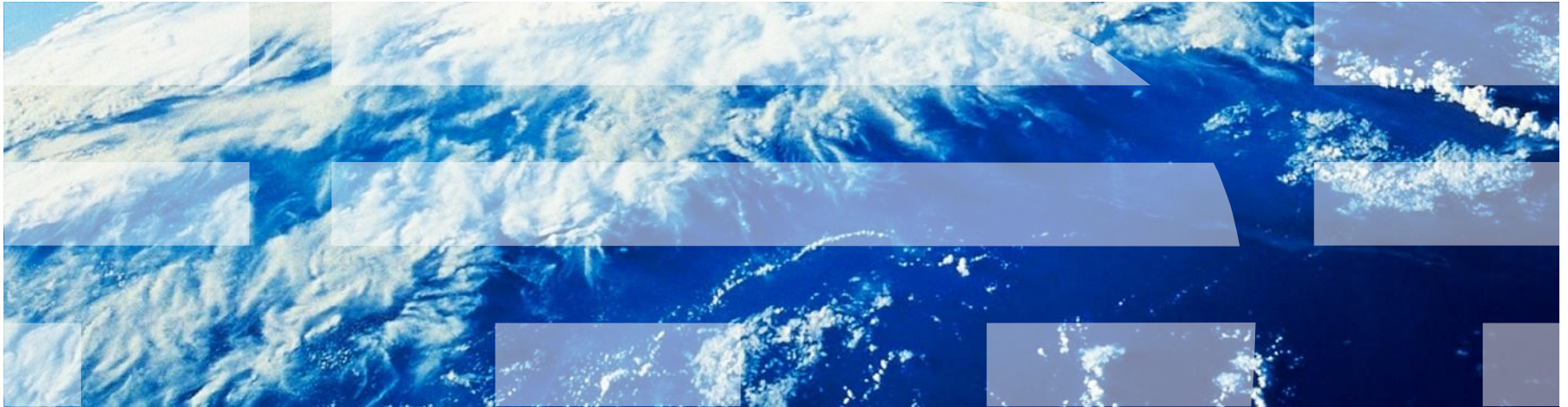Chieko Asakawa
IBM Fellow
IBM Research

Evolution of Assistive Technologies for the Blind

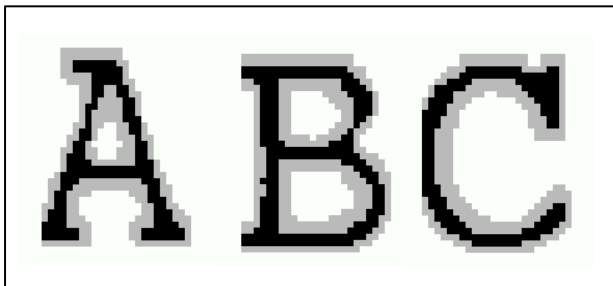# Special Technologies are Becoming General

Telephone
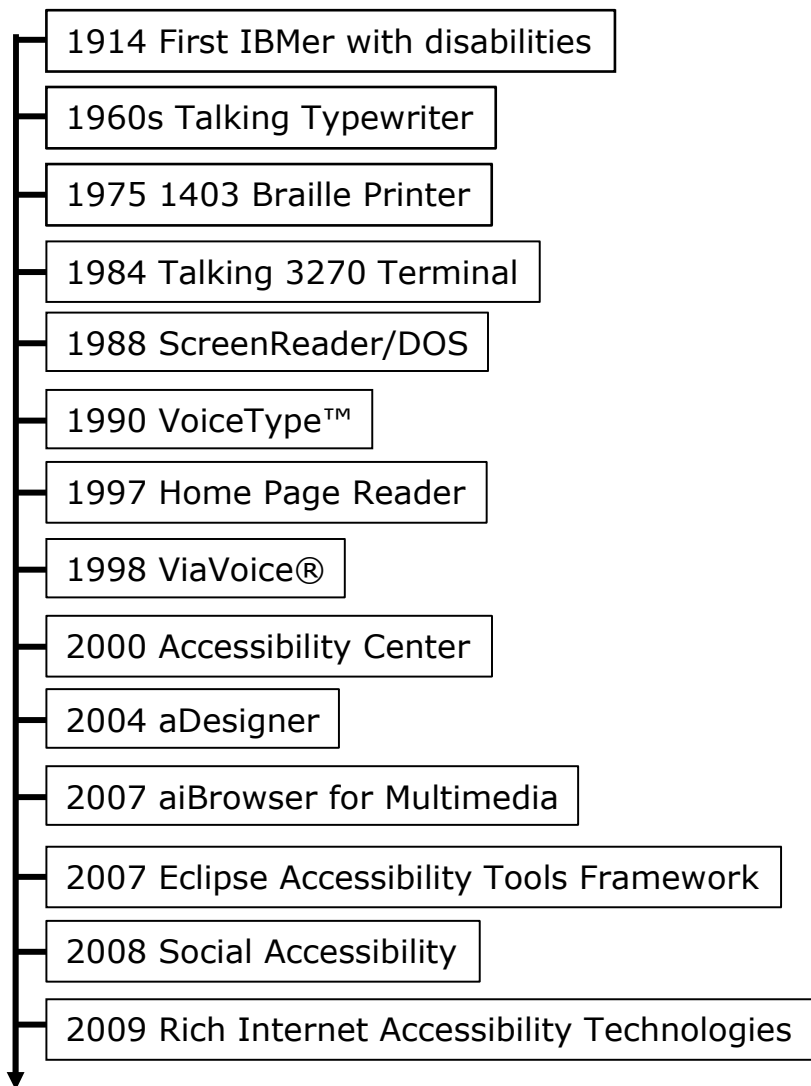

Keyboard

Optical Character Recognition
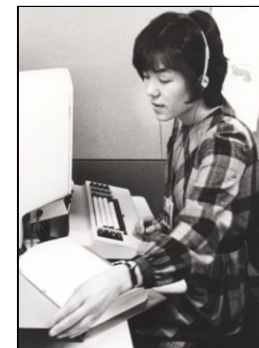

Voice Recognition

IBM Research Worldwide

IBM Research has about 3,000 employees worldwide among the 9 labs

Almaden	Watson	Zurich	Haifa	China
1986~	1961~	1955~	1972~	1995~

Austin	Brazil	India	Tokyo
1995~	2010~	1998~	1982~

IBM History of Accessibility

- 1914 First IBMer with disabilities
- 1960s Talking Typewriter
- 1975 1403 Braille Printer
- 1984 Talking 3270 Terminal
- 1988 ScreenReader/DOS
- 1990 VoiceType™
- 1997 Home Page Reader
- 1998 ViaVoice®
- 2000 Accessibility Center
- 2004 aDesigner
- 2007 aiBrowser for Multimedia
- 2007 Eclipse Accessibility Tools Framework
- 2008 Social Accessibility
- 2009 Rich Internet Accessibility Technologies
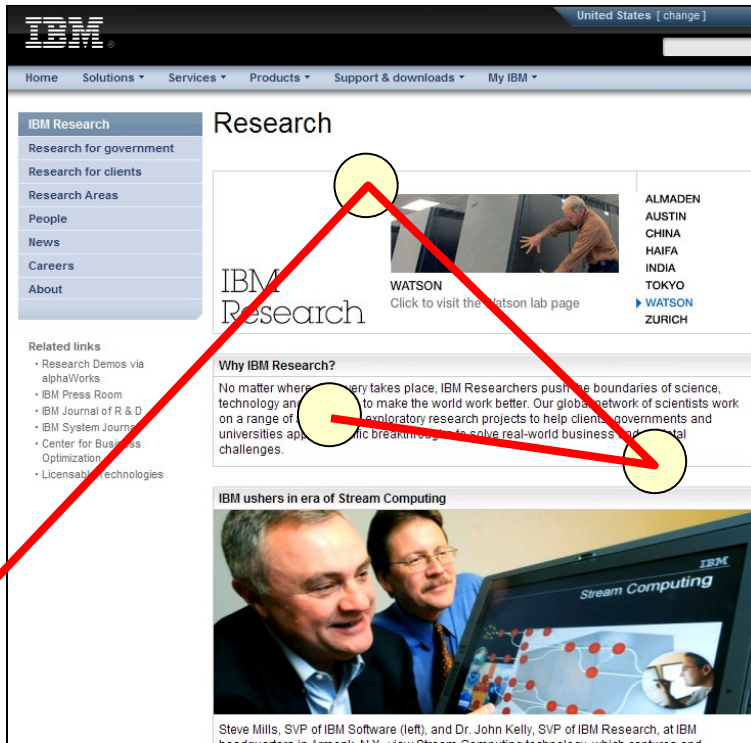
1960s
Talking Typewriter

1984
Talking 3270
Terminal

1999
Home Page Reader
Japanese, Italian, French, German, Spanish, US English, UK English, others

Large Difference Between Sighted and the Blind

Sighted

Eye-movement-based exploration
with visual cues

Blind

Skip to main content [event.]
[IBMr。] [event.]
United States
[change [event.]]
(Form 1 starts.)
[Search for:.]
[Text.] [event.]
[Search: Submit Button.] [event.]
(Form 1 ends.)
Home
Solutions [event.]
Services [event.]
Products [event.]
Support & downloads [event.]
My IBM [event.]
[IBM Sign in [event.]] [Register]
Research
(object: > > > >.)
Why IBM Research?
No matter where discovery takes place, IBM Researchers
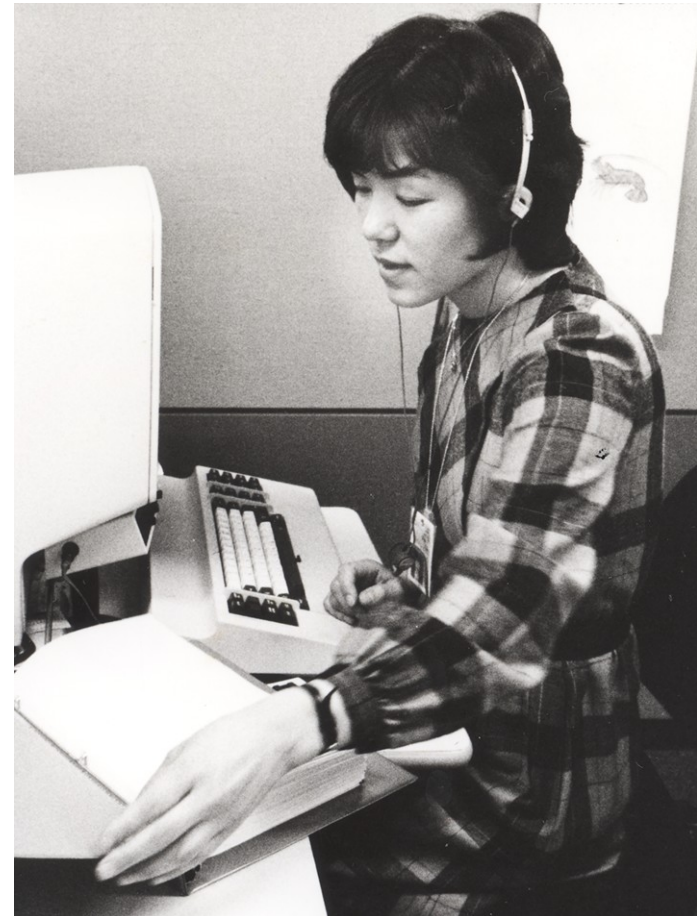
Keyboard-based exploration
without visual cues

Early Days (1980's)

http://www.asphi.it/

Optacon (1966)
Telesensory Systems, Inc.

Talking 3270 Terminal
1984

Information Accessibility | Progress

Access environment for the visually impaired

Exponential increase of accessible information (Conceptual chart)

Paper Braille

Braille Typewriter

1980s

Digital Braille

1990s

Voice Web access

Voice Web access

Digital Braille

Paper Braille

1980　1990　2000　2010

1988 IBM Digital Braille Systems

1997 IBM Home Page Reader
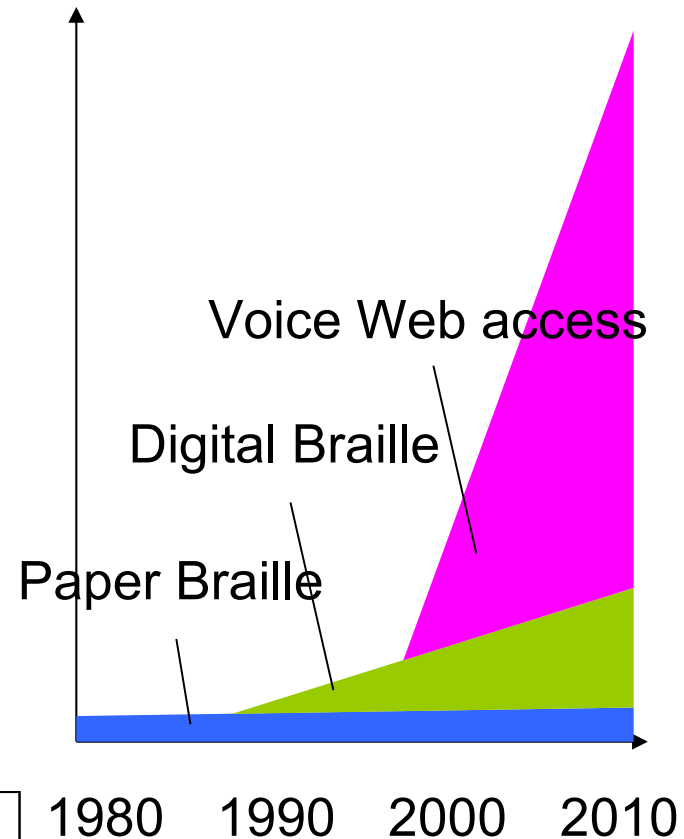
Home Page Reader

- One of the first voice browsers in the world
  - Became an IBM Japan product in 1997
  - Became an IBM Worldwide product in 1999
  - 11 languages by 2005

- Characteristics
  - Conversion of webpages (HTML tags) into voice data
  - Navigation of online shopping sites and Web search engines
  - Intuitive operation with a numeric keypad
  - Reading of hyperlinks in a female voice
  - Use of a fast-forward key for quick reading
  - Navigation of tables and frames

- Influenced Web accessibility activities and assistive technologies
  - Section 508, W3C WCAG, JAWS, etc.

Numeric Keypad Commands for HPR

■ Basic functions

Num Lock History	/ Help	* Mode setting	— Bookmark
7 Prev. character	8 Current character	9 Next character	+ Extended
4 Prev. line	5 Current line	6 Next line	
1 Prev. link	2 Current link	3 Next link	Ente Stop
0 Play		. (period) Pause	

■ Advanced functions

Num Lock Reload	/ Key-help	* 	
7 1st Character of line	8 Set reading methods	9 1st Character of next line	+
4 1st line of page	5 Set line definition	6 Last line of page	
1 1st link of page	2 Jump to linked page	3 Last link of page	
0 Fast-forward (hold down)		. (period) URL input / Web search	

First Cake I Bought On-line in 1997

Rokkatei
"Butter-sandwich" cookie

商　品: ☆マルセイバターサンド（30個入り）
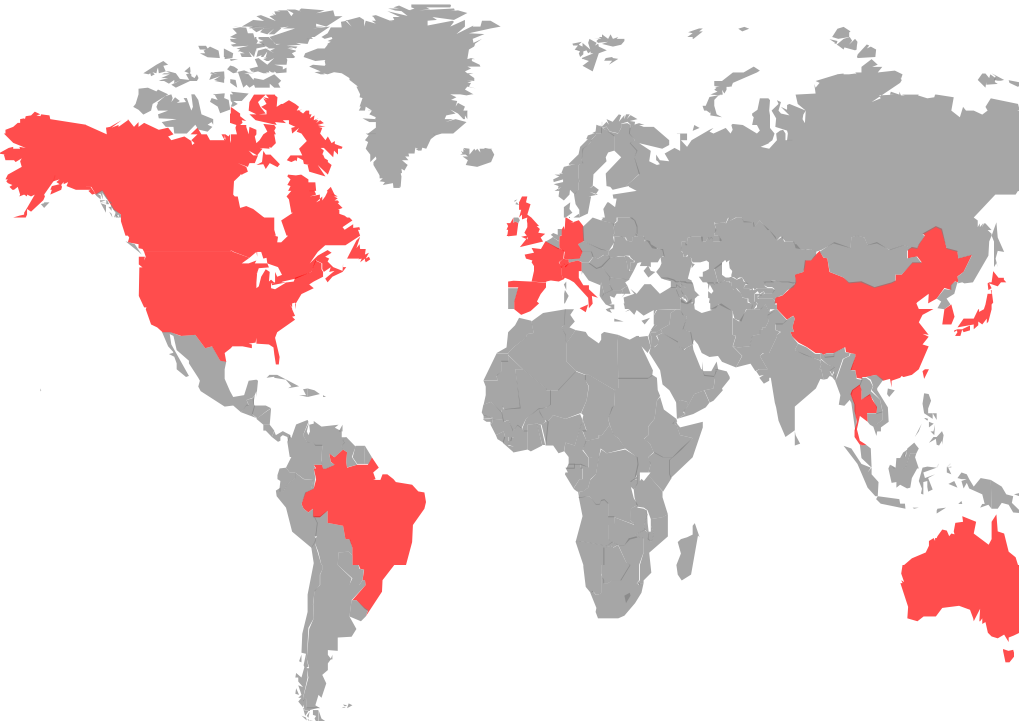販売価格: 3,300円　（消費税込）
送　料: 735円
体積(100立方cm): 28
縦×横×高さ(cm): 25×21×4.5
＊: ☆マルセイバターサンド30個入
個　数: 1　　かごに入れる

http://www.rokkatei.co.jp/

- DEMO

History of HPR

Year	Version	Language
1997	HPR V1.0	Japanese
1999	HPR V2.0	U.S. (American Eng.)
	HPR V2.5	Japanese, U.S., U.K., German, French, Spanish
2000	HPR V2.5	Chinese
2001	HPR V3.0	U.S.
	HPR V3.0	French, German, Italian, U.K., Spanish, Brazilian Portuguese
	HPR V3.01	Japanese
2002	HPR V3.0	Korean
2003	HPR V3.02	Thai
2005	HPR V3.04	U.S., U.K., German, French, Italian, Spanish, Brazilian Portuguese

User's Voices

Novice users

- It is really enjoyable to be able to read on my own a wide variety of information that is timely and related to my interests.
- I want to learn more about the Internet and personal computers.
- It's as if I've been given the ability to see.
- It's full of features yet the controls are simple, so I was able to use it after only a few minutes.
- My world has expanded now that I have been exposed to the Internet which I had previously thought was beyond my reach.
- With its simple controls, even those over 60 years of age can use it without needing to understand computers.

Experienced users

- Truly wonderful. One per household, indeed.
- I was able to perform a Web search with ease.
- Truly wonderful beyond comparison with other software. A bit sleep deprived from using it too much.
- I've been a user of DOS and UNIX, but with the emergence of HPR, the Internet environment became significantly easier and simpler.
- Due to its ability to facilitate collaboration with sighted users, I would like to see it actively deployed in schools.
- For me, PC is a window into society that enables writing, reading, searching, expressing, listening, and knowing. I would like to let many of my peers know about it.

*The comments are sampled from those received from the users between 1997 and 1998.

Cognitive Ability of Visually Impaired People
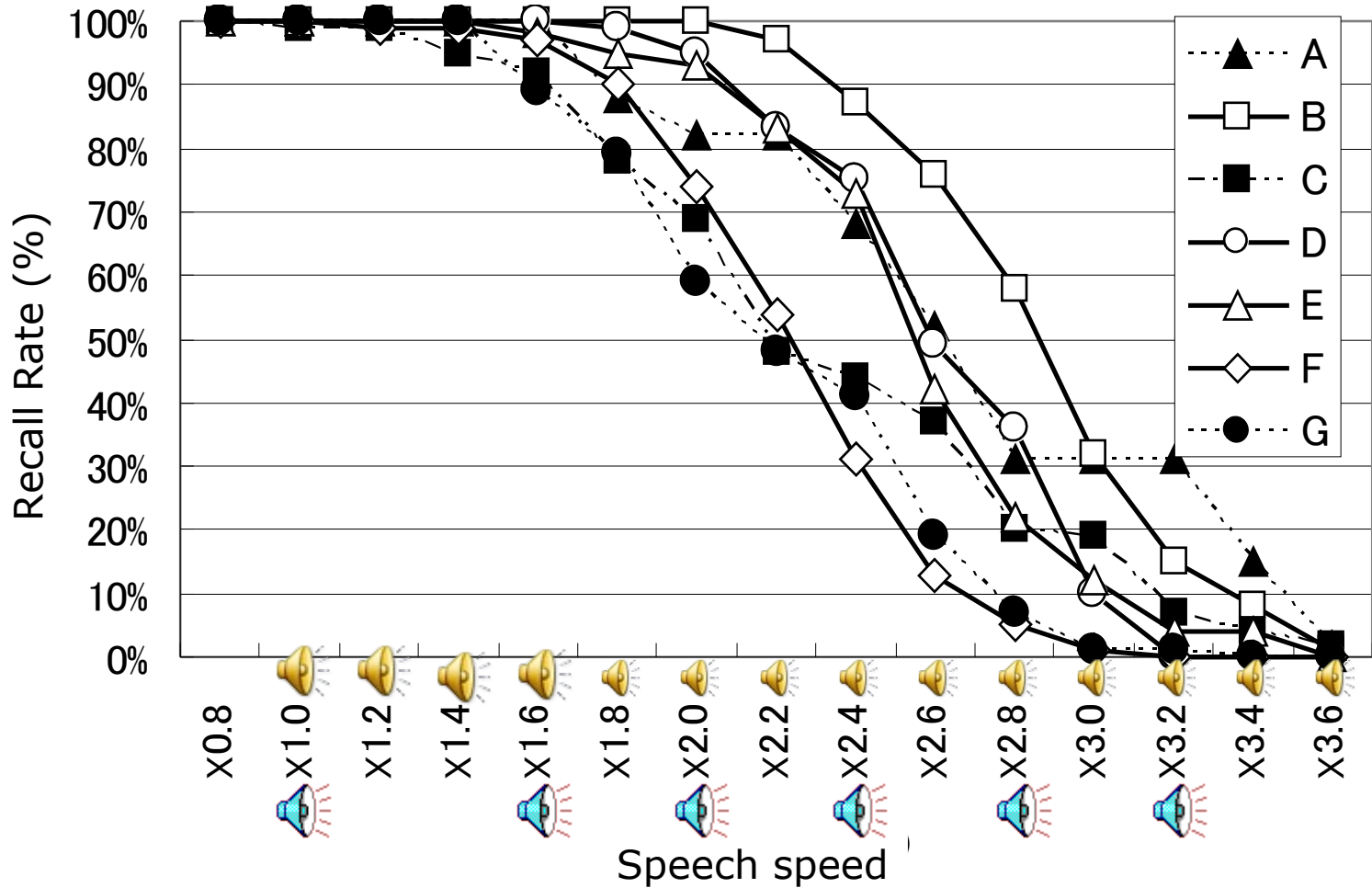
Impact of Web Accessibility on Productivity
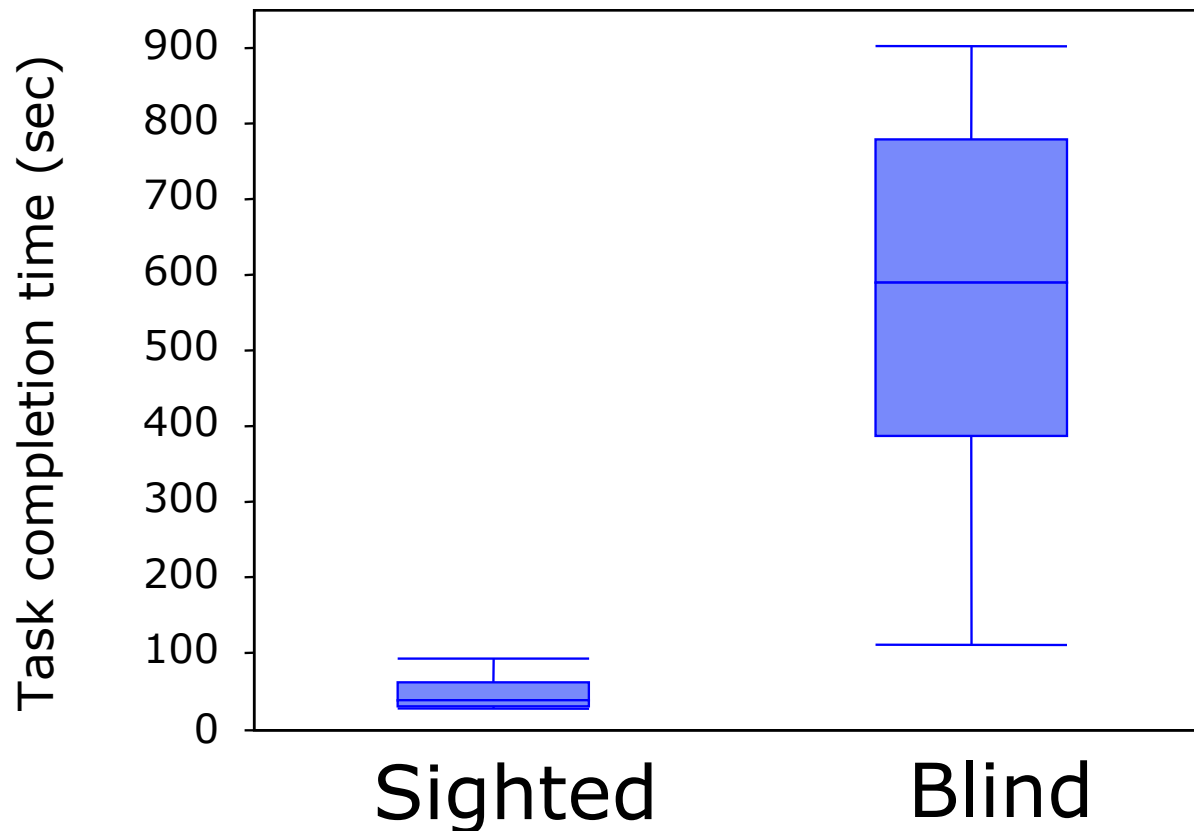
Task：Search for a DVD on an online-shopping site and put it into a shopping cart.

Takagi, H., Saito, S., Fukuda, K., and Asakawa, C. 2007. Analysis of navigability of Web applications for improving blind usability. *ACM Trans. Comput.-Hum. Interact.* 14, 3 (Sep. 2007), 13.

Information Access as a Human Rights

■ **U.N. Millennium Development Goals**

Target 8.F:
In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

■ **U.N. Convention on the Rights of Persons with Disabilities**

■ **Not Signed** ■ Signed Convention ■ Signed Convention & Protocol ■ Ratified Convention ■ Ratified Convention & Protocol
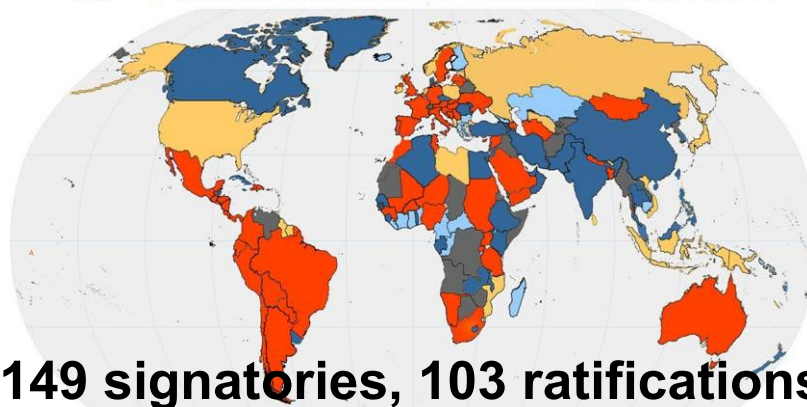
149 signatories, 103 ratifications

2011年7月現在　http://www.un.org/disabilities/

Article 9. Accessibility
...情報通信（情報通信技術及び情報通信システムを含む。）...サービスの利用可能性における障がい及び障壁を特定し、及び撤廃することを含む...

■ **Access to the internet as a human right**

OSCE media freedom representative calls on governments to recognize access to the Internet as a human right

OSCE Representative on Freedom of the Media, Dunja Mijatović, Astana, 1 December 2010. (OSCE)

WASHINGTON, 15 July 2011 – Dunja Mijatović, the OSCE Representative on Freedom of the Media, called on governments to treat Internet access as a human right that should be enshrined in their constitutions, in testimony today at the U.S. Helsinki Commission.

OSCE Press Release, 15 July 2011

16

ACTF aDesigner

- Objective
  - Provide a tool to **learn** about real accessibility issues
    - Encourage Web designers to check accessibility whenever they are authoring pages.
  - Provide a tool to effectively demonstrate accessibility issues
    - Encourage site-owners to renovate their pages to be accessible.
- Functions
  - **Visualization of blind usability**
    - Reaching time and reading text visualization
    - Integration with a voice browser engine
  - **Simulation of low vision**
    - Weak eyesight, color vision deficiencies, cataracts.
    - Detect color combination problems.
  - **Presentation simulation**
    - Check visibility of presentation slides in large conference rooms.
  - Checking compliance items from the usability point of view
    - Appropriateness of ALT texts and skip-navigation links, etc.
    - WCAG 2.0, JIS X 8341-3:2010, Section 508, etc.
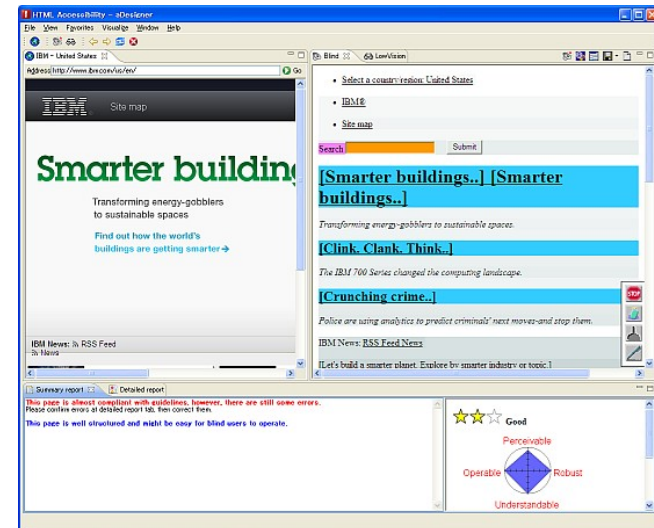
Download aDesigner from Eclipse Accessibility Tools Framework project!
http://www.eclipse.org/actf/downloads/tools/aDesigner/index.php

Examples of aDesigner's Reaching-time Visualization

(a) Original
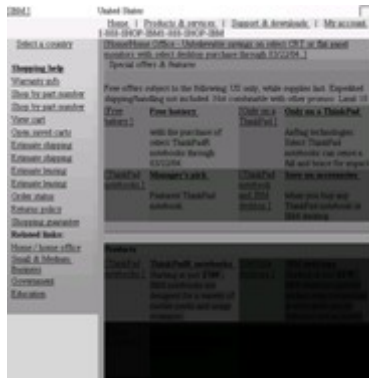
(b) Visualization
(Inaccessible)

(c) Visualization
(With skip-link)
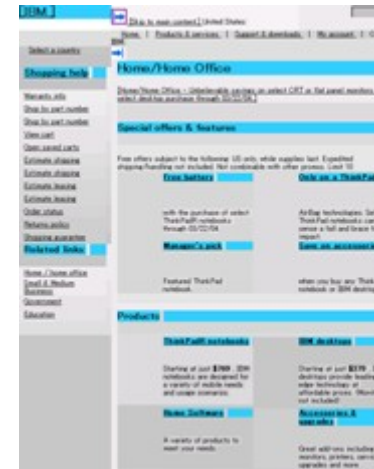
(d) Visualization
(With headings)

File   View   Favorites   Visualize   Window   Help

Live Train Times

Address http://www.transperth.wa.gov.au/TimetablesMaps/LiveTrainTimes/tabid/436/:   Go

Blind   LowVision

○ Web   ● Site

metro area   A⁺ A⁻ R

Search

Service Updates   Accessible Services   TravelEasy   Library

Register | Login

Live Train Network Status

Train Line	To Perth	From Perth
Armadale Line	●	●
Fremantle Line	●	●
Joondalup Line	●	●
Mandurah Line	●	●
Midland Line	●	●

Last Updated: Jul 15, 2011 at 10:09:44AM

Legend

● No services are currently delayed by no more than 2 minutes

---

○ Web   ● Site

rth metro area   A⁺ A⁻ R

Search

h   Service Updates   Accessible Services   TravelEasy   Library

Register | Login

Live Train Network Status

Train Line	To Perth	From Perth
Armadale Line	●	●
Fremantle Line	●	●
Joondalup Line	●	●
Mandurah Line	●	●
Midland Line	●	●

Last Updated: Jul 15, 2011 at 10:09:44AM

Legend

● No services are currently delayed by no more than 2 minutes

● One or more services are currently delayed by 3 to 4 minutes

---

Summary report   Detailed report

Some parts of this content use color combinations that are difficult to distinguish from each other.
Please confirm these parts by clicking problem items in detailed report.

Foreground/background color combination of text: 50

This content seems to have fixed size fonts.

Overall rating: ☆☆☆

Problem Map

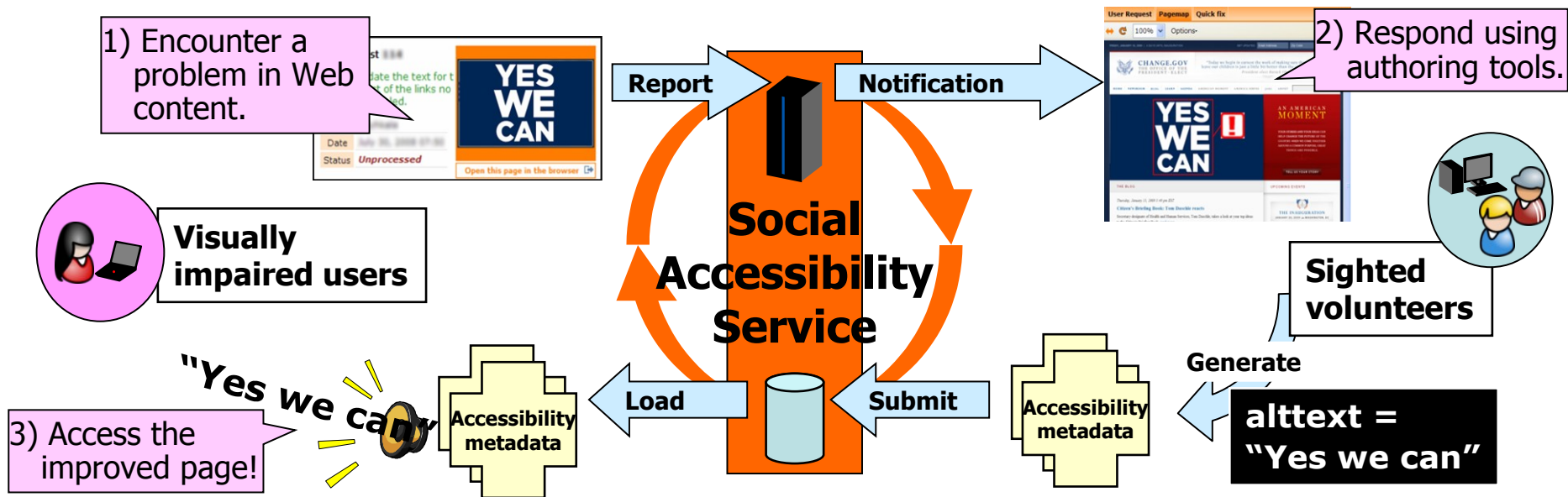# Example of Color Deficiency Simulation
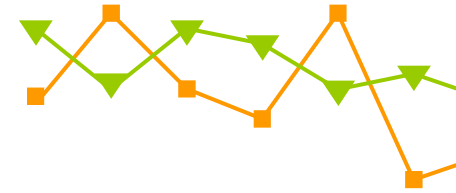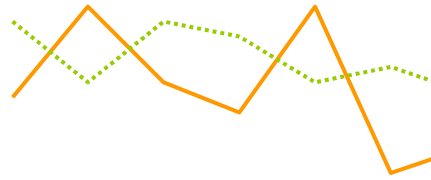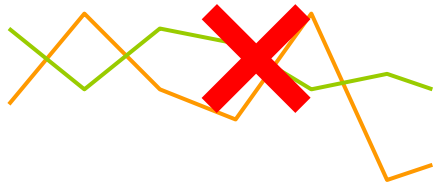
Simulation by aDesigner
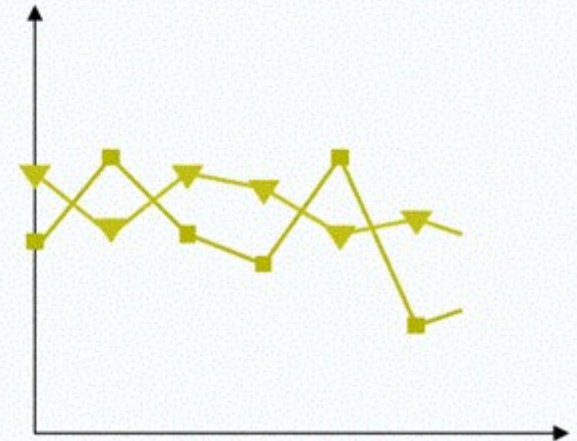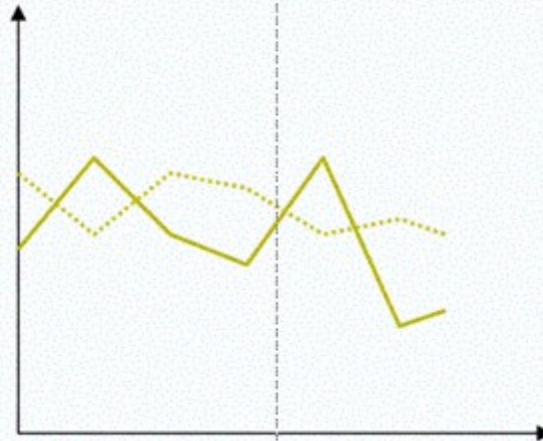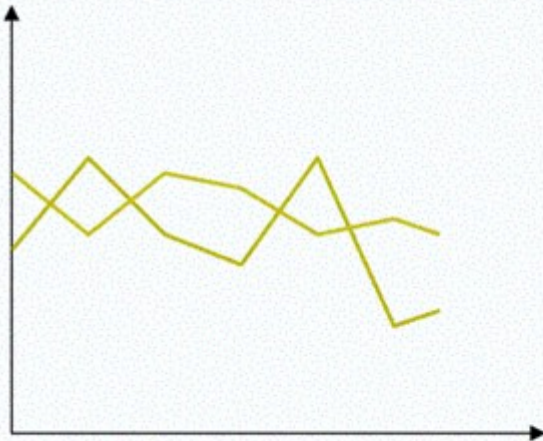
Social Accessibility

New methodology to make webpages on the Internet more accessible by gathering users' voices and by using the power of the open community.

- Social computing + accessibility

- Any Web user can improve the accessibility of any webpage on the Internet without changing the original content.

- Any visually impaired user can join the improvement process through various collaboration mechanisms.

1) Encounter a problem in Web content.

2) Respond using authoring tools.

Report   Notification

Social Accessibility Service

Visually impaired users

Sighted volunteers

3) Access the improved page!

"Yes we can"

Load   Submit   Generate

Accessibility metadata

Accessibility metadata

alttext = "Yes we can"

Example

Success Case 1 – Hospital Site

User request

"I feel this page is too complicated and not easy to understand."
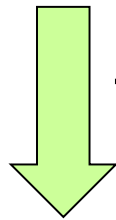
7 hours

A supporter fixed the website.

- 10 alternative texts and 121 heading tags
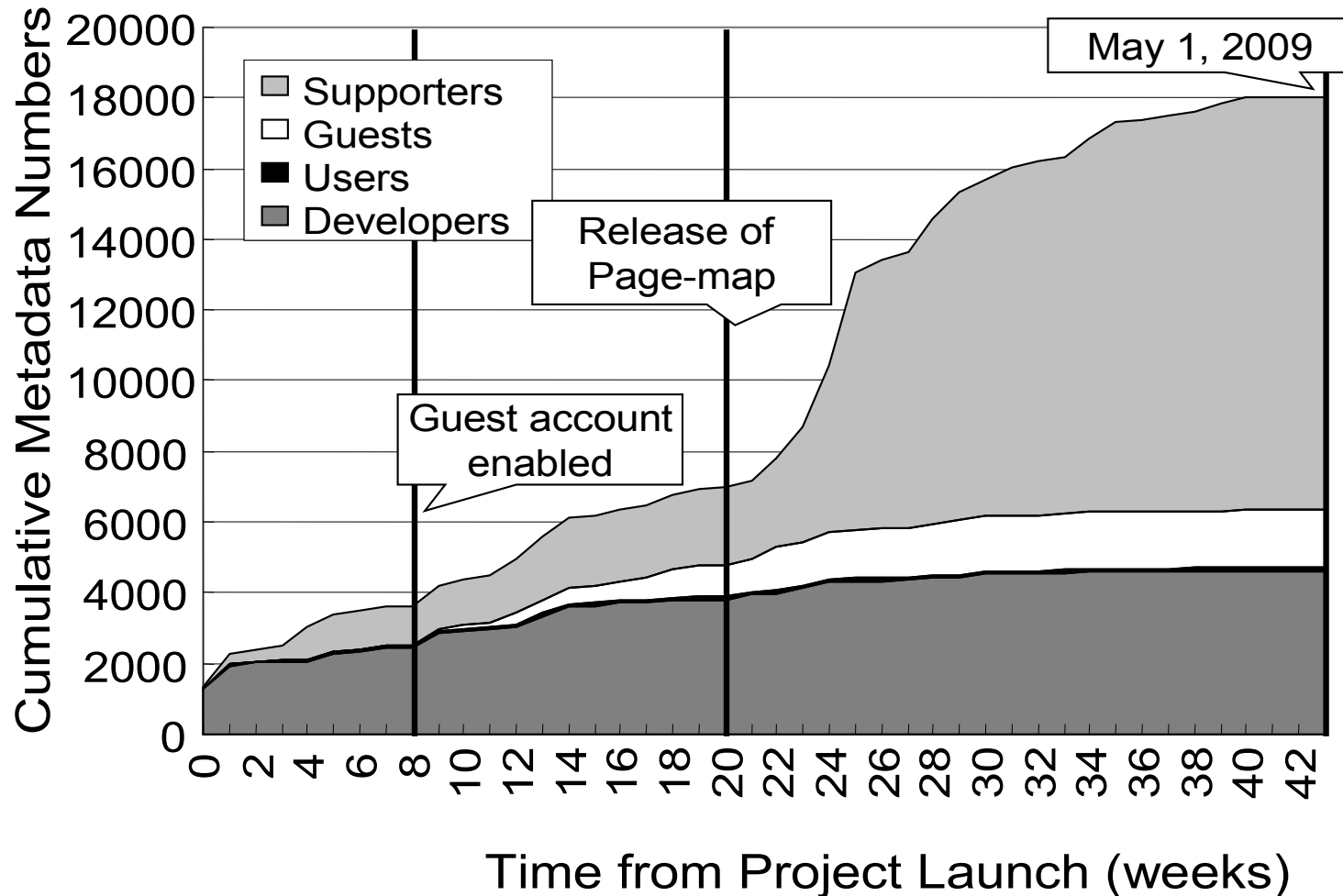- for 22 of the webpages
- in 18 minutes.

Before

After

Volunteer Activities
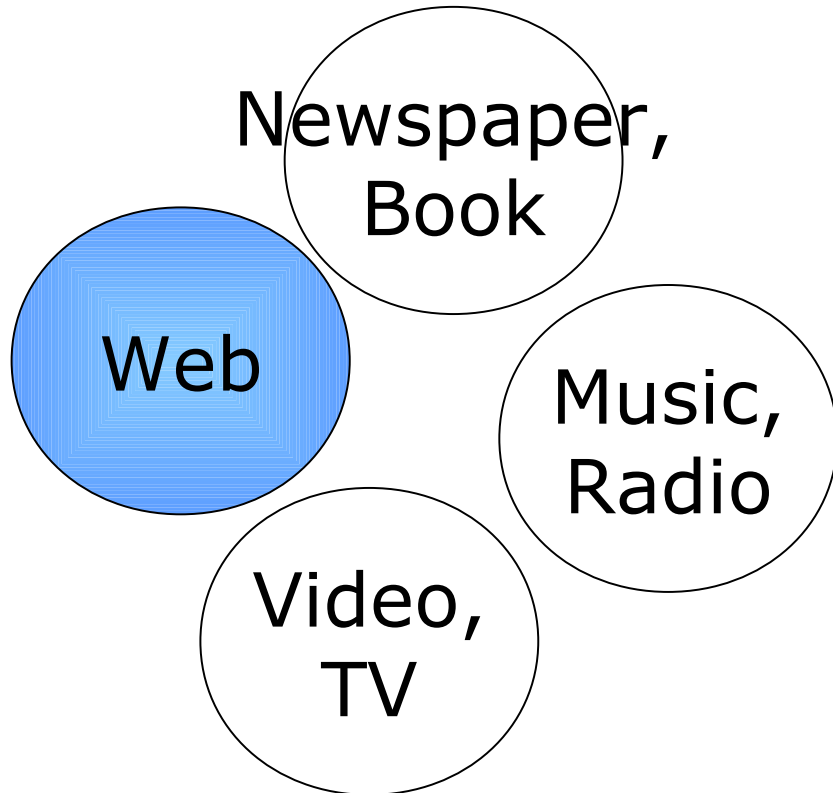
"They don't know What They don't know."

> High ratio of users are not aware of
> the problems they are facing

- "I'm not sure what I can request."
  - "Every page is difficult for me…"
  - Novice and intermediate users
- "I will stay away from a site where I faced problems."
  - "Run away" mentality
  - Intermediate and expert users
- Essential difficulty
  - E.g. difficult to recognize inappropriate heading positions
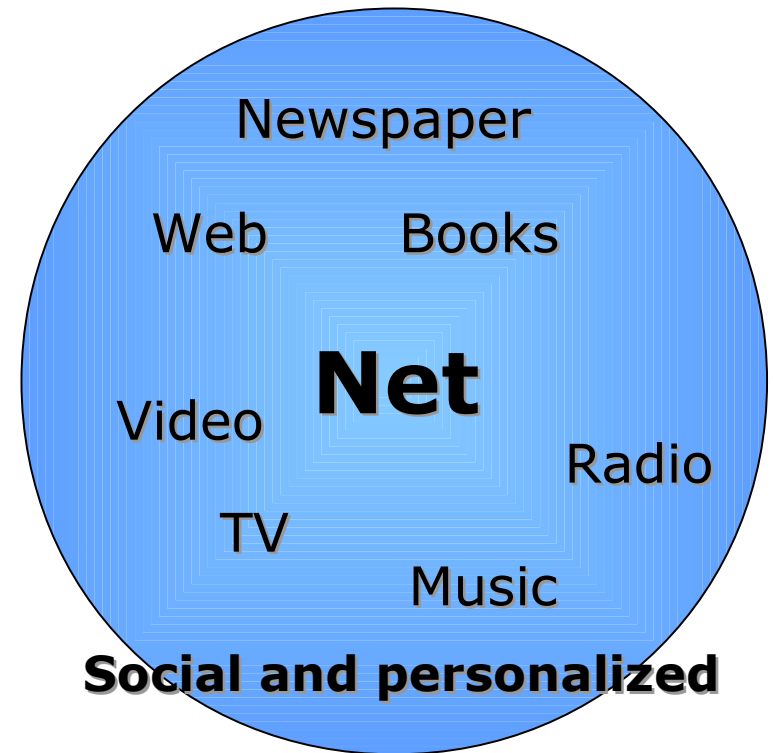- Technical limitations
  - Stealth (window-less) Flash

Quit using the Web!

Expansion of Net, Expansion of Web Accessibility

2000

Newspaper, Book

Web

Music, Radio

Video, TV

**HTML 4.x
WCAG 1 era**

201x

Newspaper

Web   Books

Net

Video

Radio

TV

Music

Social and personalized

**HTML 5
WCAG 2 era**

Status of Captions and Audio Descriptions

	Captions	Audio Descriptions
Internet	5.0%[1]	0.0%[1]
Movies	12.0%[4]	0.9%[4]
TV (Private)	42.3%[2]	0.4%[3]
TV (Public)	49.4%[2]	5.6%[3]

*1: Our informal survey (2009)
*2: Ministry of Internal Affair and Communication (2008)
*3: National Institute of Information and Communications Technology (2008)
*4: Media Access Support Center (2008)

Possible Reduction of Workload

Current audio descriptions

Synthesized audio descriptions

Workload

Recording

Transcribing

Recording

Transcribing

Reduction by Synthesis

Reduction by Tool support
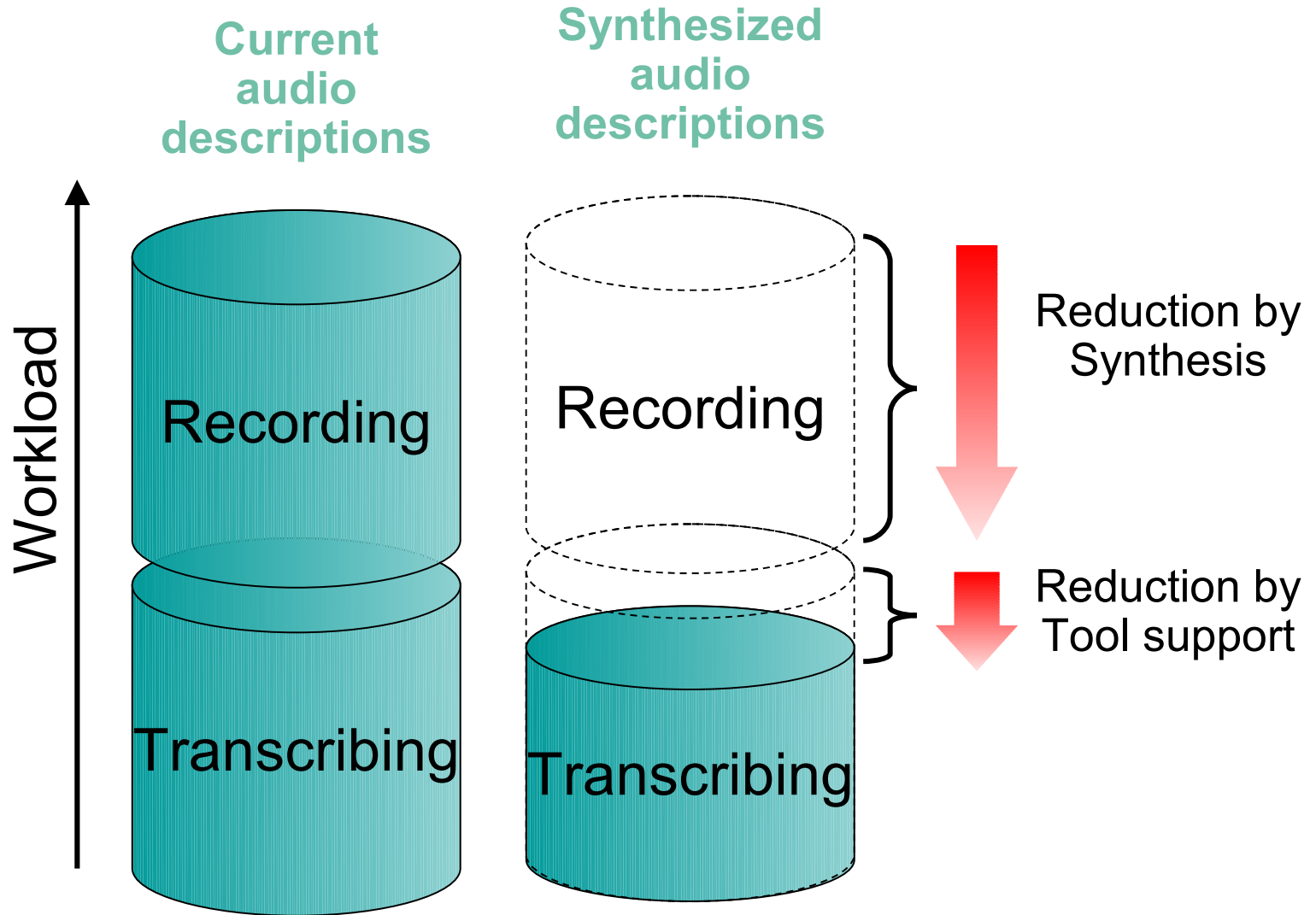
New Challenges for Accessibility Technologies

650 Million

Persons with Disabilities

560 Million

Senior population

770 Million

Literacy problems

World population 6.5 Billion

Expansion of "Accessibility"

Access to society

Access to buildings

Access to information systems

1970s

1990s

2010s

Inclusive society
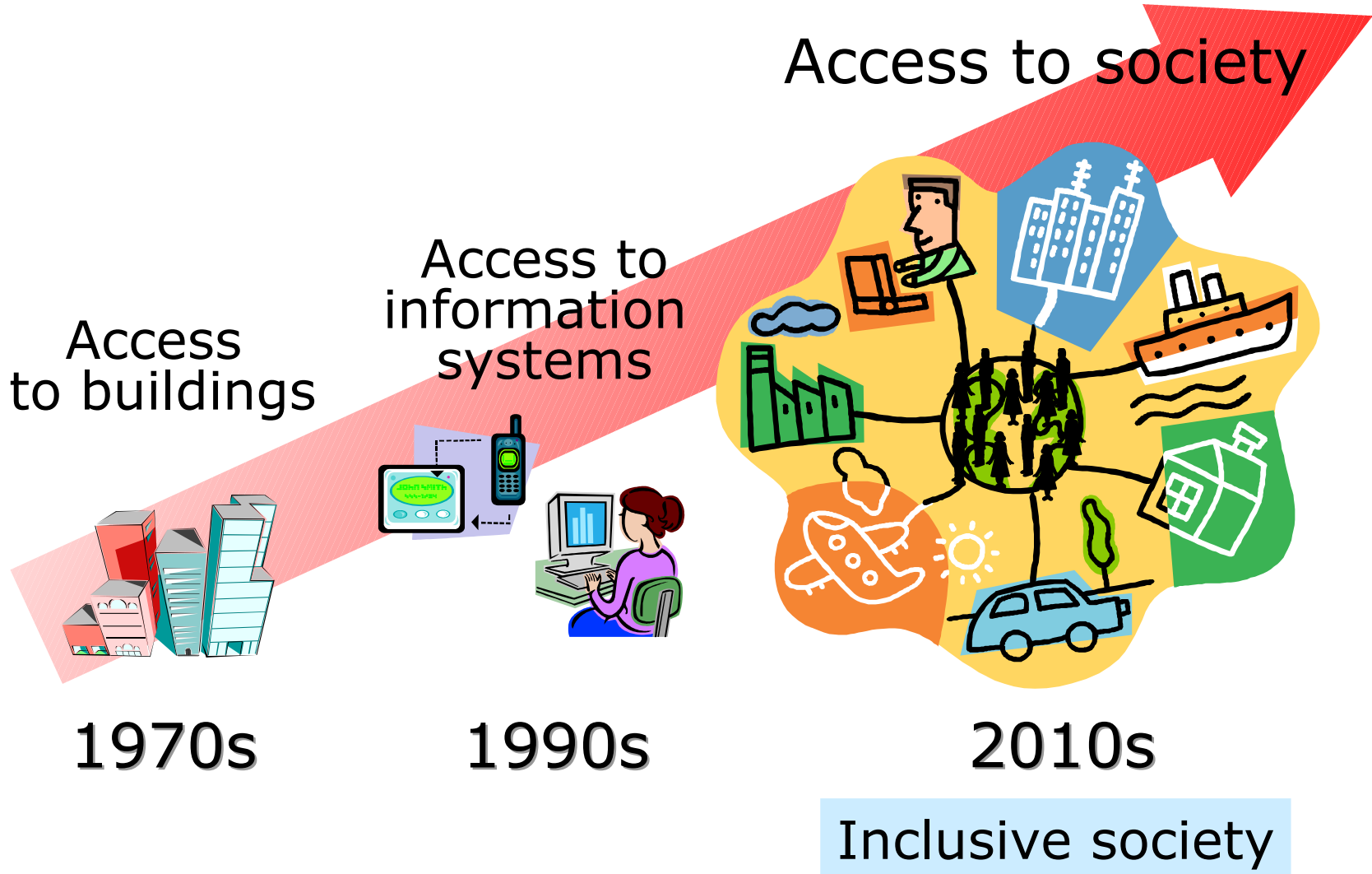
Spoken Web

Scenario: Service Delivery Through a Phone to Rural Populations

A village entrepreneur gathers important information including train schedules and current prices of grain

And uploads all the information over the phone.

A villager wants information on train timings.
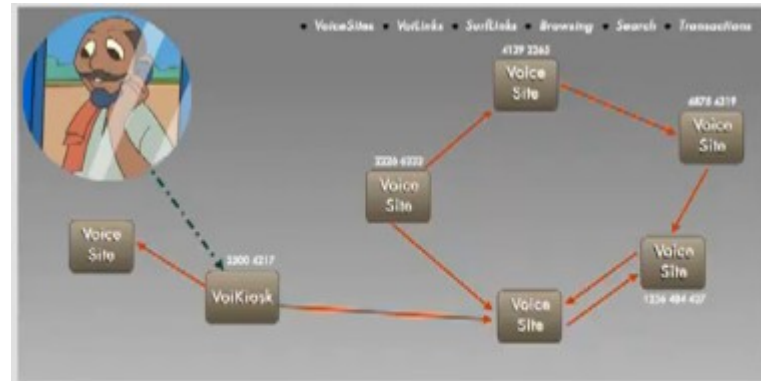
The Villager then dials in to the VoiceSite and gets the info he needs in one phone call.

http://www.youtube.com/watch?v=trFfrOiCSWQ

© 2011 IBM Corporation

Advent of Super-aged Society

(%) Percentage aged 65 or over (%)

- Decreasing working-age population
- Retirement of baby-boomers

Japan

U.S.

Europe

China

India

Ratio of Young Workers to Elderly

1990	2010	2030	2050
5.9	2.8	1.9	1.4
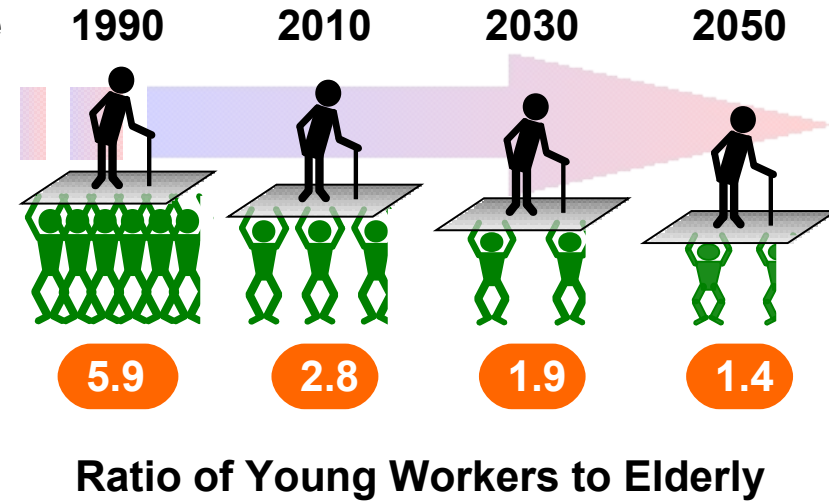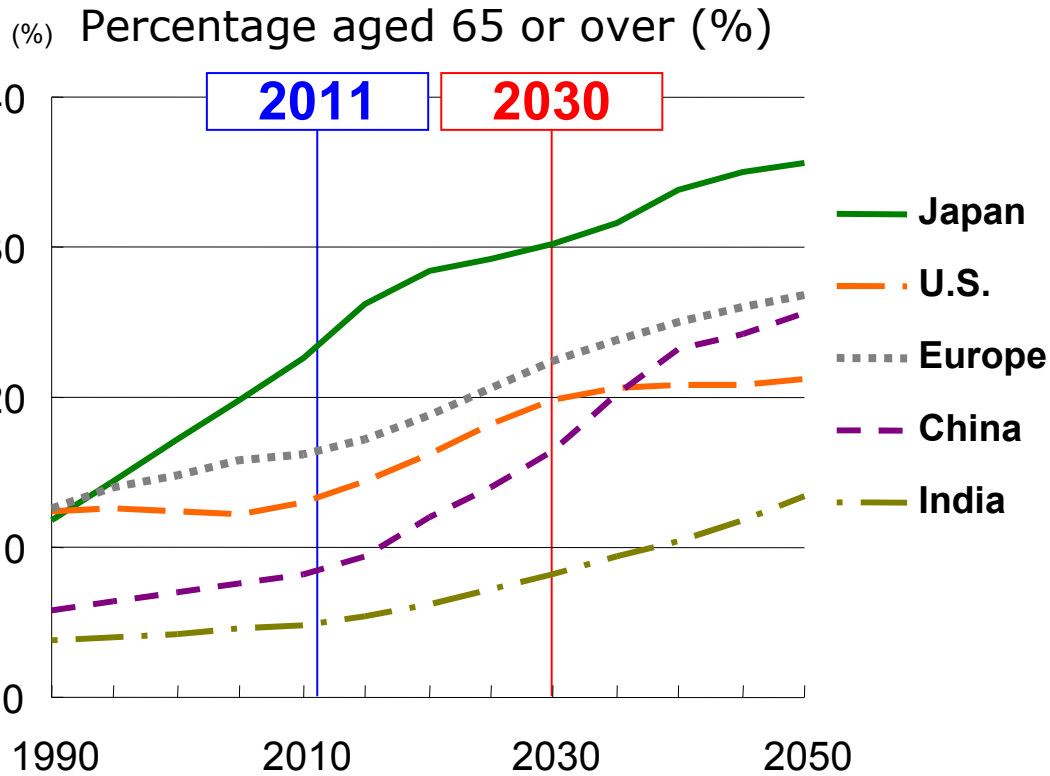
Source: United Nations, World Population Prospects: The 2010 Revision

Sasayaki (Whispering) Interface based on Analytics

Interface Technology to provide supportive information based on analysis of sensors embedded in the environment.

- Voice-oriented augmented reality technology

- "Sasayaki" (Whispering) as the analogy.
  - "Please insert coins before selecting a station."
  - "Please watch your steps. Hazardous section ahead."
  - "A car is coming. Please be careful."
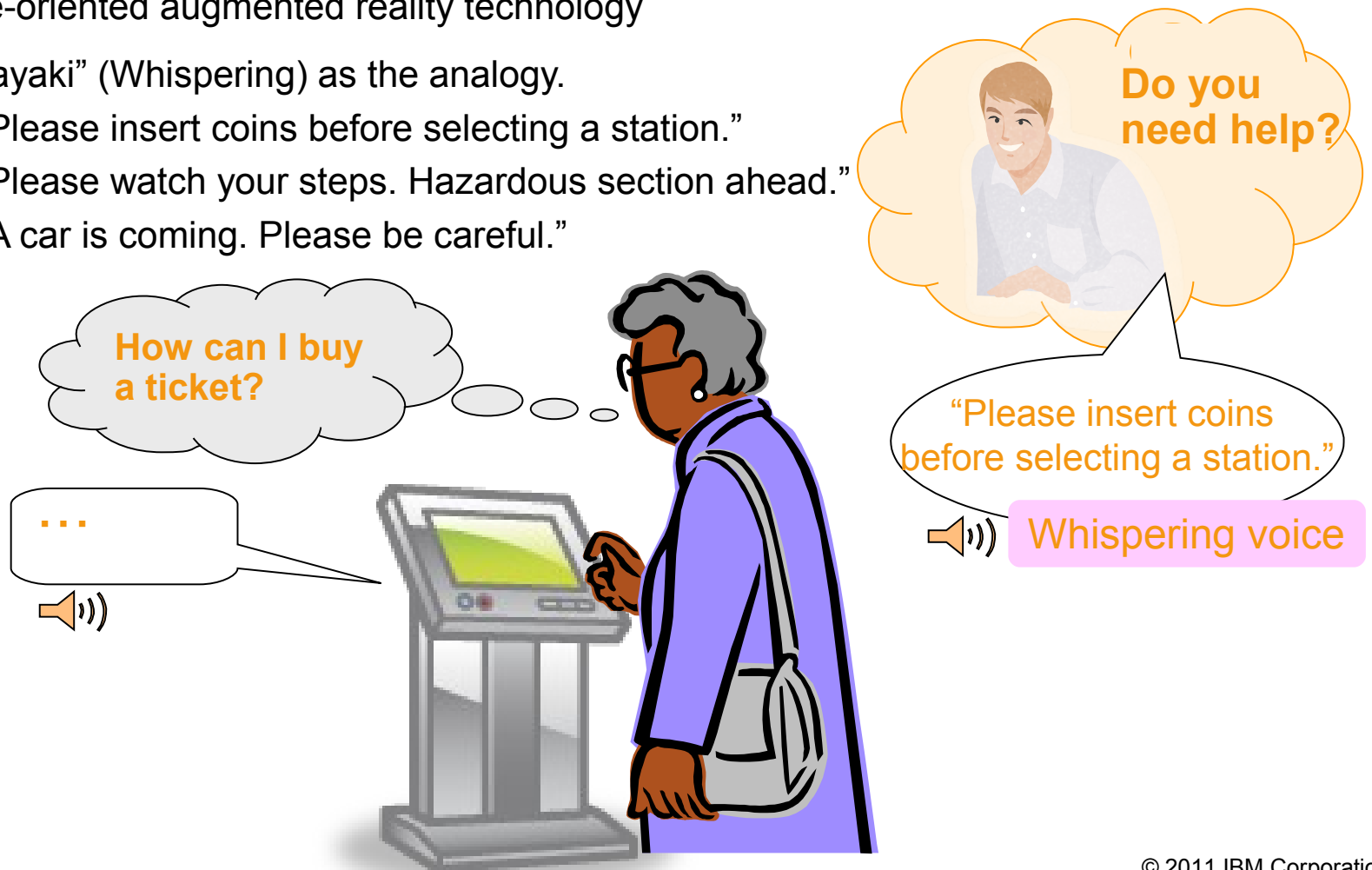
Information Democratization | Beyond the Language Barrier

Multilingual Community

Translation service by Crowd sourcing

Automatic translation

Automatic translation

Mr. S (78, India)

Automatic Translation

Mr. N (84, Japan)

New Securities Firm (Tunisia)
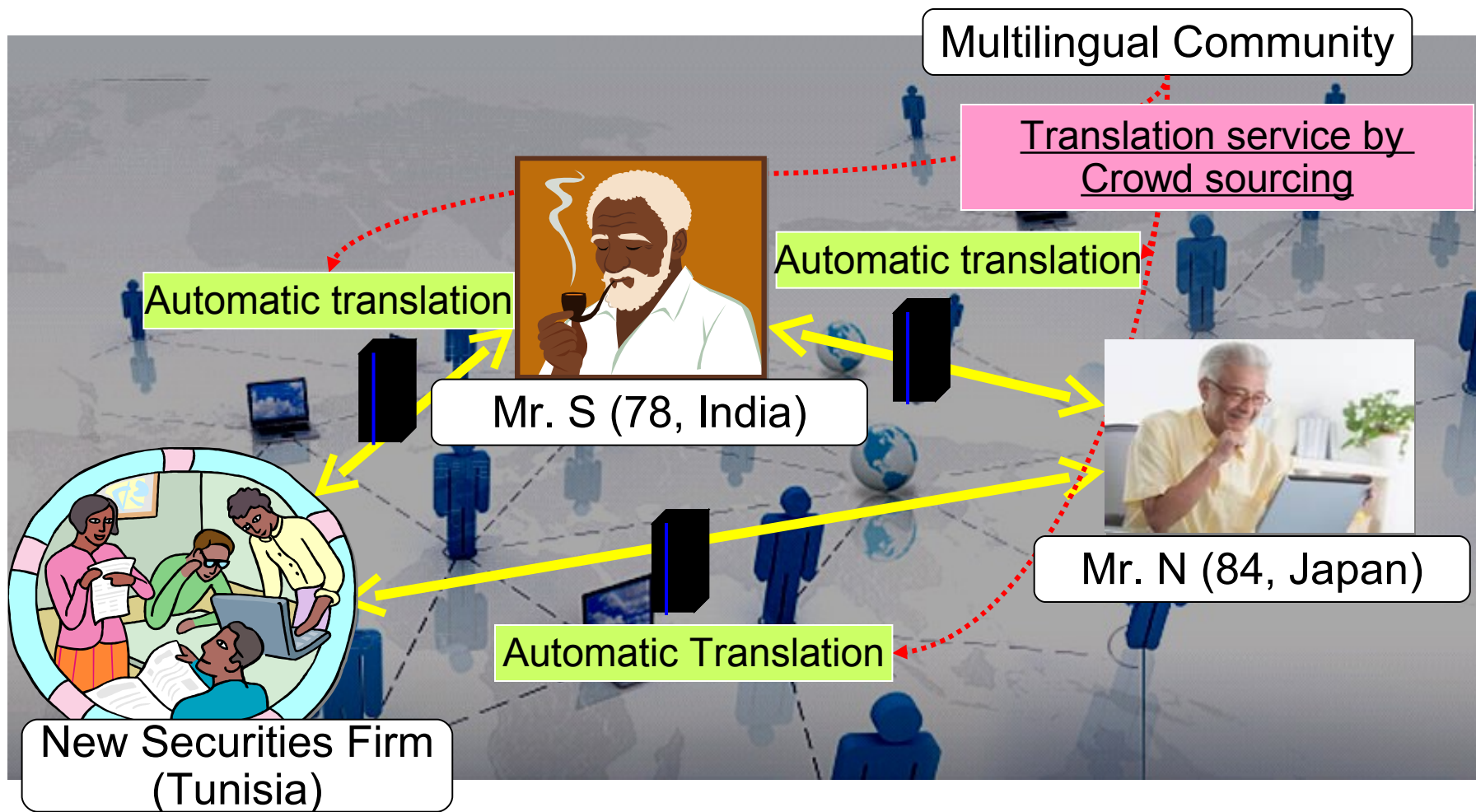
Information Democratization | Fight against Information Overload
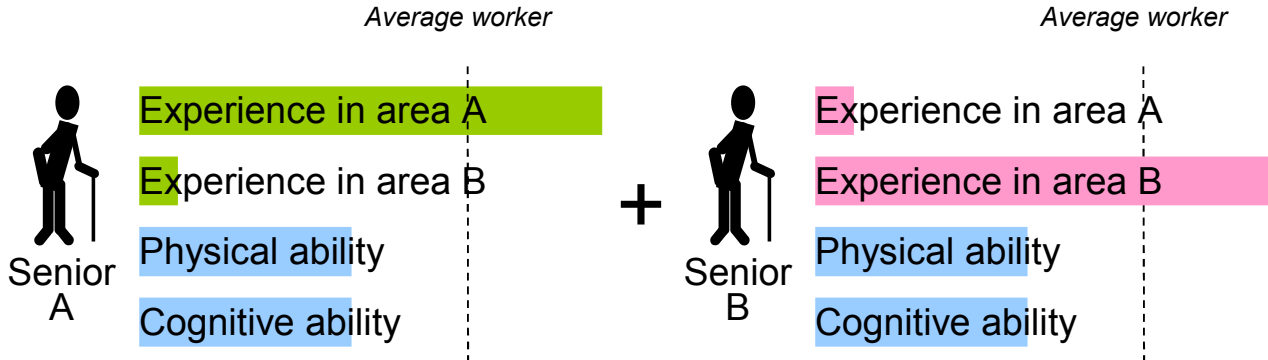

Information Visualization
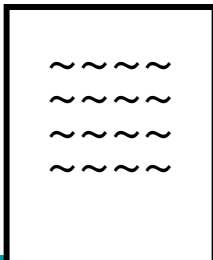
Automatic Summarization
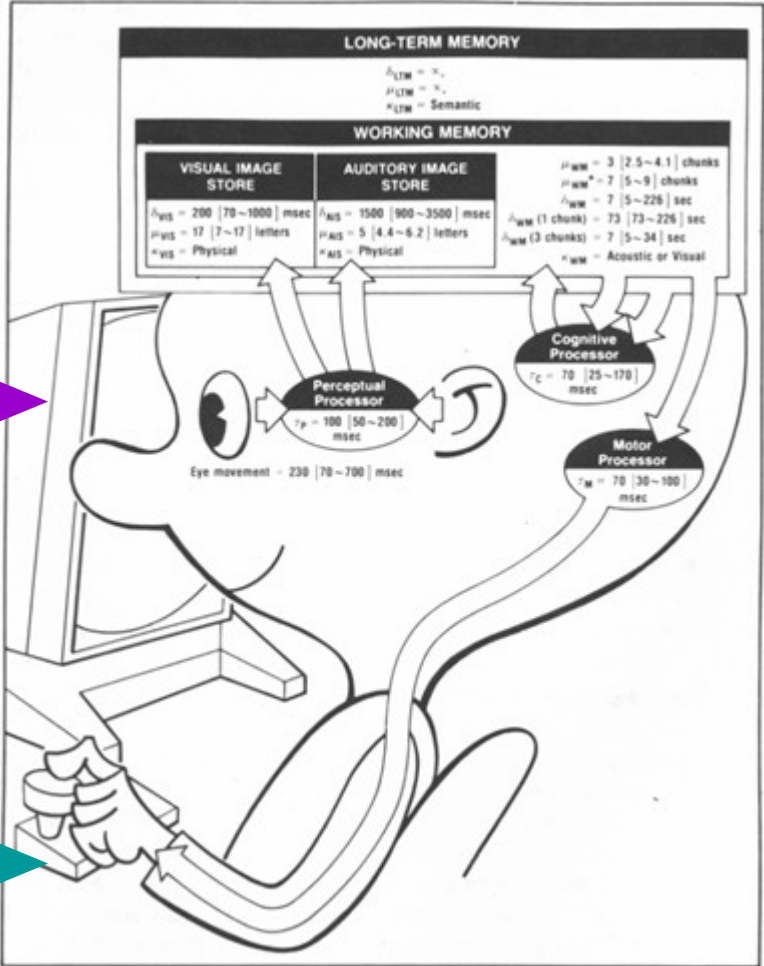
Model Human Processor~The Psychology of Human-Computer Interaction

- デモ

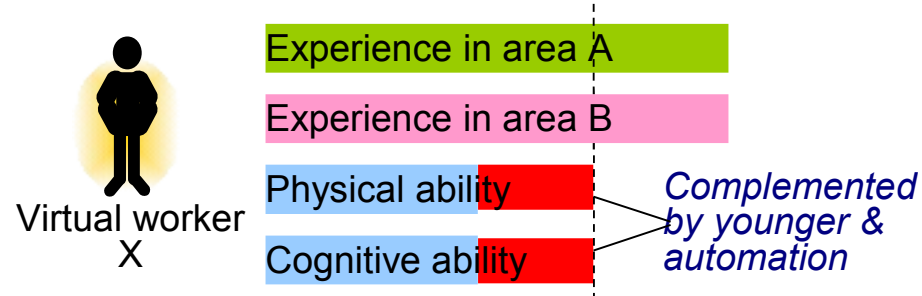# Senior Cloud Project

Senior Workforce Mosaic

Scenario: Remote Forestry

Social Participation
The "Loop" Enabled by Information Democratization

Information Democratization

Accessibility

Social Media

Ambient Interaction

Visualization and Summarization

Machine Intelligence （Translation, QA, etc.）

Participation in society

Social **Connection**

Motivation for social activities

Learning new skills