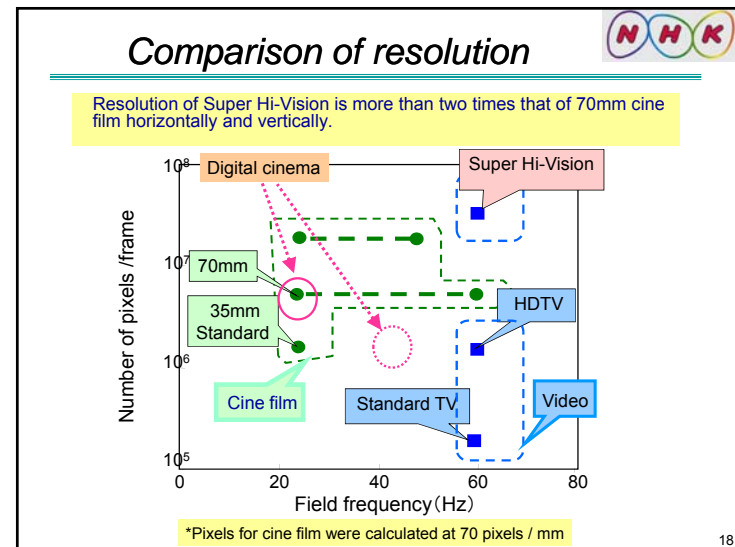
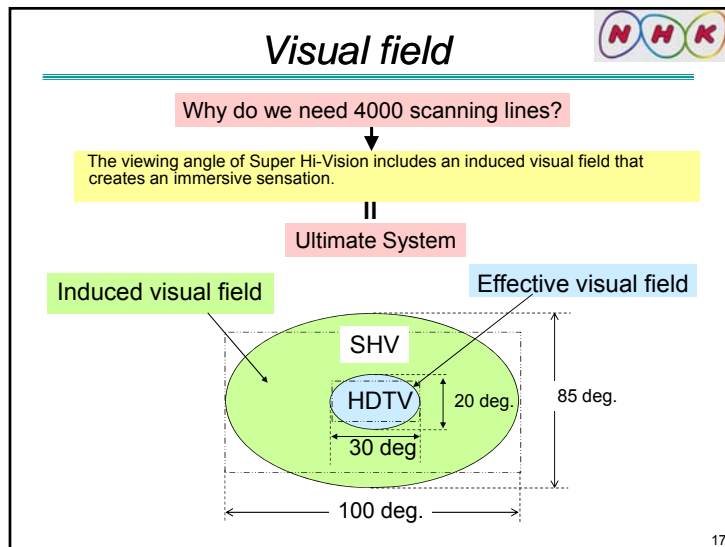
Standard viewing distance
0.75 x Picture Height

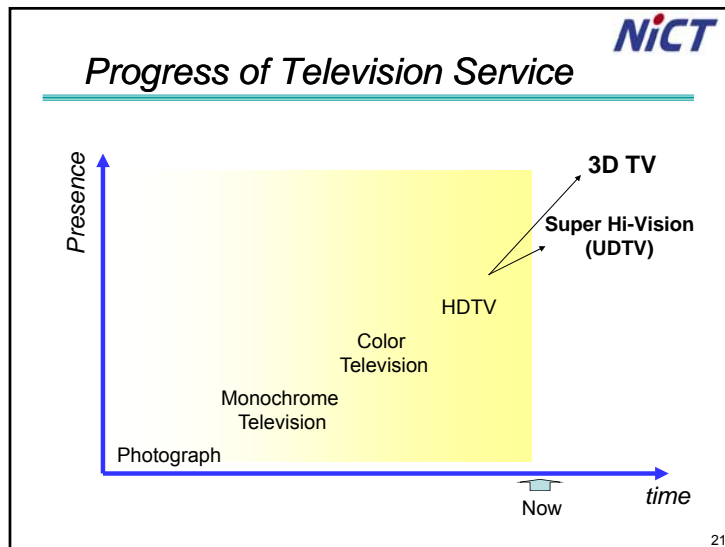
Digital Cinema

2160 lines x 4096 pixels
55deg.

1.5 x Picture Height

16



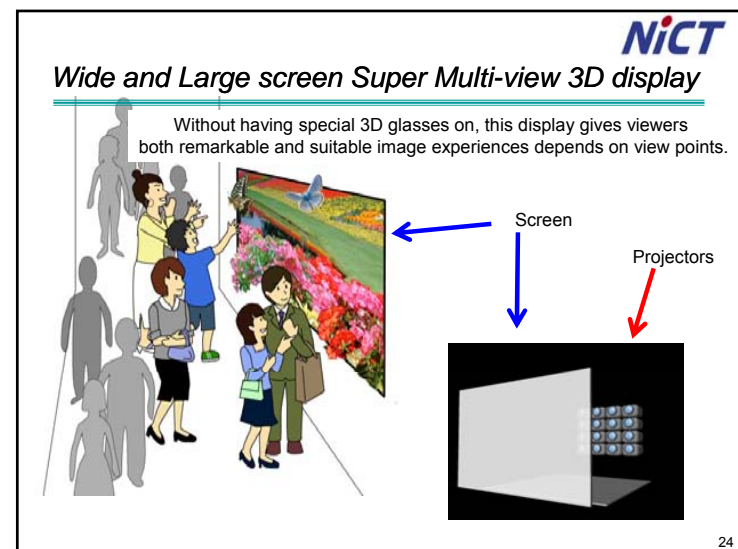
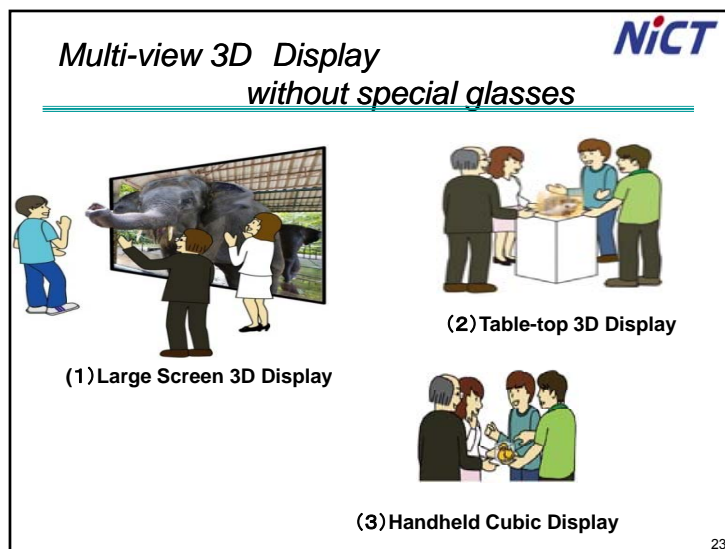


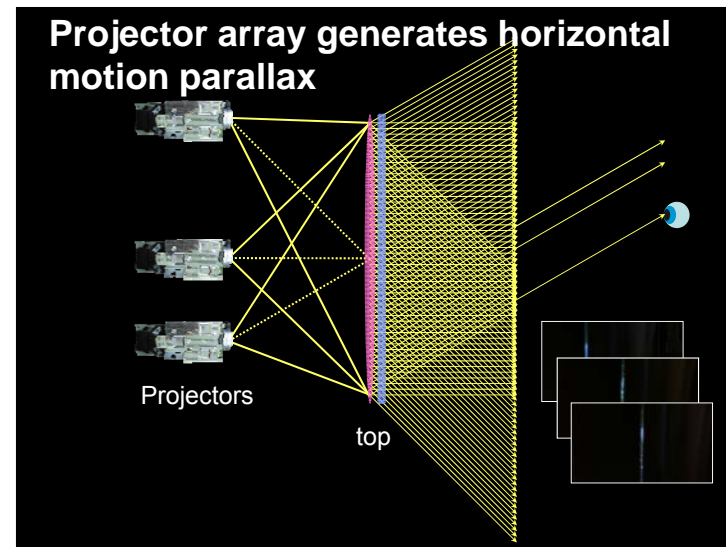
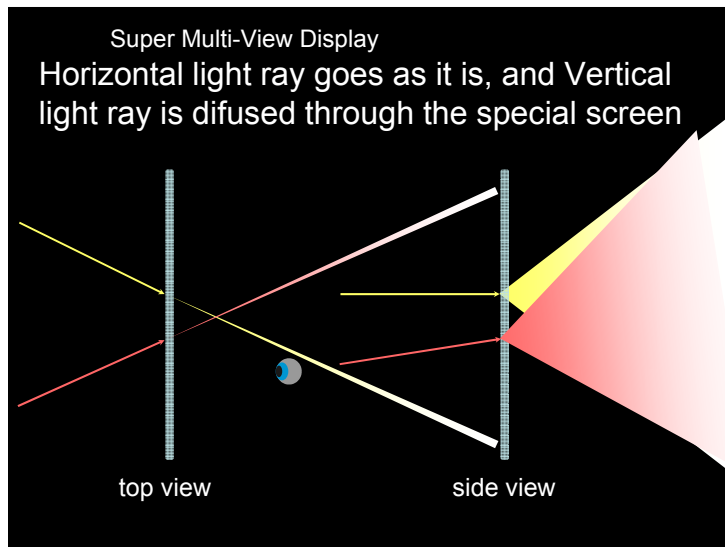
NiCT

Comparisons of 3DTV Methods

3DTV Method	Basic configuration	Features	Depth clues to be reproduced		
			Convergence & Parallax	Motion Parallax	Accommodation
Binocular system (Stereoscopic system)	Comprises two television systems	Availability of conventional video. High picture quality	○	×	×
Multi-view system	Comprises three or more television systems.	Auto-stereoscopic in most display. Addition of motion parallax	○	△	×
Volumetric or multi-layer system	Fills a certain volume of space with multiple display screen	Natural depth in a fixed area, phantom image	○	× ~ △	○
Spatial image reproducing system	Super multiview/ Integral imaging	Reproduces light ray Parallax in omni direction	○	○	△ ~ ○
	Holography	Based on record and reproduction of extremely fine fringe pattern	○	○	○

22





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Wide and Large screen Super Multi-view 3D display

The diagram on the left shows 'Multi-view in horizontal direction' with multiple light rays originating from a point and hitting a screen. To the right is a photograph of the physical display, labeled '70" Screen' and '50-100 Projectors'.

Experimental super multi-view display

Video

Currently developing 200 inch-class Glasses-Free 3D Display

27

NiCT
Table-top 3D Display -f VisiOn -

The diagram on the left shows people sitting around a table, looking at a 'Reproduced 3D image' on the 'Table plane'. Labels include 'Side view', 'Viewing position', and 'Bird's eye view'. To the right is a diagram of the 'Table plane' with a 'Viewing position' and a 'Table plane' label.

(a) People can discuss watching 3D objects on the table

(b) The principle of fVisiOn

(c) Reproduced 3D images from different view points

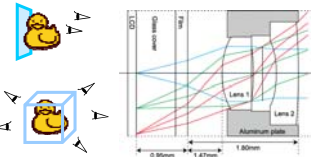
Video

28

Handheld Cubic Display - gCubik- NiCT

- gCubik's Concept
 - Group-sharing of 3D images
 - Graspable virtual objects
 - Glasses-free autostereoscopic display
 - Glazed-showcase like display
- Implementation Approach
 - A cube formed by autostereoscopic displays (Integral Photography: IP)
 - Put virtual 3D objects inside the cube
- A Conquered Problem
 - Viewing angle of ordinary lenticular or IP lens array is limited around 20~40°.
 - Showcase-like watching requires a wider viewing angle 120°.
 - Developed two-tiered IP lens array provides 120° viewing angle.
 - gCubik allows viewing from arbitrary directions using our novel lens array.

Video



29

Electronic Holography NiCT

Holography is a ultimate 3D imaging method

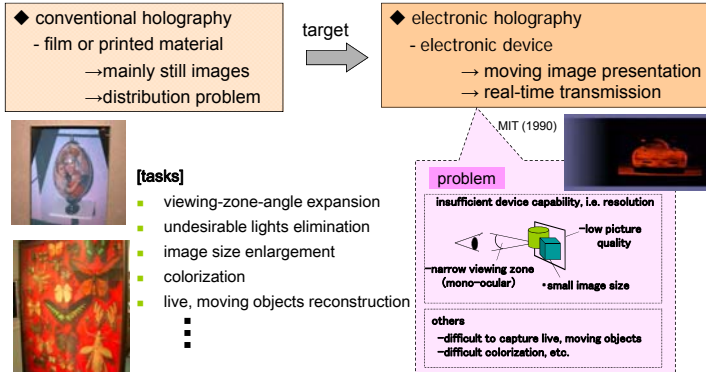
- The light from an actual object is recorded and reproduced accurately.
- No use for special glasses or equipment
- Has full parallax capability and provides viewers with more depth clues that help them see more natural and realistic 3D images



Experimental setup for electronic holography

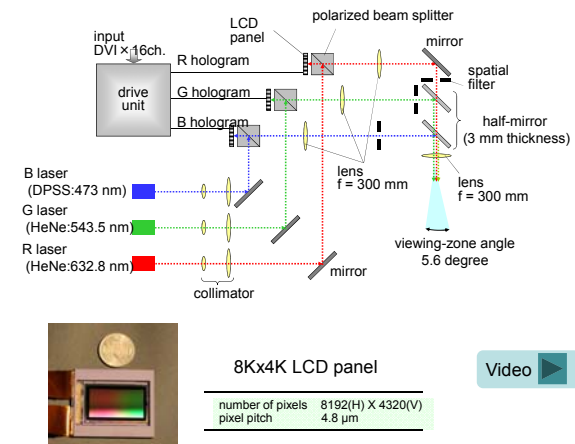
30

Realization of electronic holography system NiCT



31

Color holography reconstruction system NiCT

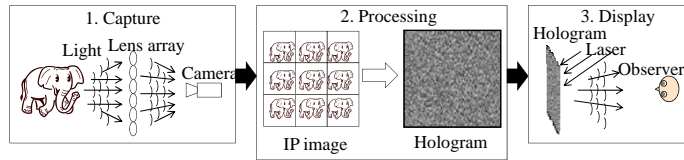


Video

32

A Real-Time Color Holography System for Live Scene

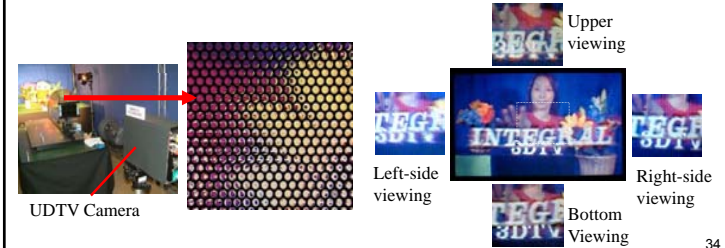
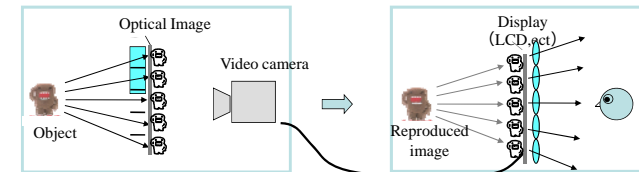
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33

Integral 3D imaging system

NHK



34

Multi-sensory Interaction System

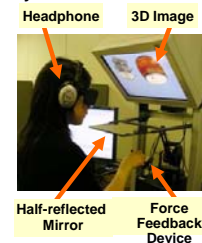
You feel as if a thing is here.

NICT

Multi-sensory Interaction

NICT

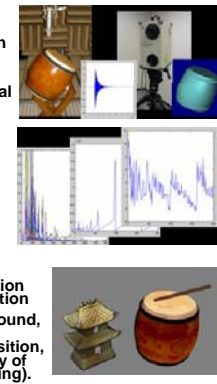
Multisensory Interaction System



- You can see, touch, and hear it as if you are interacting with a real 3D object.

System Features

- Acquirement of multisensory information
 - Acquiring 3D structure, texture images and contact sounds from real objects
- Analysis and modeling
 - Modeling 3D structure and tactile sense
 - Frequency mode analysis of contact sounds
- Integration and re-creation of multisensory information
 - Generating 3D image, sound, and tactile sense in accordance with the position, the strength and the way of touch (tapping or scraping).

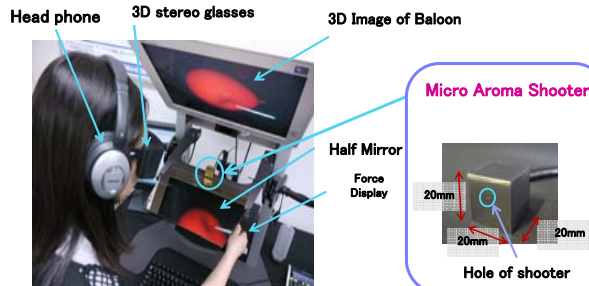


Using this system, we are currently investigating human cognitive mechanisms of multisensory integration.

36

Multisensory Interaction System for Re-creating 3D Images, Sounds, the Sense of Touch, *and smell*

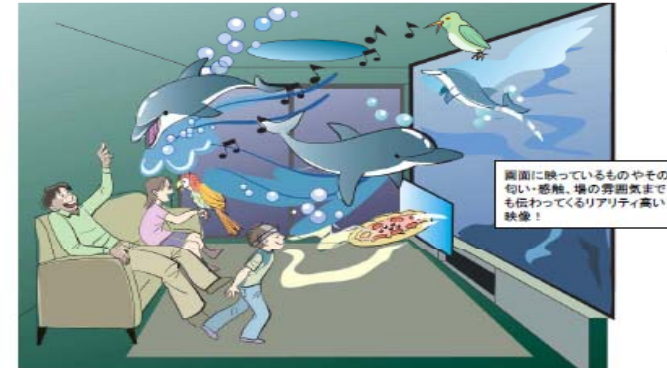
NICT



This device can control the diffusion of fragrance in time and space.

37

Future Home Theater with Ultra-Realistic Broadcasting



From HP of the Ministry of Internal Affairs and Communications

Understanding human multi-sensory mechanisms

NICT

39

Understanding human multi-sensory *NICT* mechanisms

Developing measurement and analysis techniques using brain imaging, psychophysics, and biometric signals, and formulating human evaluation indexes of "presence."

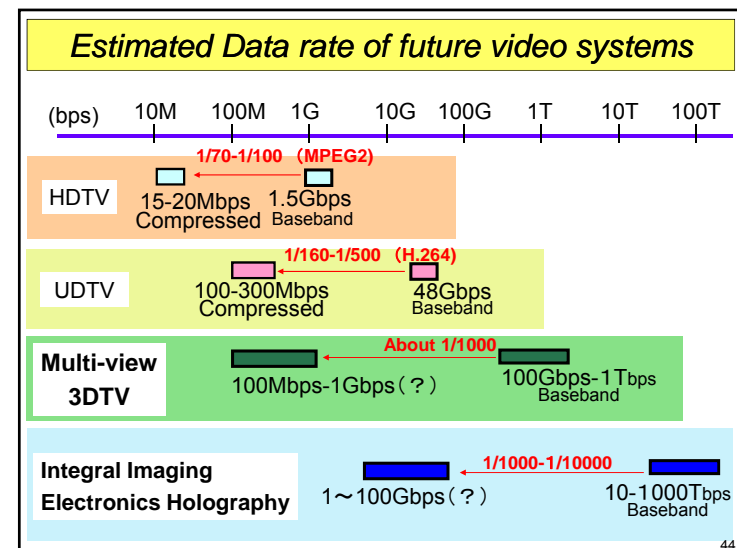
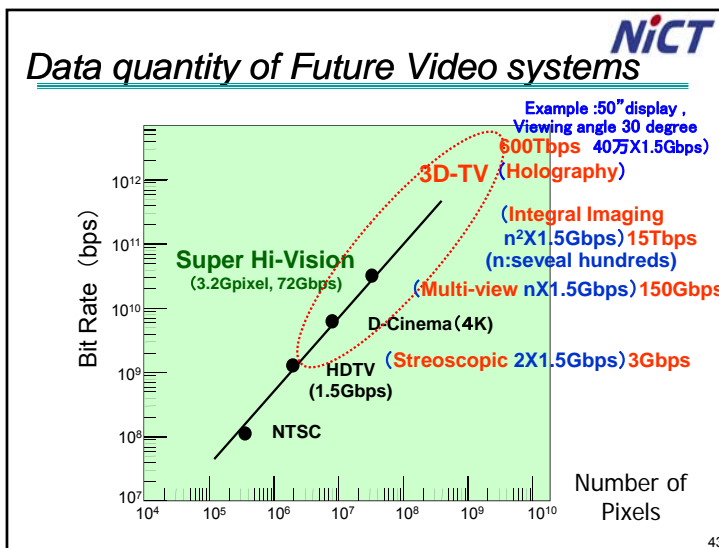
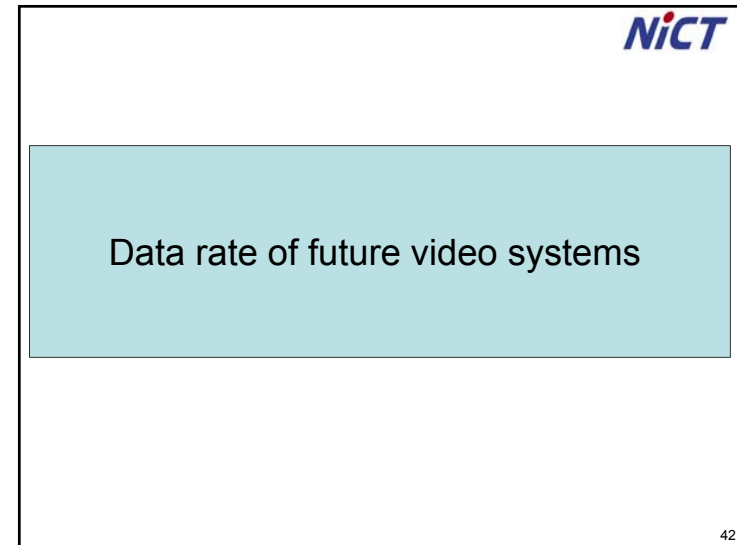
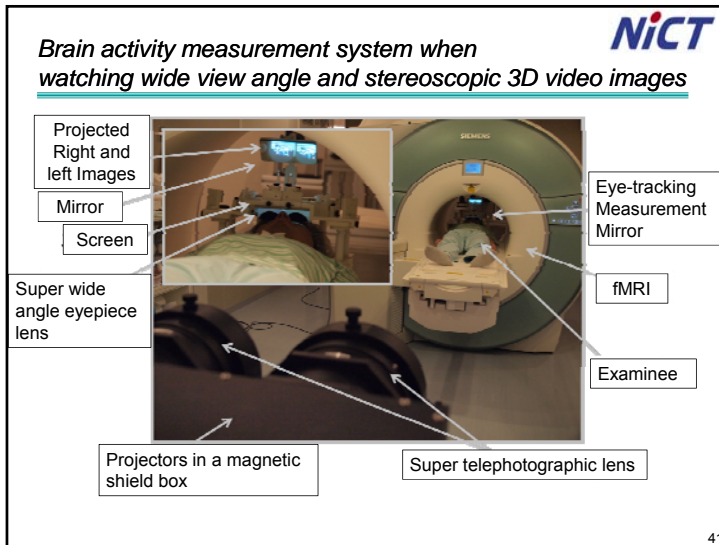


Brain imaging using fMRI when human is viewing wide and 3D image



Brain imaging using NIRS when human is smelling aroma oil

40



Ultra-Realistic Communications Forum



45



What is Ultra-Realistic Communications?

- **“Super-” realism**

Means of communication that furnish a highly realistic experience “beyond” space and time by physically capturing, transmitting, and reproducing multi-sensory stimulation and information on sight, hearing, touch, smell, and taste as faithfully as possible.

- **“Transcending” realism**

Means of communication that go “beyond” realism with more than physically transmitted information in order to provide a greater emotional impact and deeper understanding.

46

Future Ultra-Realistic Communications



Future Broadcasting



Tele-shopping



Remote medicine



Tele-work office



Educational applications



47



Technologies and Science to realize Ultra-Realistic communications

- Three dimensional image (3DTV)
- Ultra-high definition image
- Three dimensional sound reproduction
- Haptic sensor and reproduction
- Smell sensor and reproduction
- Multi-modal, cross-modal, and interaction system
- Investigation of the mechanism about human perception and cognition of “shared reality”

48

Ultra-Realistic Communications Forum



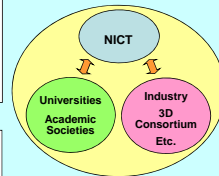
- On March 7, 2007, the URCF was established with the participation of industry, universities, the Ministry of Internal Affairs and Communications (MIC), and the NICT.
- The URCF promotes the development of technologies relating to HD images, 3D images, hyper-realistic sound, and multi-sensory communications.

Objectives

- Contribute to the advancement and development of technologies relating to HD images, 3D images, hyper-realistic sound, and multi-sensory communications
- Actively and efficiently promote R & D, verification experiment, standardization, etc.
- Create the most advanced ultra-realistic communications

Activities

- Hosting symposia and workshops
- Verification experiment
- Standardization
- Participating in various technical exhibitions
- Support of various research project
- Corporation with related consortia and academic societies

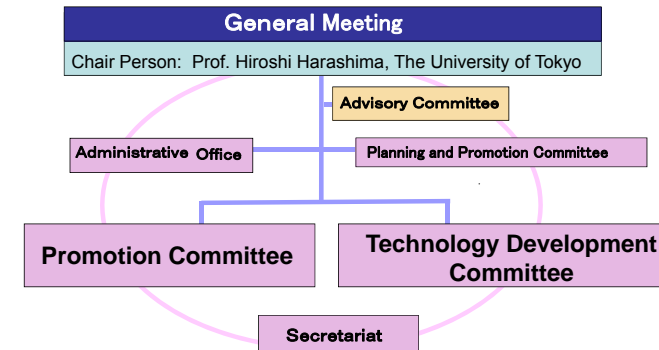


<http://www.scit.or.jp/urcf/>

(Members of URCF 194 at the end of November, 2010)

49

Organization



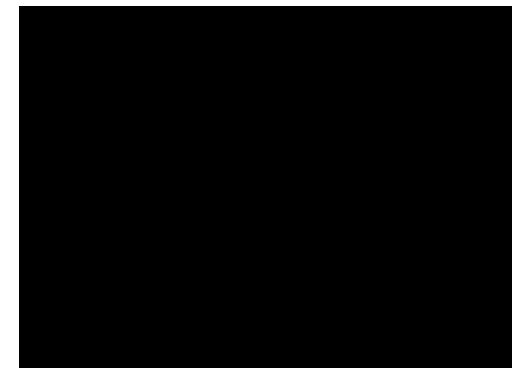
50



Summary

51

What will be possible using Ultra-Realistic Communication Technologies?



From promotion video for invitation World Cup Soccer 2018/2022 to Japan

52

Summary



- NICT is promoting R & D of the technologies to realize 3D image and sound reproduction, and investigation of the mechanism about human perception and cognition of "shared reality". Through these activities, we will be able to enjoy real and natural communications, "shared reality," as if people at great distance are in the same place at the same time.

53



Thank you for your kind attention!

54