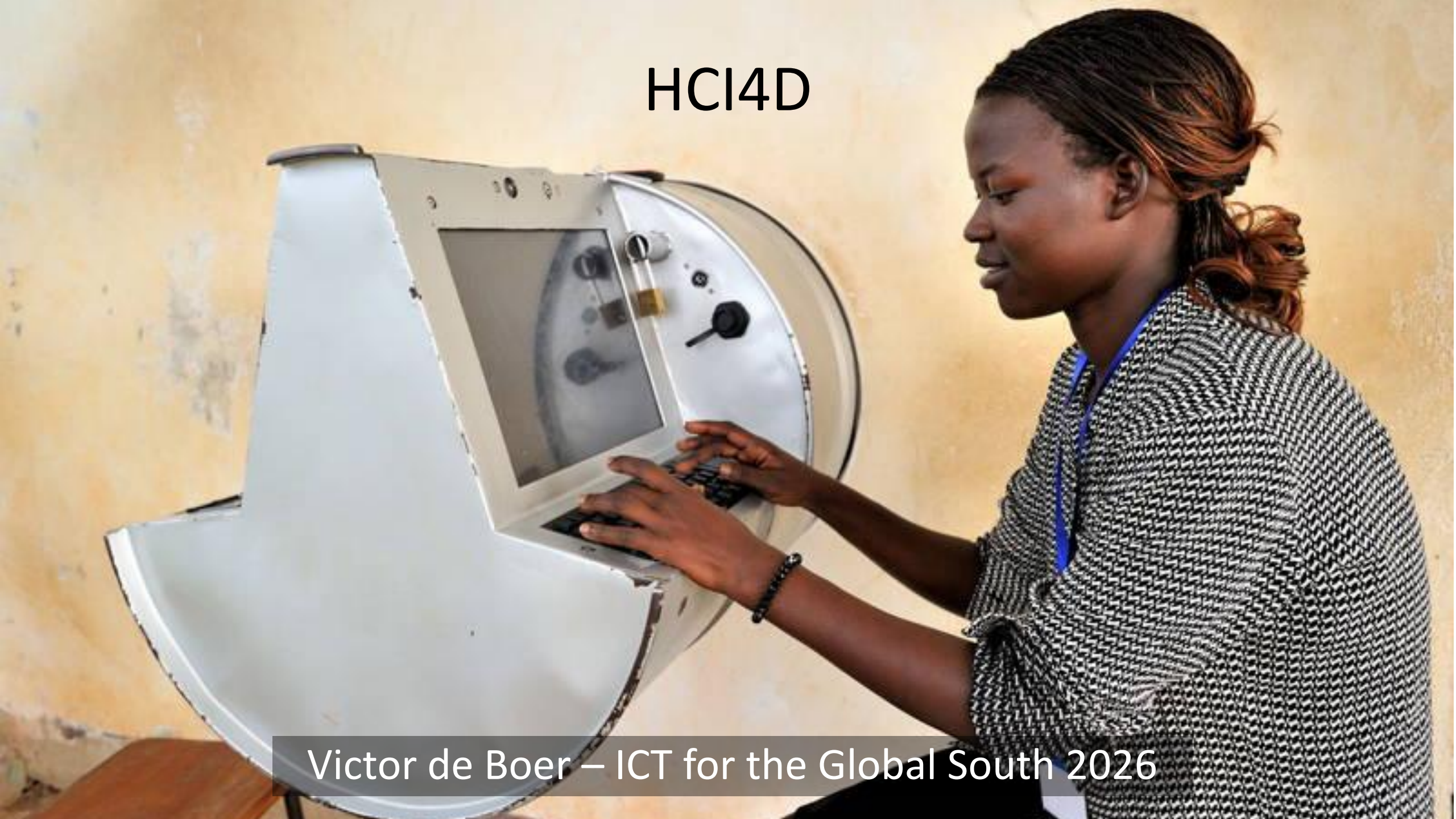
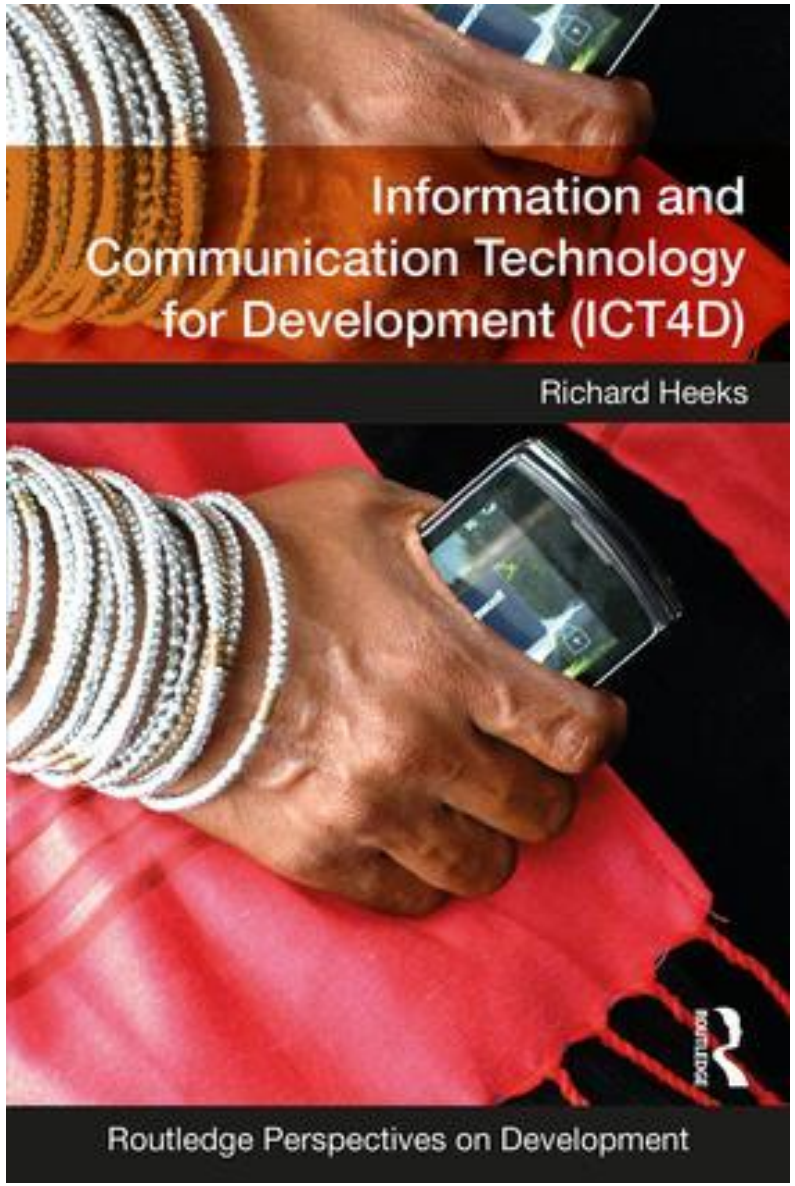
HCI4D

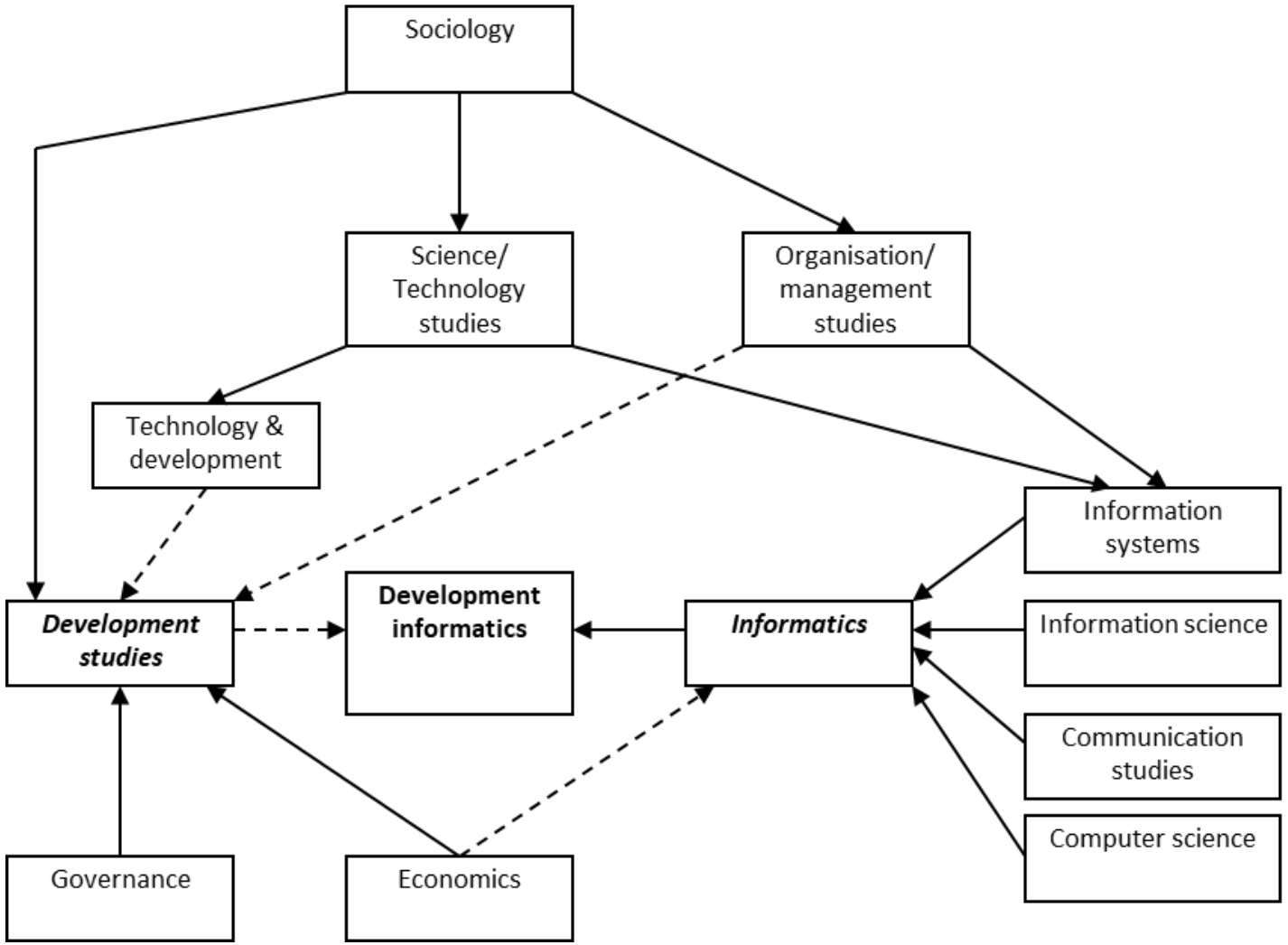


Victor de Boer – ICT for the Global South 2026



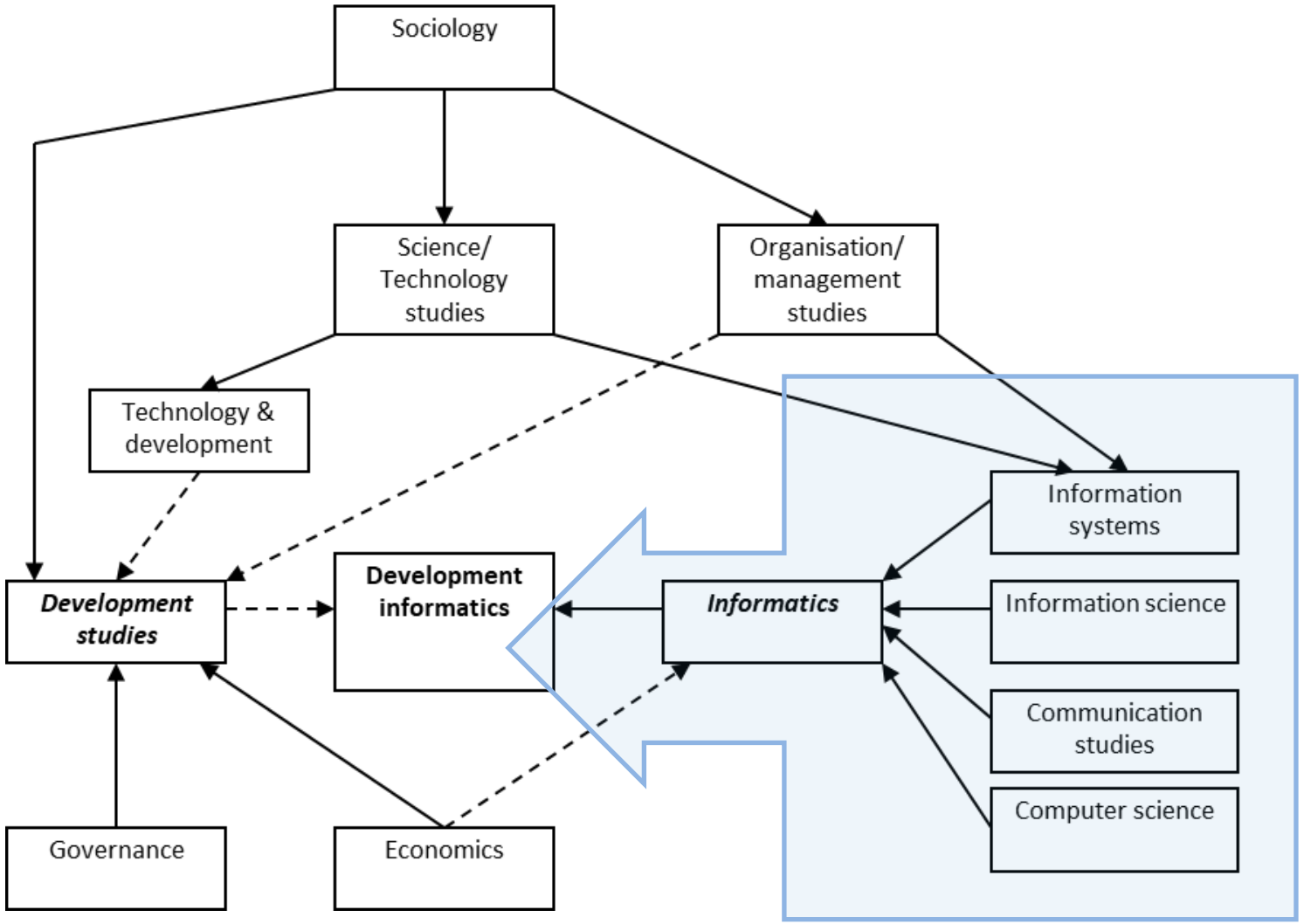
Richard Heeks
Professor of Development Informatics in the Institute for Development Policy and Management, University of Manchester, UK

Disciplinary foundations for *development informatics*



Source: Heeks (2010c)

CS approach but aware of the holistic nature of ICT4D



Source: Heeks (2010c)

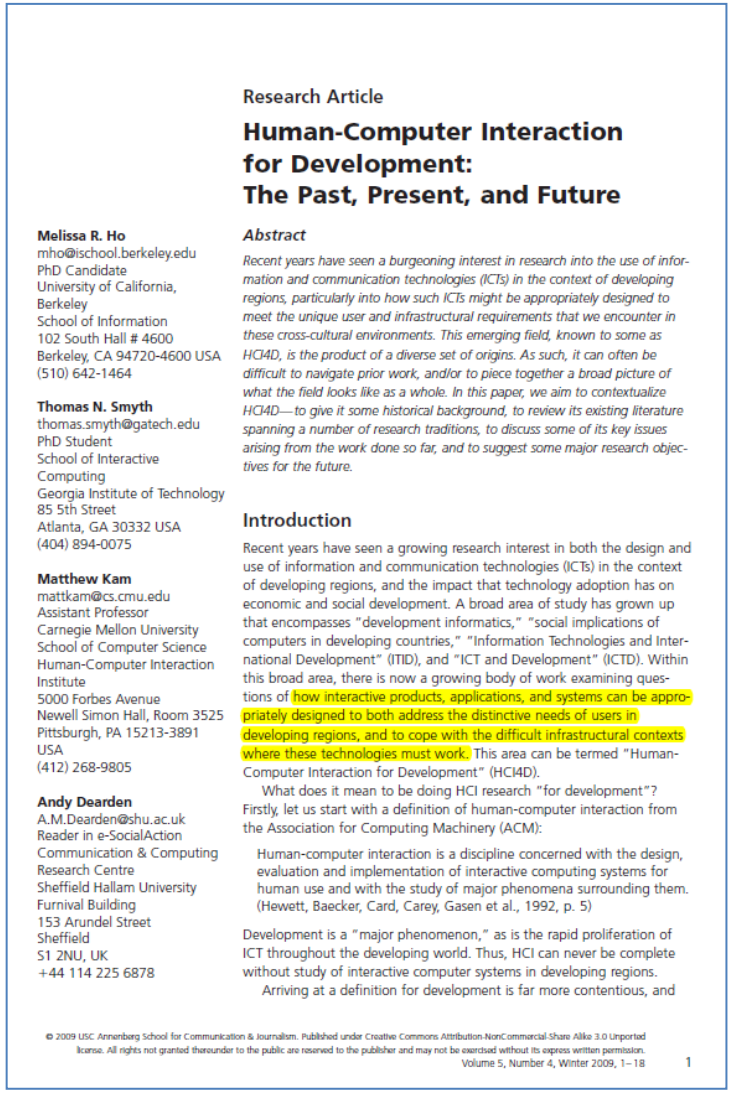
Examples of CS4D (a CS@VU perspective)

- Human Computer Interaction
  - Voice interfaces
- Information Retrieval/Artificial Intelligence
  - QA with Watson
- Large Scale Distributed Systems
  - Ad hoc mesh networks
- Software engineering
  - Sustainable and green ICT
- Systems and Network Security
  - Protecting privacy
- Agent Systems Research
  - Modeling behaviour, change
- Knowledge Representation
  - Logics for Context, Internet-less Web of Data

Today’s programme

- General introduction to HCI4D
  - Cross-cultural HCI
- Interfaces for low-literate users
  - Icons
  - Voice

Ho, Melissa R., et al. "Human-computer interaction for development: The past, present, and future." *Information Technologies & International Development* 5.4 (2009): pp-1.



Research Article

Human-Computer Interaction for Development: The Past, Present, and Future

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Abstract

Recent years have seen a burgeoning interest in research into the use of information and communication technologies (ICTs) in the context of developing regions, particularly into how such ICTs might be appropriately designed to meet the unique user and infrastructural requirements that we encounter in these cross-cultural environments. This emerging field, known to some as HCI4D, is the product of a diverse set of origins. As such, it can often be difficult to navigate prior work, and/or to piece together a broad picture of what the field looks like as a whole. In this paper, we aim to contextualize HCI4D—to give it some historical background, to review its existing literature spanning a number of research traditions, to discuss some of its key issues arising from the work done so far, and to suggest some major research objectives for the future.

Introduction

Recent years have seen a growing research interest in both the design and use of information and communication technologies (ICTs) in the context of developing regions, and the impact that technology adoption has on economic and social development. A broad area of study has grown up that encompasses "development informatics," "social implications of computers in developing countries," "Information Technologies and International Development" (ITID), and "ICT and Development" (ICTD). Within this broad area, there is now a growing body of work examining questions of how interactive products, applications, and systems can be appropriately designed to both address the distinctive needs of users in developing regions, and to cope with the difficult infrastructural contexts where these technologies must work. This area can be termed "Human-Computer Interaction for Development" (HCI4D).

What does it mean to be doing HCI research "for development"? Firstly, let us start with a definition of human-computer interaction from the Association for Computing Machinery (ACM):

> Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them. (Hewett, Baecker, Card, Carey, Gasen et al., 1992, p. 5)

Development is a "major phenomenon," as is the rapid proliferation of ICT throughout the developing world. Thus, HCI can never be complete without study of interactive computer systems in developing regions.

Arriving at a definition for development is far more contentious, and

Human–computer interaction

From Wikipedia, the free encyclopedia

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Community portal
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Contact page

Tools

Print/export

Languages

Human–computer interaction (**HCI**) involves the study, planning, design and uses of the interaction between people (users) and computers. It is often regarded as the intersection of computer science, behavioral sciences, design and several other fields of study. The term was popularized by Card, Moran, and Newell in their seminal 1983 book, *The Psychology of Human-Computer Interaction*, although the authors first used the term in 1980,[1] and the first known use was in 1975.[2] The term connotes that, unlike other tools with only limited uses (such as a hammer, useful for driving nails, but not much else), a computer has many affordances for use and this takes place in an open-ended dialog between the user and the computer.

A woman teaching girls in Afghanistan how to use computers. Human use of computers is a major focus of the field of HCI.

“Human-Computer Interaction for Development” (HCI4D).

To **study**

“[…] how interactive products, applications, and systems can be **appropriately designed** to both address the distinctive needs of users in developing regions, and to cope with the difficult infrastructural contexts where these technologies must work.”

-Ho et al.

Also..

"[…] we do not seek merely to understand how humans and ICTs interact in developing regions, but to **apply this understanding** to adapt the interactive behavior of ICTs in these contexts, **to shape new and more appropriate forms of ICTs**, and to **devise human centered approaches** to designing ICTs that can be used by people to improve lives, livelihoods, and freedoms."

-Ho et al.

HCI4D research vs practice
Action research

Compared to other fields of research, HCI4D seems particularly prone to risks of conflating research activity and development practice

(Ho et al.)

ICT4D / ICTD

Development informatics

Grand Challenges (Ho et al.)

Problematize HCI4D	A Clear Development Success Story
Reuse HCI4D Knowledge to Avoid Reinventing the Wheel	User Interfaces for Illiterate and Semi-Literate Users
Supporting an Ecosystem Around Affordable Computing	Improving HCI Capacity in Developing Regions

In multicultural environments it is even more important [to] consider how our understanding of the complex dialectic between **culture**, **economy** and **technological innovation** influences our ability to empower our people. (p. 4)

Hugo, J. (2002). HCI and multiculturalism in southern Africa. Proceedings of the CHI 2002 Development Consortium.

Related: **Cross-cultural HCI**

Study of Human-Computer Interaction across cultural differences

"[…] how culture relates to user interface design, research, and practice. " –Ho et al.

Cf. Cross-cultural Interface design

- Internationalization (I18n)
- Localization (I10n)
- "Communitization" – Hugo

Internationalization is the process of designing and building an application to facilitate localization. **Localization**, in turn, is the cultural and linguistic adaptation of an internationalized application to two or more culturally-distinct markets.

-Apple.com

Localization

Translation
Adapt and Adjust

English

Japanese

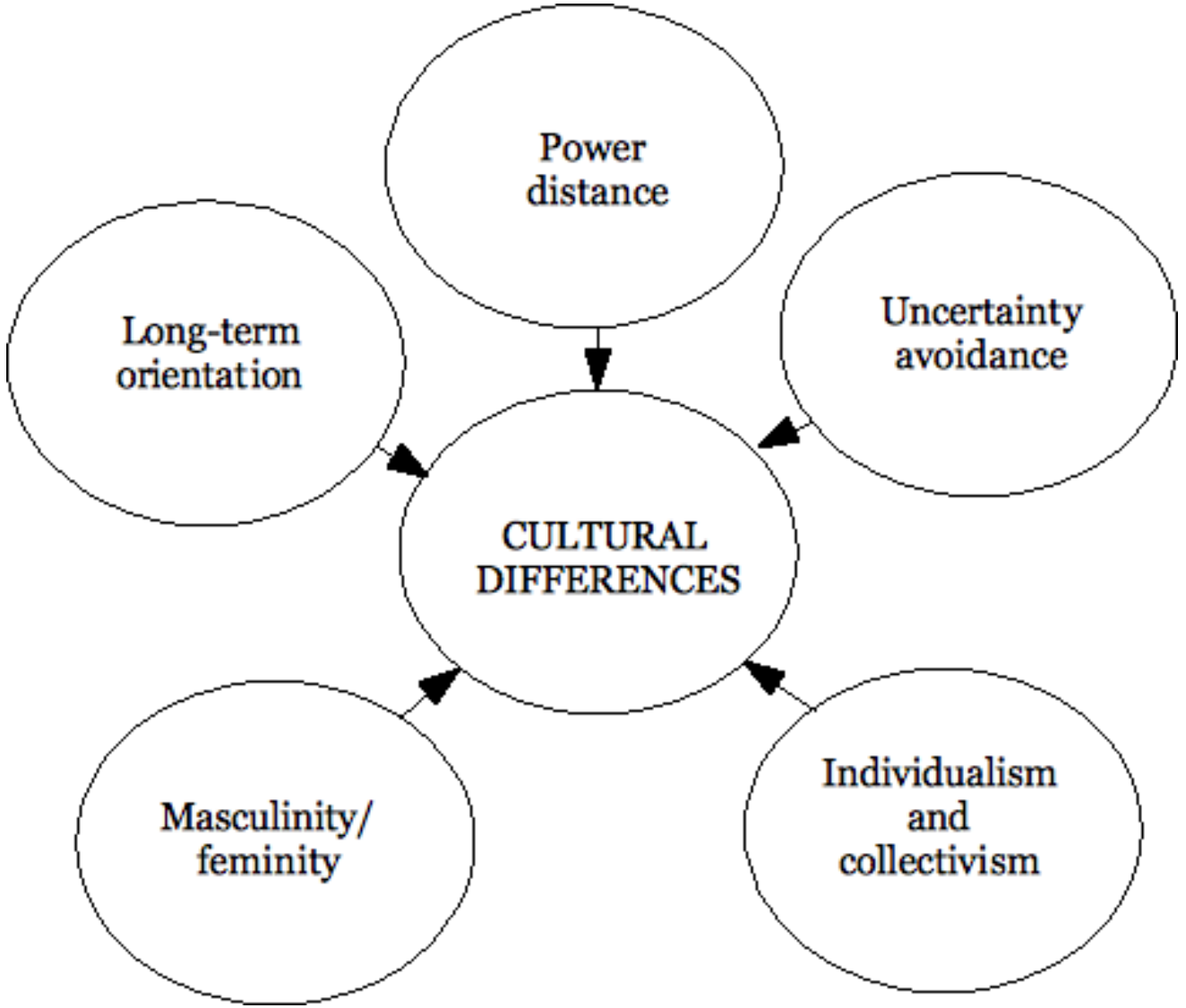
Details

Dates: Month, day, year vs. day, month, year.
Time: 12-hour vs. 24-hour time.
Color: Avoid local color sensitivities.
Currency: Pay attention to conversions and formats.
Phone Numbers: Formats are different around the world.
National Holidays: Holidays are country and region specific.
Geographic Examples: Keep it relevant for your audience.
Website Language Codes: ISO codes are important to know.

http://mashable.com/2011/12/22/website-localization/

Hofstede’s cultural dimensions

Geert Hofstede
Social psychologist



Country	Power Distance	Individualism	Masculinity	Uncertainty Avoidance	Long Term	Country	Power Distance	Individualism	Masculinity	Uncertainty Avoidance	Long Term
Argentina	49	46	56	86	20	Mexico	81	30	69	82	24
Australia	36	90	61	51	21	Namibia	65	30	40	45	35
Bangladesh	80	20	55	60	47	New Zealand	22	79	58	49	33
Belgium	65	75	54	94	82	Nigeria	80	30	60	55	13
Brazil	69	38	49	76	44	Pakistan	55	14	50	70	50
Canada	39	80	52	48	36	Phillipines	94	32	64	44	27
China	80	20	66	30	87	Poland	68	60	64	93	38
Egypt	70	25	45	80	7	Russia	93	39	36	95	81
Finland	33	63	26	59	38	Saudi Arabia	95	25	60	80	36
Germany	35	67	66	65	83	Senegal	70	25	45	55	25
Ghana	80	15	40	65	4	Singapore	74	20	48	8	72
Greece	60	35	57	100	45	South Africa	49	65	63	49	34
Hong Kong	68	25	57	29	61	South Korea	60	18	39	85	100
Hungary	46	80	88	82	58	Spain	57	51	42	86	48
India	77	48	56	40	51	Sri Lanka	80	35	10	45	45
Indonesia	78	14	46	48	62	Sweden	31	71	5	29	53
Iran	58	41	43	59	14	Switzerland	34	68	70	58	74
Iraq	95	30	70	85	25	Syria	80	35	52	60	30
Israel	13	54	47	81	38	Tanzania	70	25	40	50	34
Italy	50	76	70	75	61	Thailand	64	20	34	64	32
Japan	54	46	95	92	88	UAE	90	25	50	80	
Kenya	70	25	60	50		UK	35	89	66	35	51
Libya	80	38	52	68	23	USA	40	91	62	46	26
Malaysia	100	26	50	36	41	Vietnam	70	20	40	30	57

Example: individualism

Match.com – Italy

Match.com – Venezuela

Italy:76, Venezuela: 12

https://www.humanfactors.com/downloads/apr13.asp

International development is almost never a **goal** in cross-cultural HCI.

Human-centered approaches

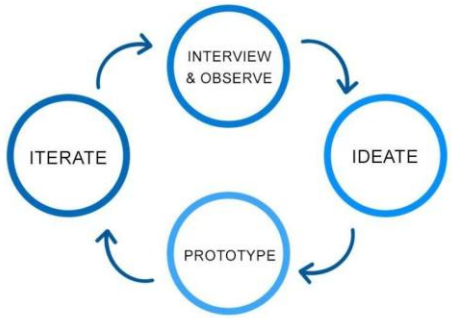
"[…] we do not seek merely to understand how humans and ICTs interact in developing regions, but to **apply this understanding** to adapt the interactive behavior of ICTs in these contexts, **to shape new and more appropriate forms of ICTs**, and to **devise human centered approaches** to designing ICTs that can be used by people to improve lives, livelihoods, and freedoms."

-Ho et al.

~~User~~ Human-centered design methodology

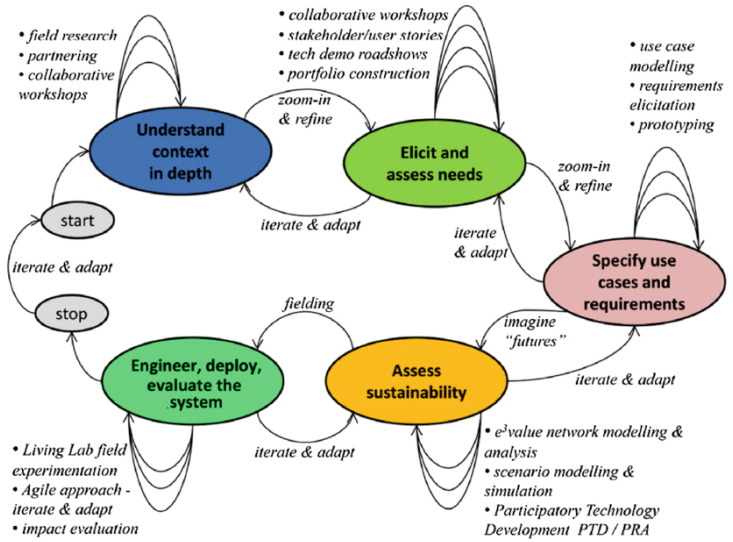
Participatory approach (cf. International Development)

- Political environment, ethics, cultural differences



Living labs-like

- Early prototyping (use comics with children)



Action research and the many responsibilities of the HCI4D researcher

e.g. **ICT4D3.0** methodology Bon et al.

Bon, Anna. "ICT4D 3.0: An adaptive, user-centred approach to innovation for development." BPMDS 2016

Grand Challenges (Ho et al.)

Problematize HCI4D

A Clear Development Success Story

Reuse HCI4D Knowledge to Avoid Reinventing the Wheel

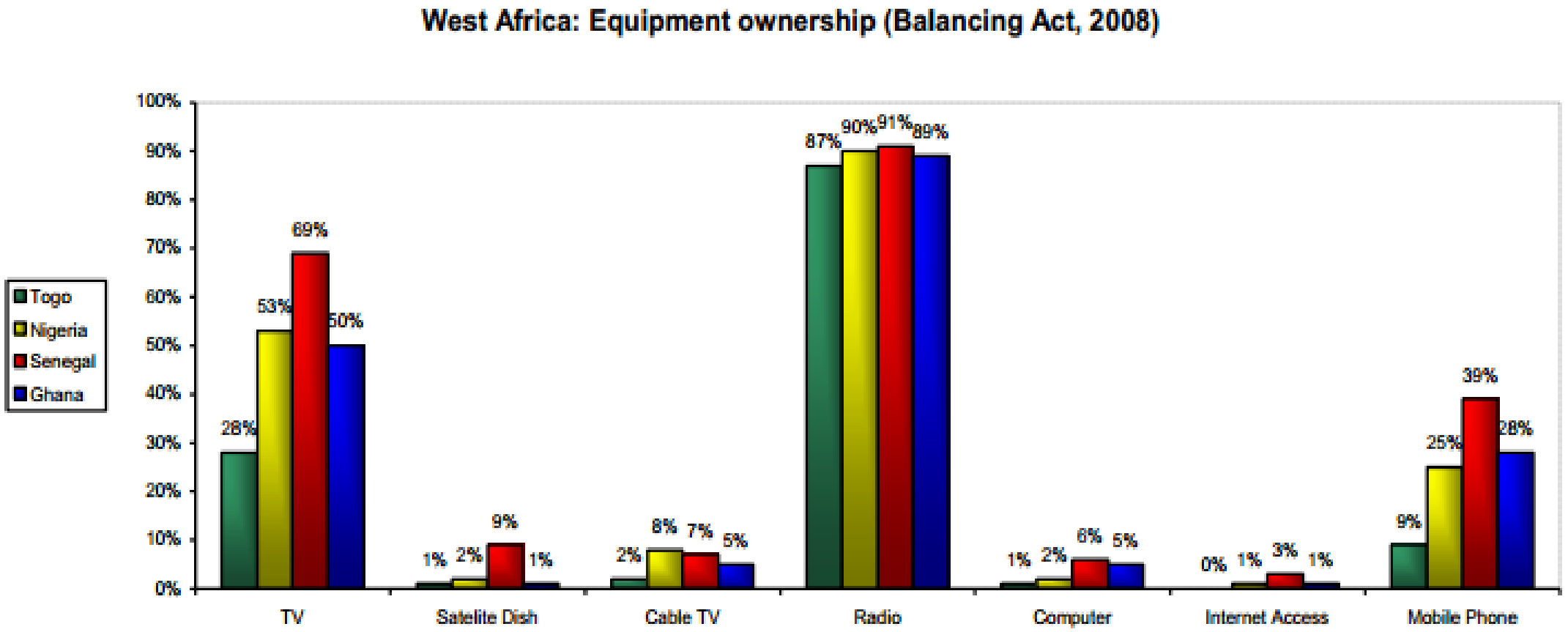
User Interfaces for Illiterate and Semi-Literate Users

Supporting an Ecosystem Around Affordable Computing

Improving HCI Capacity in Developing Regions

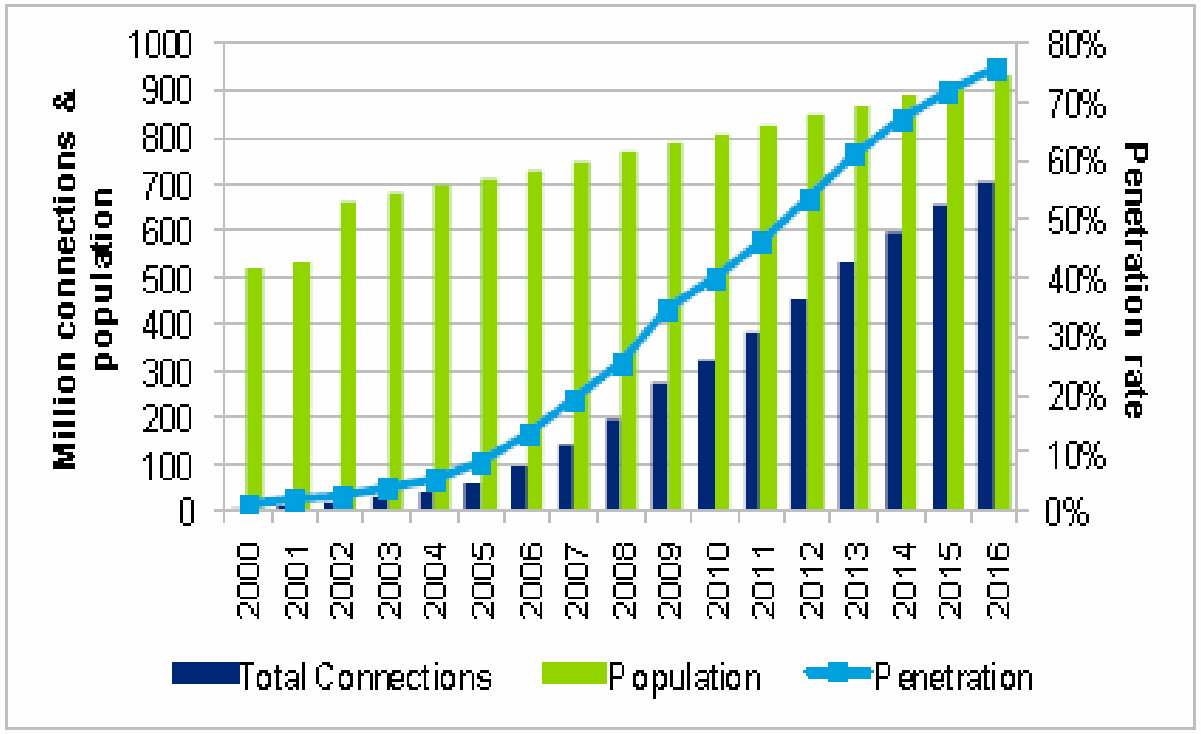
Interfaces for low-literate users

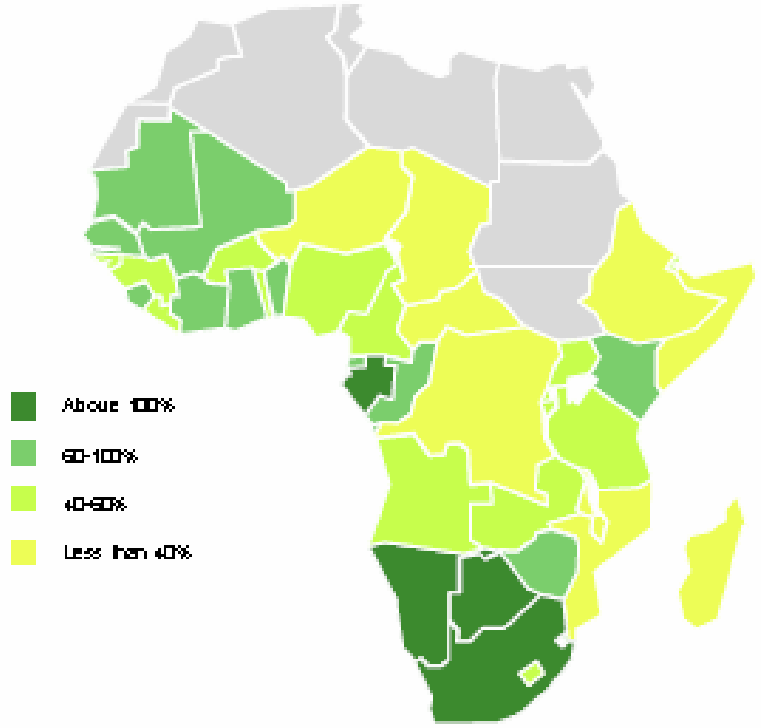
Which Information Appliances are used?



Based on Sbc4d.com

Information Appliances: Mobile phones





Source: Wireless Intelligence

Basic phone

- Low cost
- Call + text
- No web/apps
- Durable
- Long battery life

Feature phone

- Low cost
- Call + text
- Limited web/apps (java based)
- Durable
- Mid-battery life

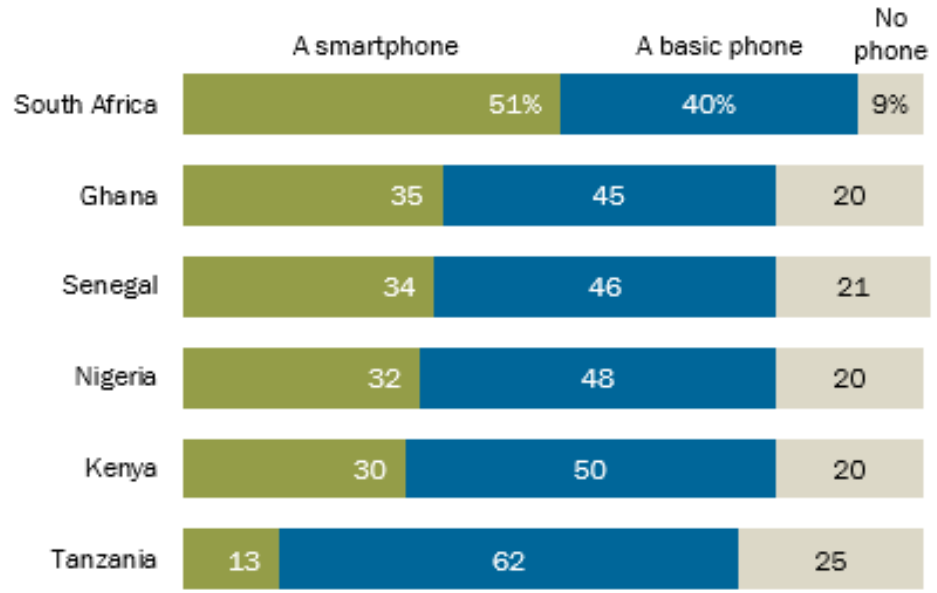
Smart phone

- High cost (getting lower!)
- Call + text + whatsapp
- Full web / apps (android/apple)
- Less durable
- Short battery life

Information Appliances: Mobile phones

Majorities across sub-Saharan Africa own a mobile phone; basic phones are most common type

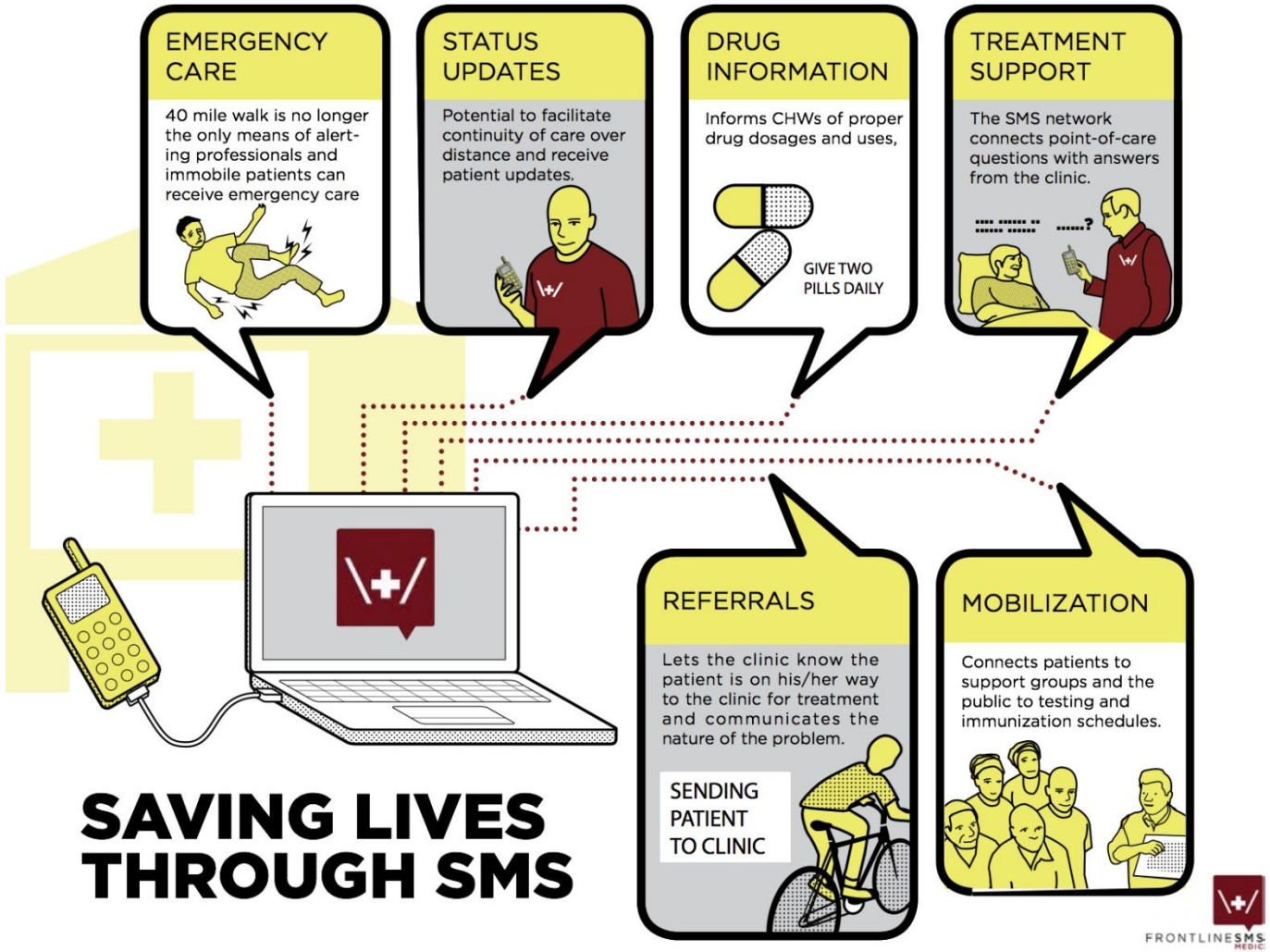
Adults who report owning ...



Note: Percentages based on total sample.
Source: Spring 2017 Global Attitudes Survey. Q64 & Q65.

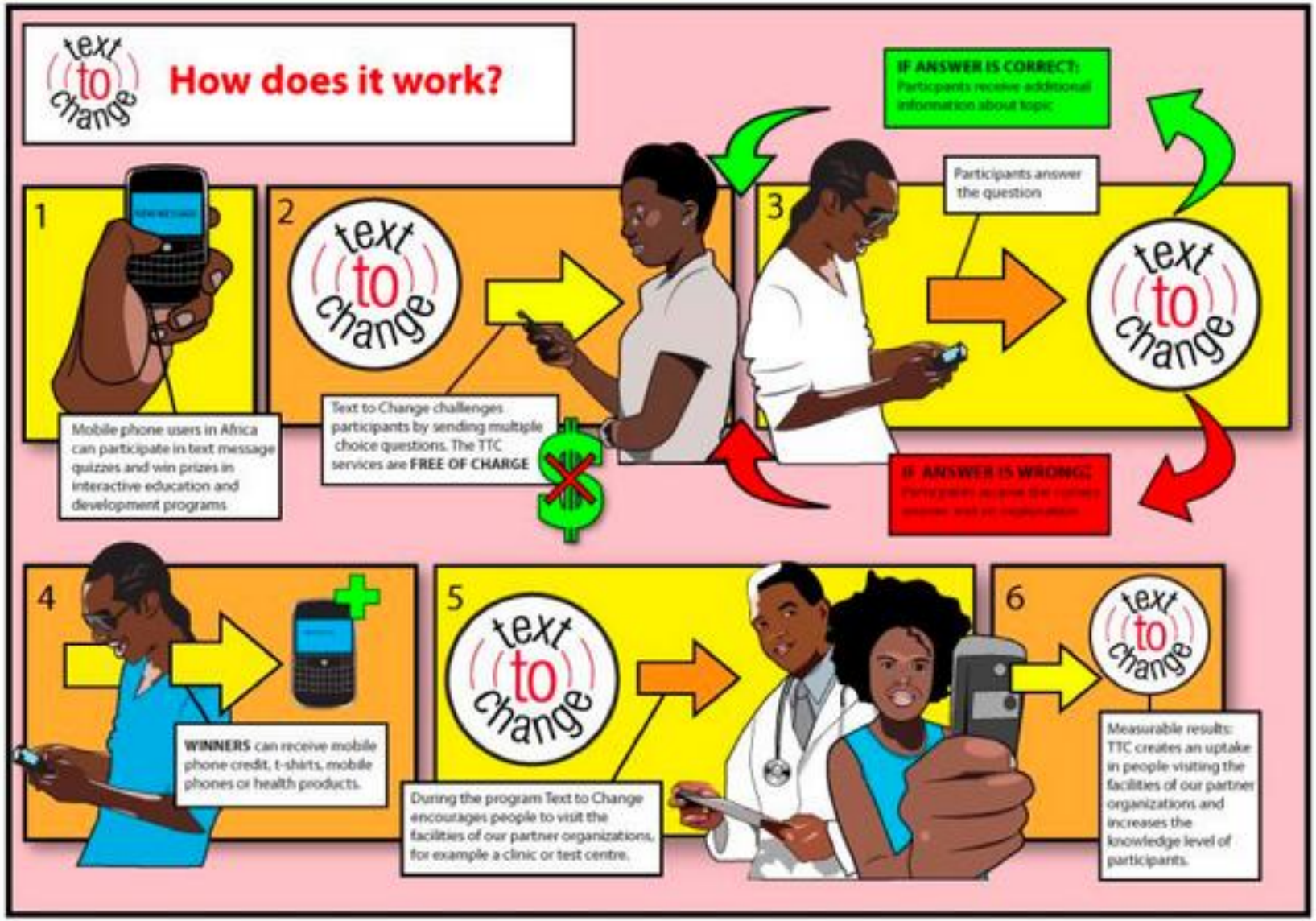
PEW RESEARCH CENTER

Many examples with SMS



Medic.frontlinesms.com

Text2change.org



But! Low-literate users

One of the grand challenges (Ho et al.)

Especially prevalent among the rural poor

Cf. Accessibility here

Web design http://www.w3.org/TR/WCAG20/

- Literacy in Zimbabwe

A. 0-40%
B. 40-60%
C. 60-80%
D. 80-100%

- Literacy in Zimbabwe

A. 0-40%
B. 40-60%
C. 60-80%
D. 80-100% <- 88.7%

2014, http://en.wikipedia.org/wiki/List_of_countries_by_literacy_rate

- Literacy in Mali

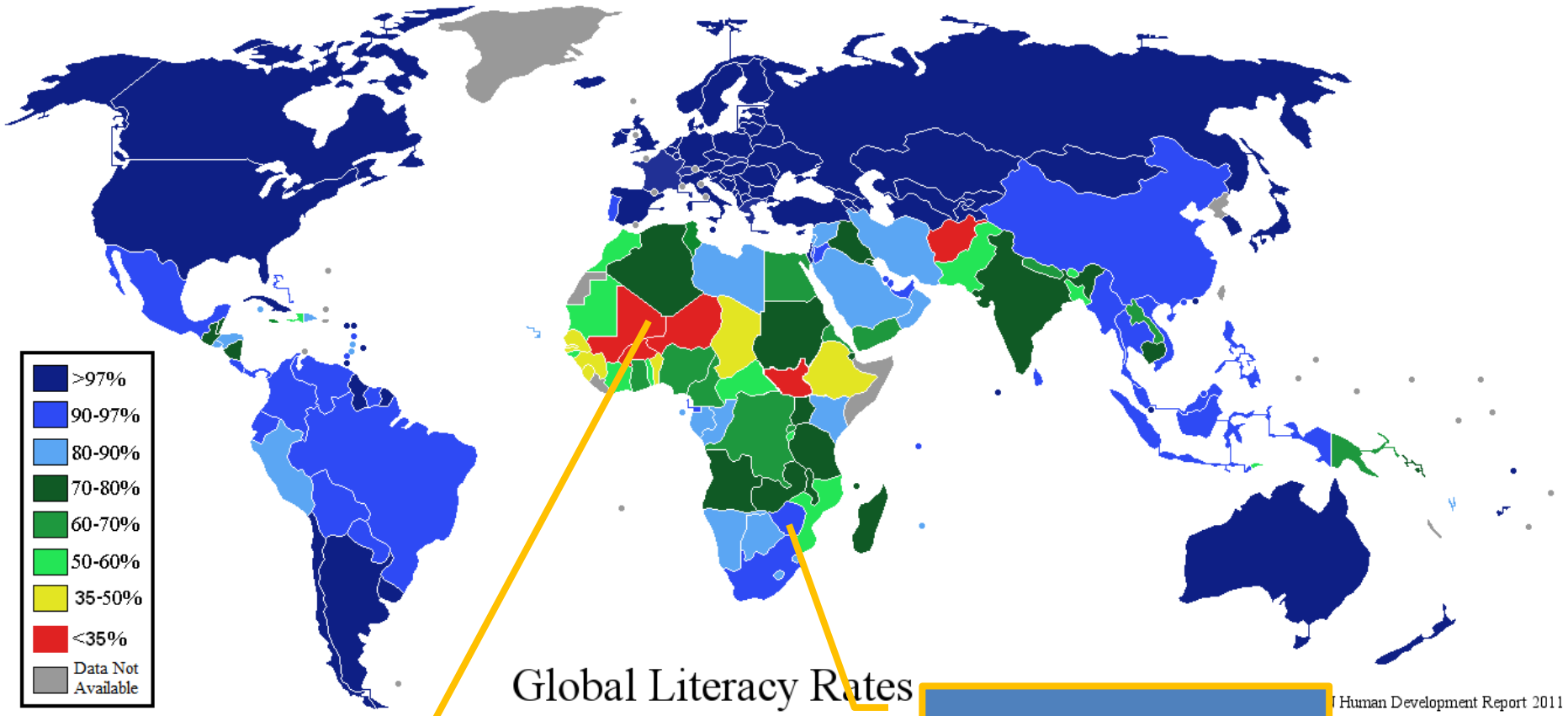
A. 0-40%
B. 40-60%
C. 60-80%
D. 80-100%

- Literacy in Mali

A. 0-40% <- 33% (for women much lower)
B. 40-60%
C. 60-80%
D. 80-100%

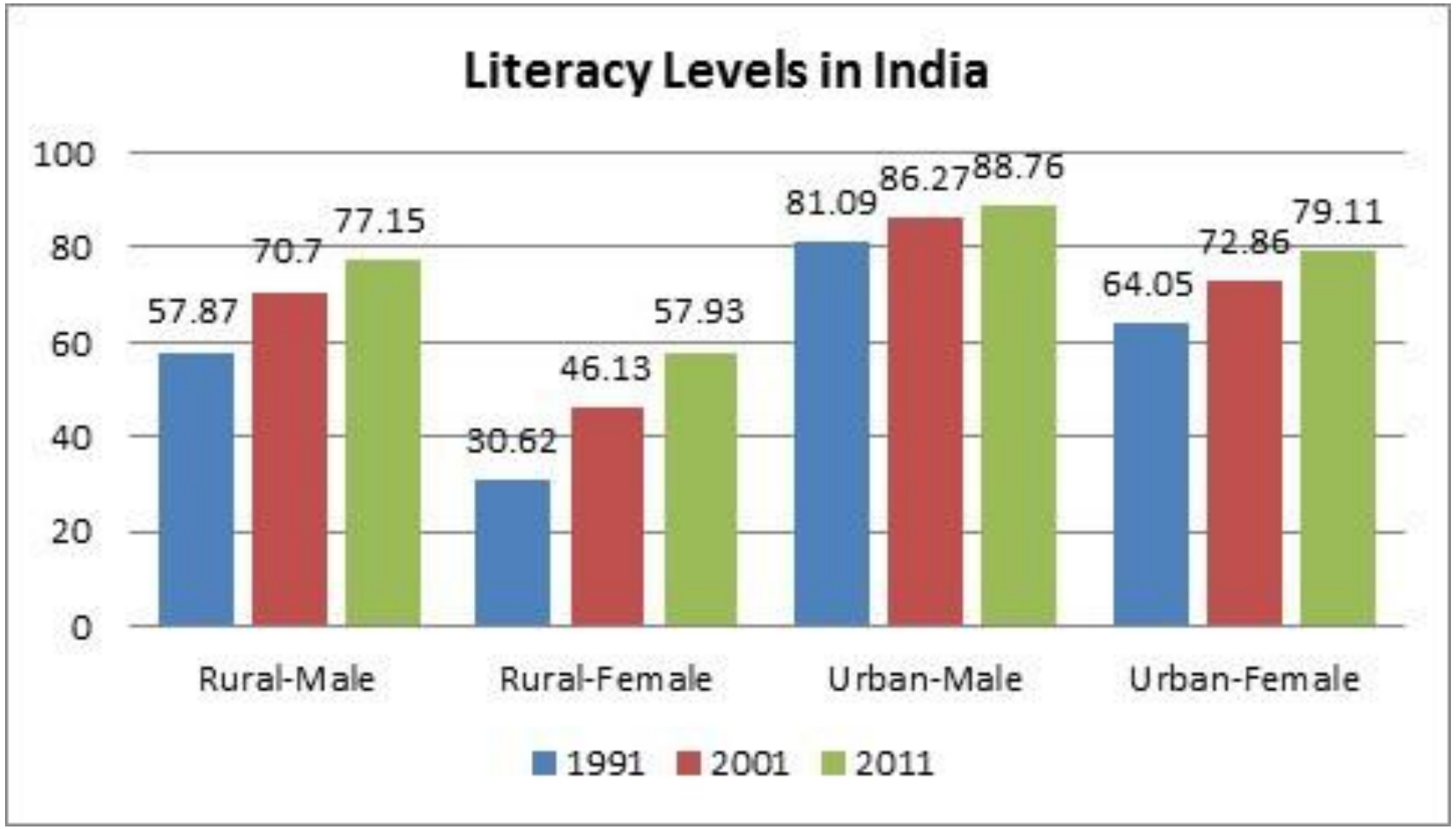
2015, http://en.wikipedia.org/wiki/List_of_countries_by_literacy_rate

Varies greatly in continent



http://en.wikipedia.org/wiki/List_of_countries_by_literacy_rate#/media/File:Analfabetismo2013unesco.png

Varies greatly within country



2011, http://censusindia.gov.in

Varying levels

Level	Description
Level 1	Indicates persons with very poor skills, where the individual may, for example, be unable to determine the correct amount of medicine to give a child from information printed on the package.
Level 2	Respondents can deal only with material that is simple, clearly laid out, and in which the tasks involved are not too complex. It denotes a weak level of skill, but more hidden than Level 1. It identifies people who can read, but test poorly. They may have developed coping skills to manage everyday literacy demands, but their low level of proficiency makes it difficult for them to face novel demands, such as learning new job skills.
Level 3	Is considered a suitable minimum for coping with the demands of everyday life and work in a complex, advanced society. It denotes roughly the skill level required for successful secondary school completion and college entry. Like higher levels, it requires the ability to integrate several sources of information and solve more complex problems.
Levels 4 & 5	Describe respondents who demonstrate command of higher-order information processing skills.

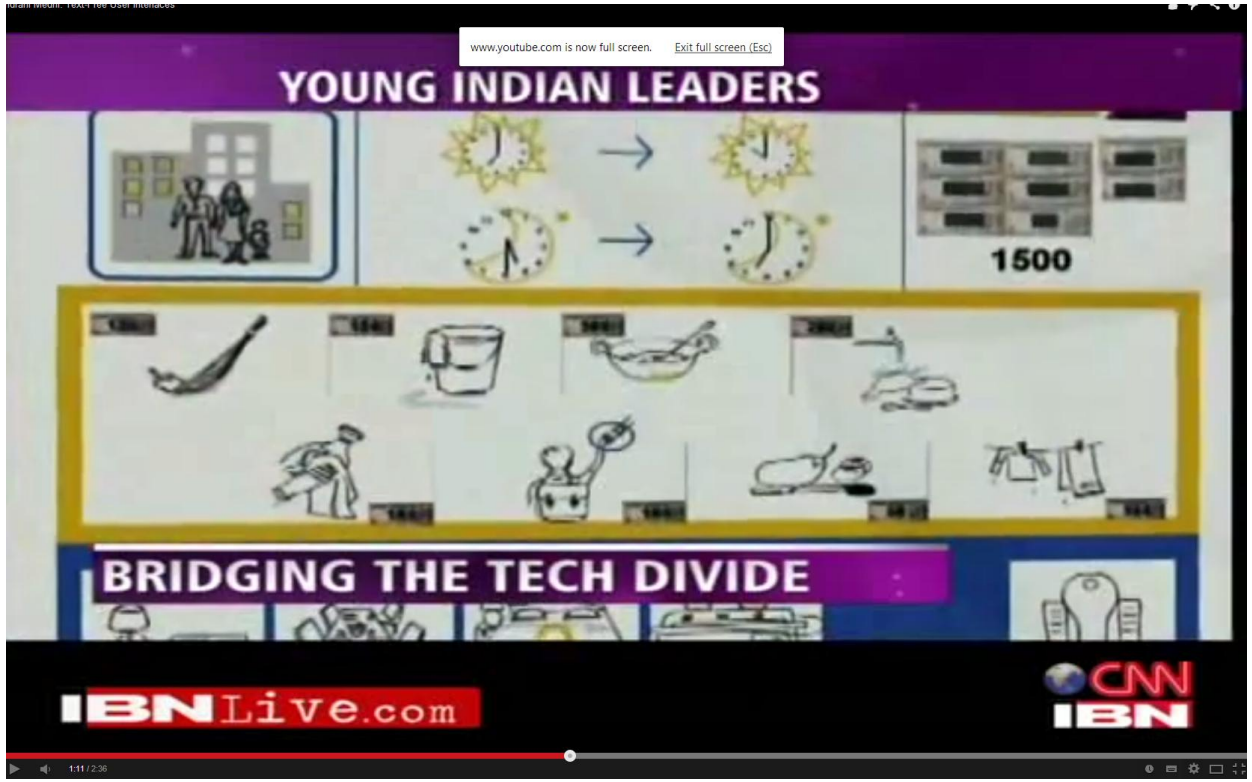
Table 1: Literacy levels identified by the LAMP framework (UNESCO Institute for Statistics, 2005a)

Also: numeracy

Always base yourself on information as specific as possible

UI Solutions for Low-literacy users

Icon-based interfaces



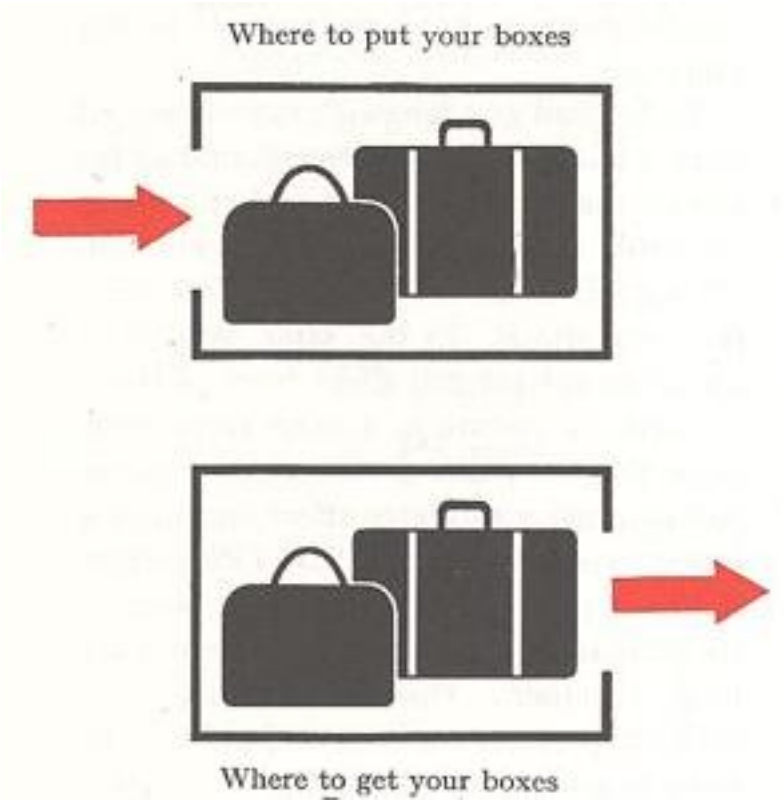
Indrani Medhi, Microsoft Research

Figure 1: The Talking Book showing the icons of the new UI design using PD.

The Talking Book: Participatory Design of an Icon-based User Interface for Rural People with Low Literacy Andrew Bayor

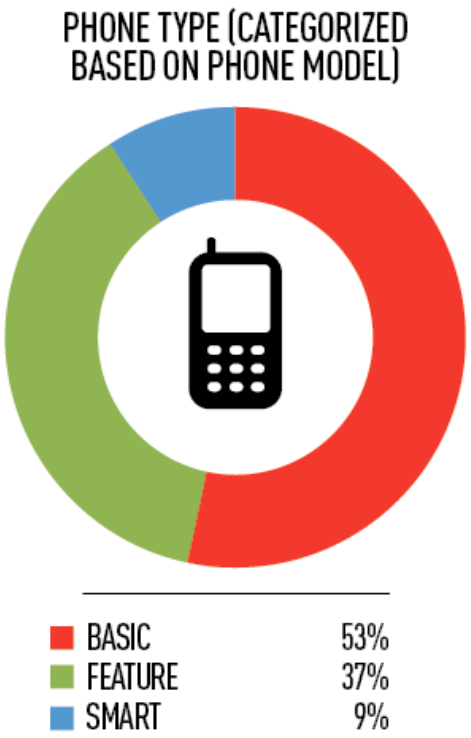
Icon-based interaction

NCR ATM interface for illiterate

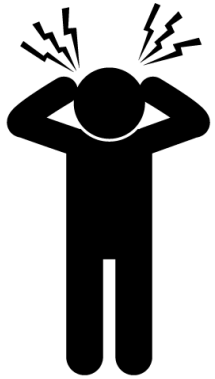


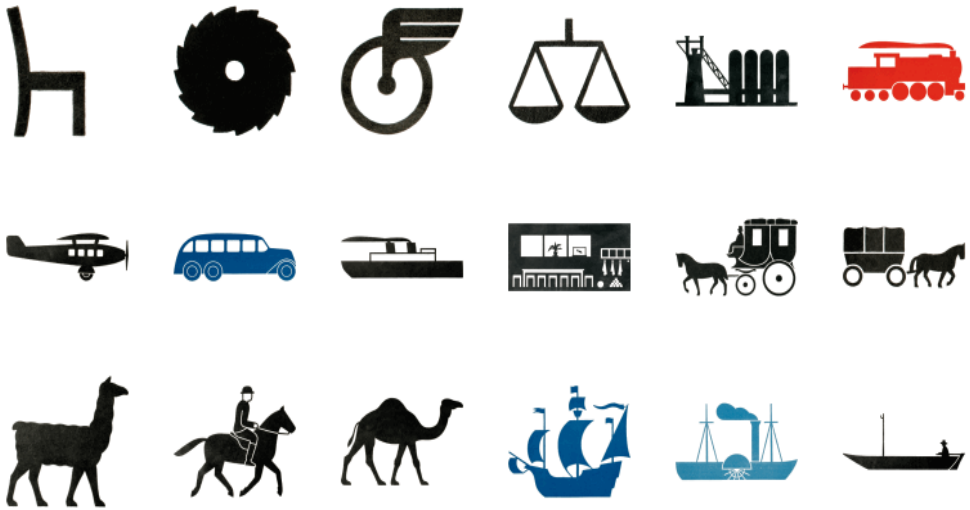
'grammar' - ISOTYPE by Otto Neurath available at http://imaginarymuseum.org/MHV/PZImhv/NeurathPictureLanguage.html

Feature phones



Challenge: no such thing as globally recognized icons





Speech: The most natural user interface

Voice-interfaces

Not exclusive to ICT4D (cf Siri, Alexa, In-car systems)

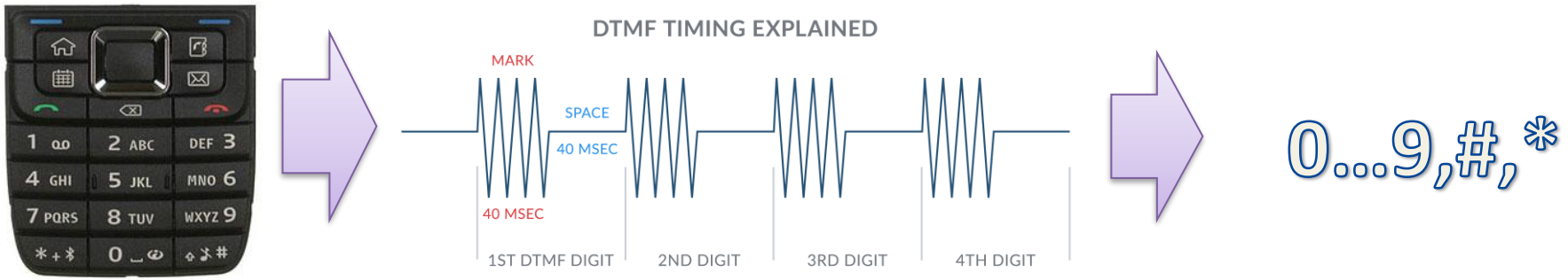
Very suitable for oral cultures

Interactive voice response (IVR)

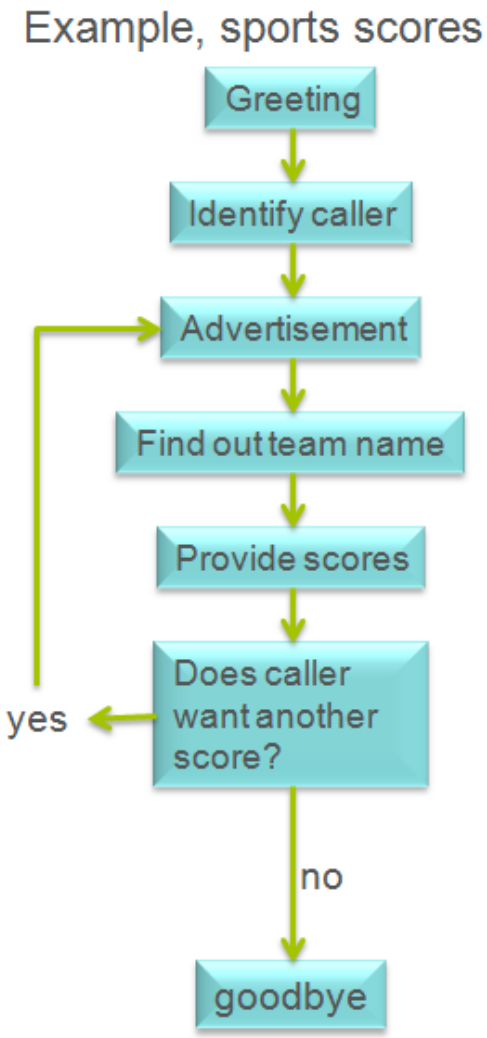
Usable on **simple mobile phones**

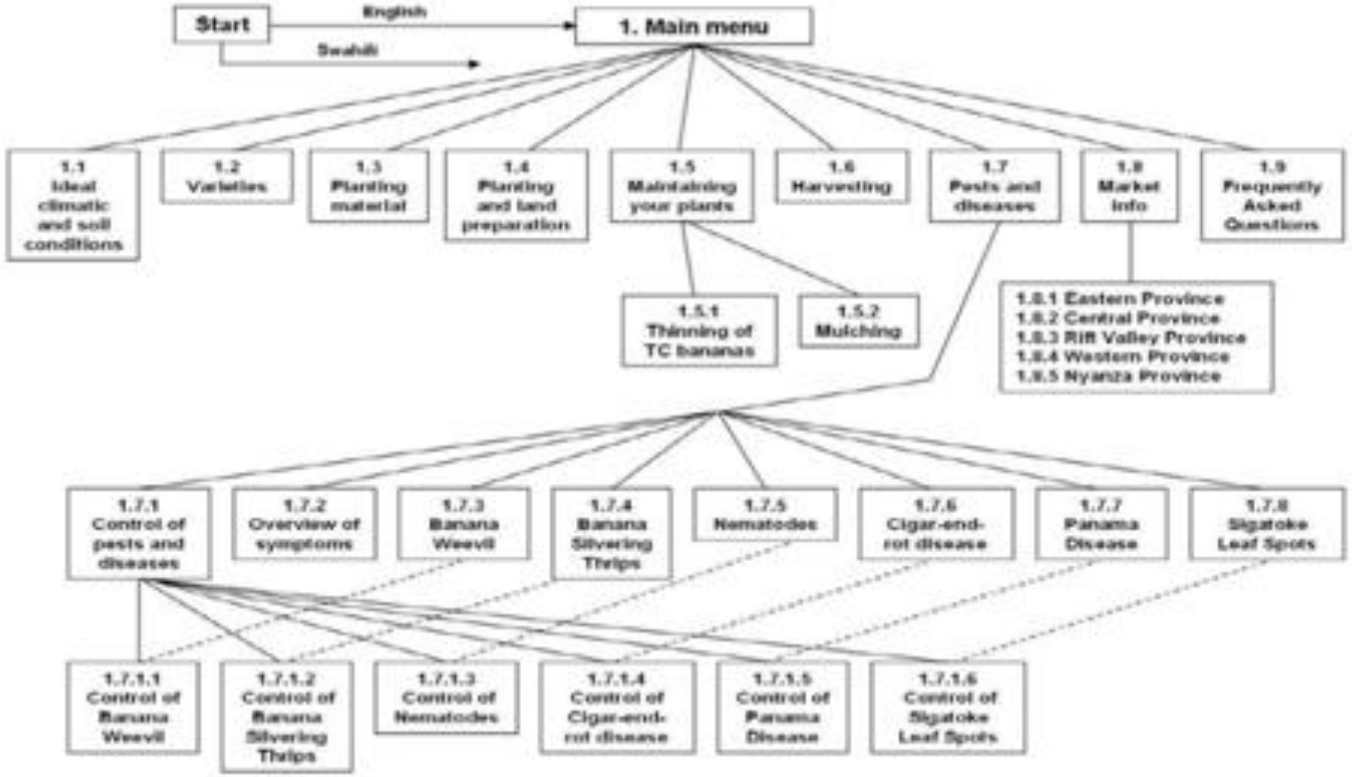
Two channels:

- Voice
- DTMF (Dual-tone multi-frequency signaling)



Voice menus for interactive information access





Voice menu for Banana service:
P. Nasfors. Efficient Voice Information Services for Developing Countries, Master Thesis, Department of Information technology, Uppsala University, Sweden, 2007.

Computer-literacy

Digital divide

Cf. Ho et al:

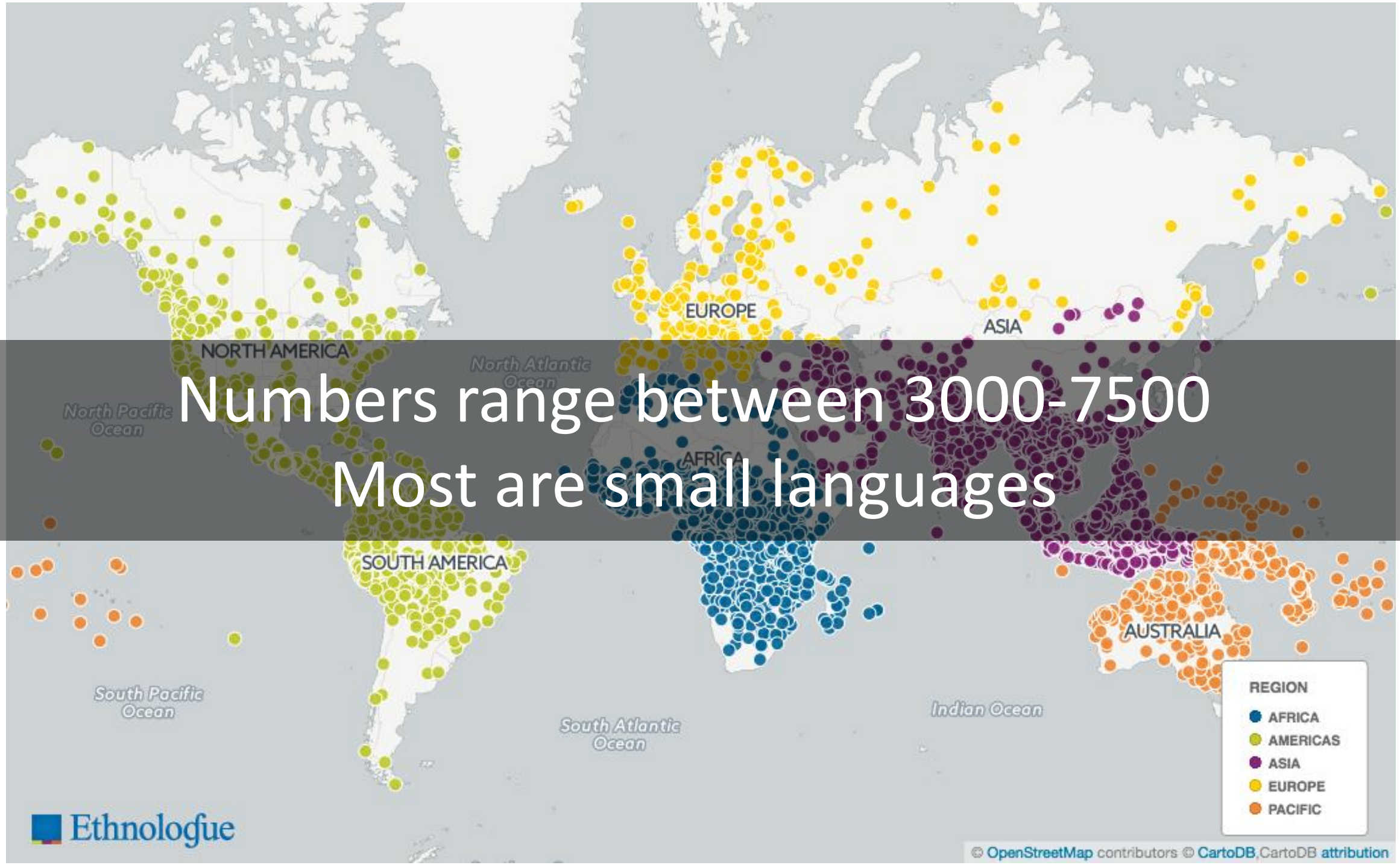
- Walton et al (2003) Usability difficulties that South African subjects encounter with *hierarchical information structures* to the non-tree-like schema that the subjects use to conceptualize their “family trees.”

- “Prasad [et al.] (2008) found that, despite using the *postcard metaphor*, non-literate urban slum users continue to face difficulties in understanding all aspects of an asynchronous communication model”

Languages

https://nation.com.pk/28-Mar-2018/world-languages

How many languages in the world?



Numbers range between 3000-7500
Most are small languages

‘Small Languages’

Large language populations: English, German, Chinese, Portuguese, Dutch…

Large number of textual corpora available, great economic value to localization

Small languages: Frisian, Bambara (3M speakers),

Small number of textual corpora available, some economic value to localization

Very small languages: Bomu (30K speakers),…

No textual corpora available, very low economic value to localization

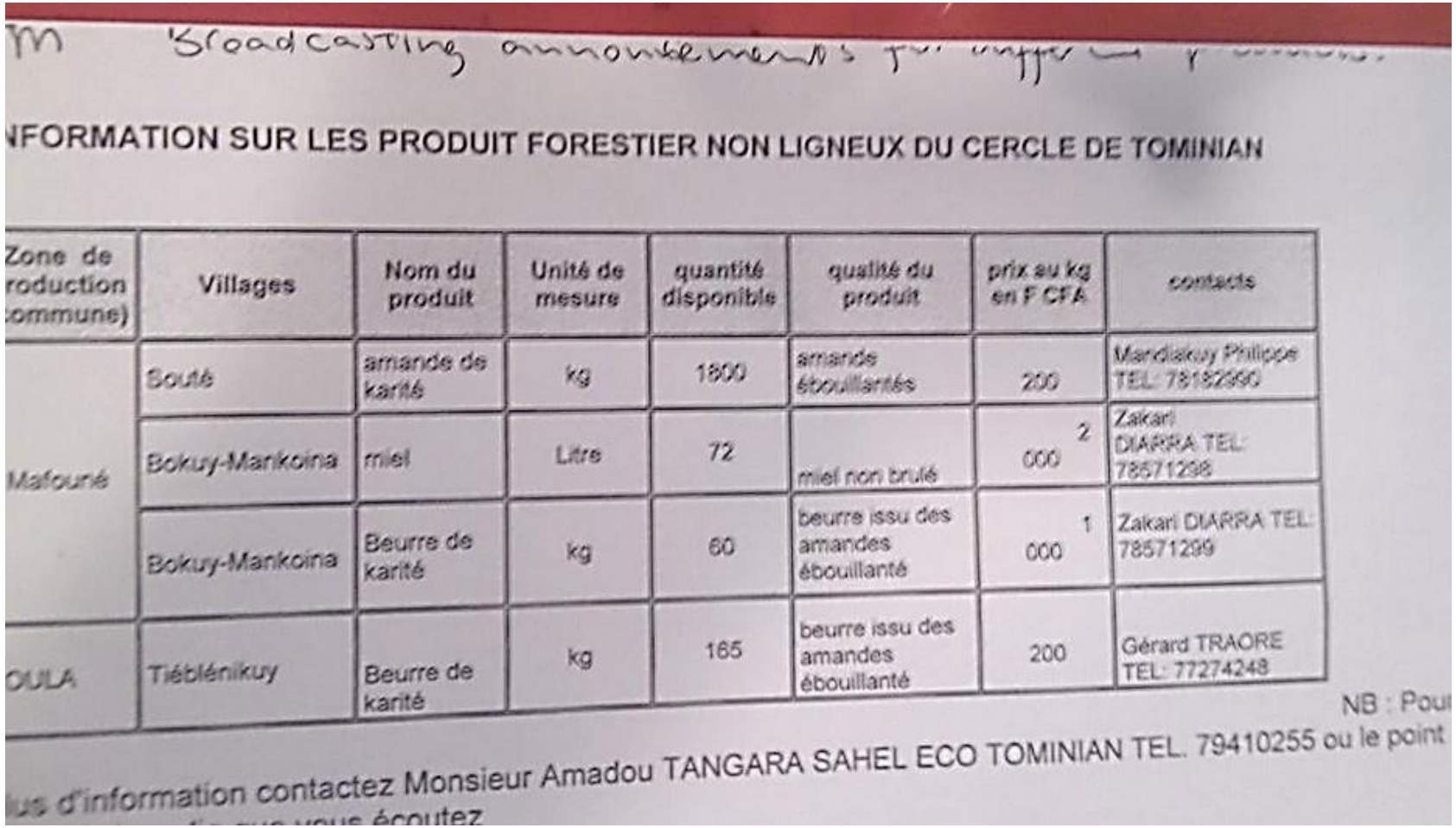

LIKE
LATER
SHARE
THE WEB OF VOICES
RadioMarché
Tabale
Foroba Blon
05:34
HD


RadioMarché
Voices - W4RA

M-agro Use Case
Context: Regreening in Africa

SAHEL ECO

Communiqué



m Broadcasting announcements for ...

NFORMATION SUR LES PRODUIT FORESTIER NON LIGNEUX DU CERCLE DE TOMINIAN

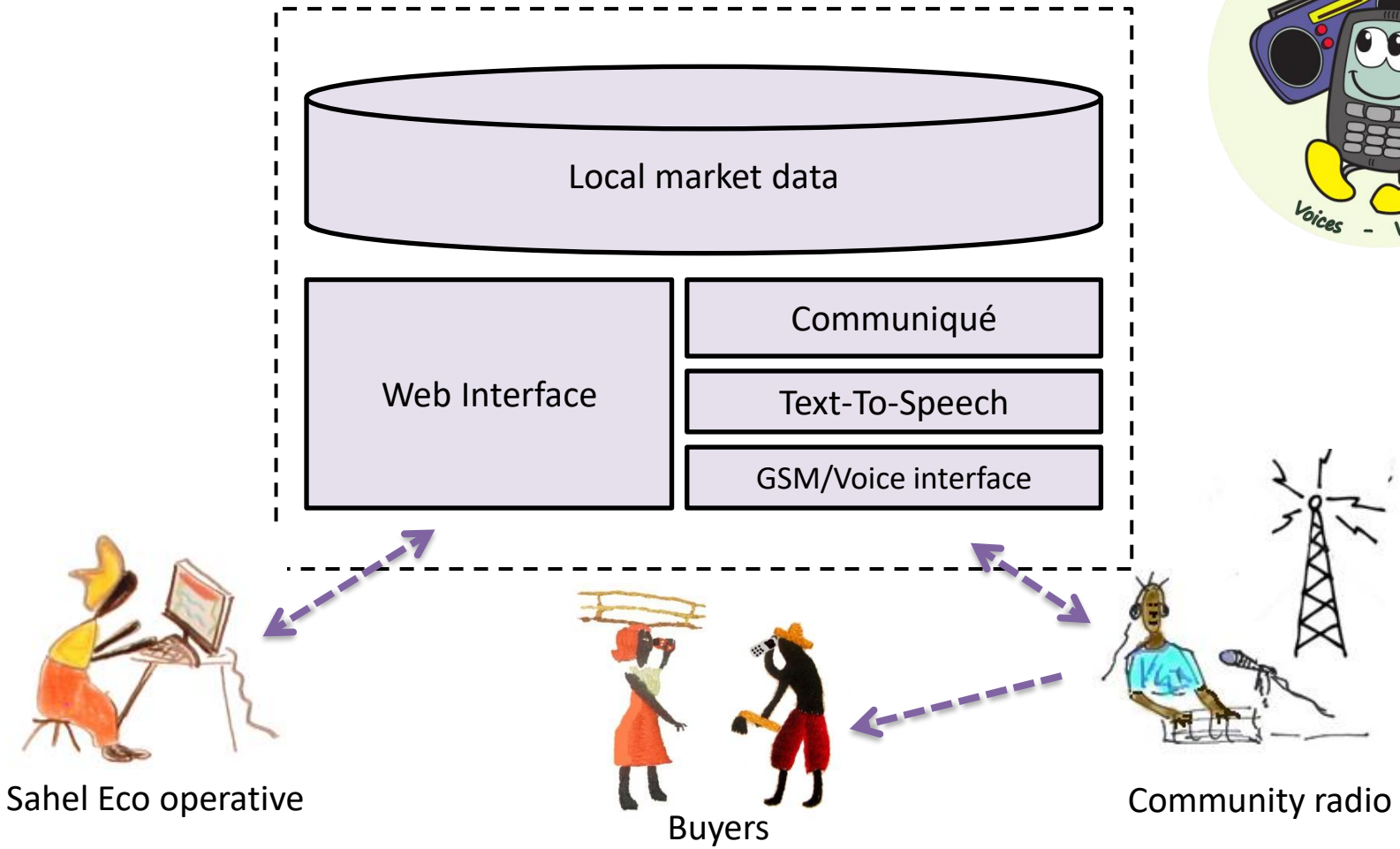
Zone de roduction ommune)	Villages	Nom du produit	Unité de mesure	quantité disponible	qualité du produit	prix au kg en F CFA	contacts
Mafouné	Souté	amande de karité	kg	1800	amande ébouillantés	200	Mandiakuy Philippe TEL: 78182990
	Bokuy-Mankoina	miel	Litre	72	miel non brulé	2 000	Zakari DIARRA TEL: 78571298
	Bokuy-Mankoina	Beurre de karité	kg	60	beurre issu des amandes éboullanté	1 000	Zakari DIARRA TEL: 78571299
OULA	Tiéblénikuy	Beurre de karité	kg	165	beurre issu des amandes éboullanté	200	Gérard TRAORE TEL: 77274248

NB : Pou

lus d'information contactez Monsieur Amadou TANGARA SAHEL ECO TOMINIAN TEL. 79410255 ou le point

...us vous écoutez


RadioMarché
Voices - W4RA


Local market data
Web Interface
Communiqué
Text-To-Speech
GSM/Voice interface
Sahel Eco operative
Buyers
Community radio

Voice channel: Multiple solutions

Netbook

HTTP

Orange Emerginov Platform

Netbook running Prophecy

SIP over Ethernet

Officeroute running Asterix

Netbook running Prophecy + Asterix

Bluetooth

Mobile phone

Low-powered hardware running Asterisk

USB

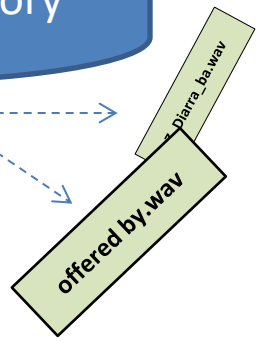
GSM dongle

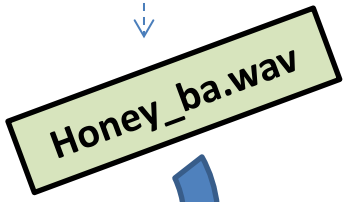
Audio communiqué

- Audio communiqué generated by slot-and-filler Text-to-speech system
  - concatenating **prerecorded phrases**
  - Each radio host uses own voice (!)

- Malian French
- Bambara
- Bomu

“Slot and Filler” Text-to-Speech





Bambara:	15_ba.wav	L_ba.wav	Of_ba.wav			
English:	15	liters	of	honey	offered by	Zakari Diarra

VoiceXML

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<vxml version="2.0" lang="en">
<form>
 <prompt bargein="false">
  Welcome to RadioMarche!
  <audio src="audio/communique_1_bambara.wav"/>
 </prompt>
 <option dtmf="1" value="1">Press one for X</option>
 <option dtmf="2" value="2">Press two for Y</option>
 ...
</vxml>
```

DTMF = Dual-tone multi-frequency signaling

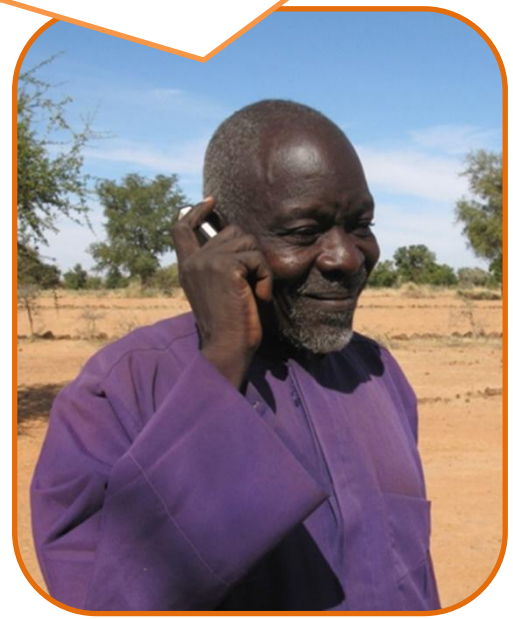
Nana Baah Gyan demonstrates an early prototype of RadioMarche

https://www.youtube.com/watch?v=2JsiQmg7Km8

Nichesourcing for polyvocal CH object annotation

World Museum objects from Northern Ghana

1. What is this object (*class*)
2. What is the purpose of this object (*usage*)
3. How should the object be treated (*care*)



Naomi Maronic

Which of the Grand Challenges of HCI4D by Ho et al. are addressed by Gyan et al?

Problematize HCI4D	Story
Reuse HCI4D Knowledge to Avoid Reinventing the Wheel	User Interfaces for Illiterate and Semi-Literate Users
Supporting an Ecosystem Around Affordable Computing	Improving HCI Capacity in Developing Regions
A Clear Development Success	

Take Home

- HCI4D as subfield of CS4D / Dev.informatics
  - Research vs. practice
  - Related to cross-cultural HCI (L10N)
- Low-literacy as one of HCI4D's Grand Challenges
  - Different levels/types of literacy
  - Solutions: Icons, Voice
- Voice as a channel: IVR apps
  - One modality/channel to access web data
  - UX is (even more) important