

# Challenges of Implementing Standardized Emergency Data Exchange over Interactive Voice Response in Sri Lanka

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Sarvodaya



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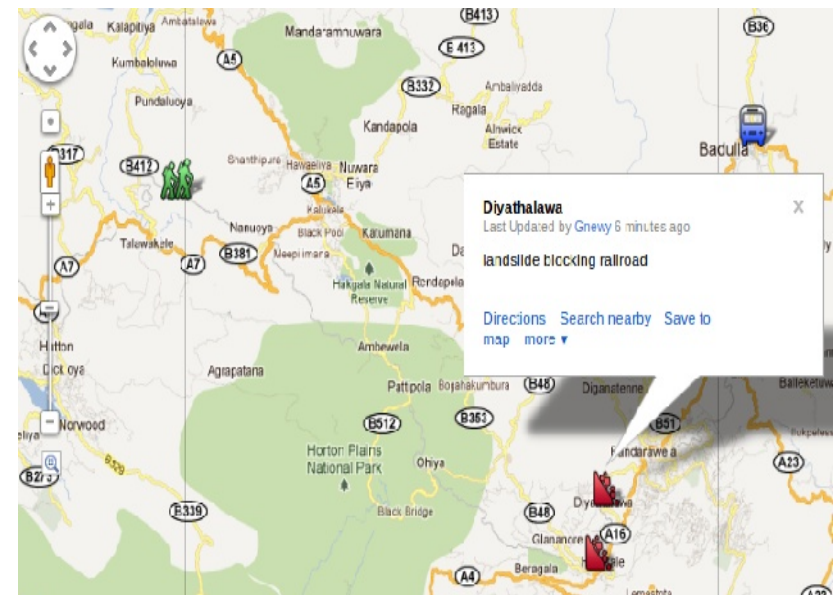
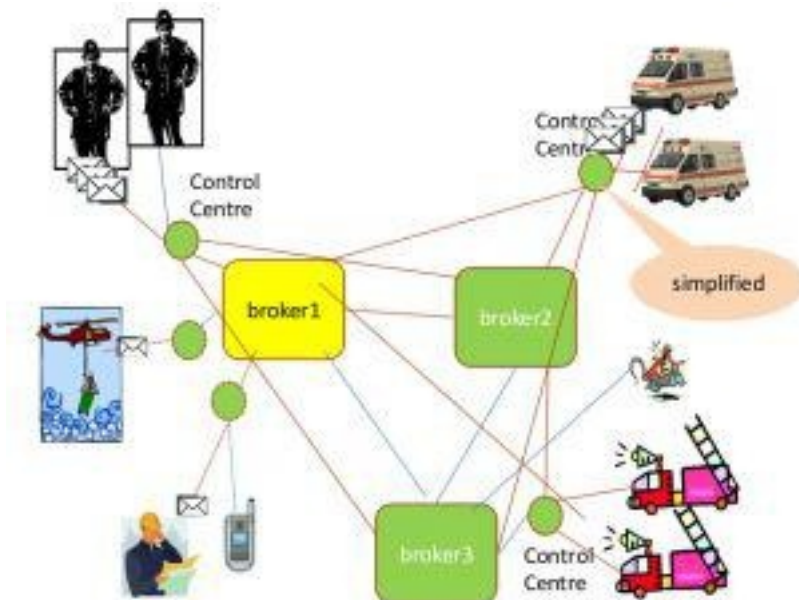
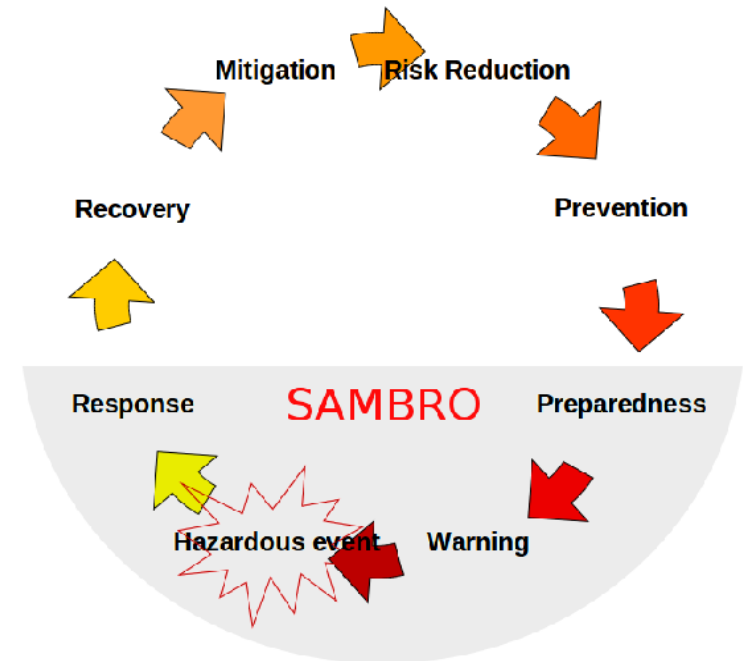


LIRNEasia

[www.lirneasia.net](http://www.lirneasia.net)

# LIRNEasia Disaster Communication Research

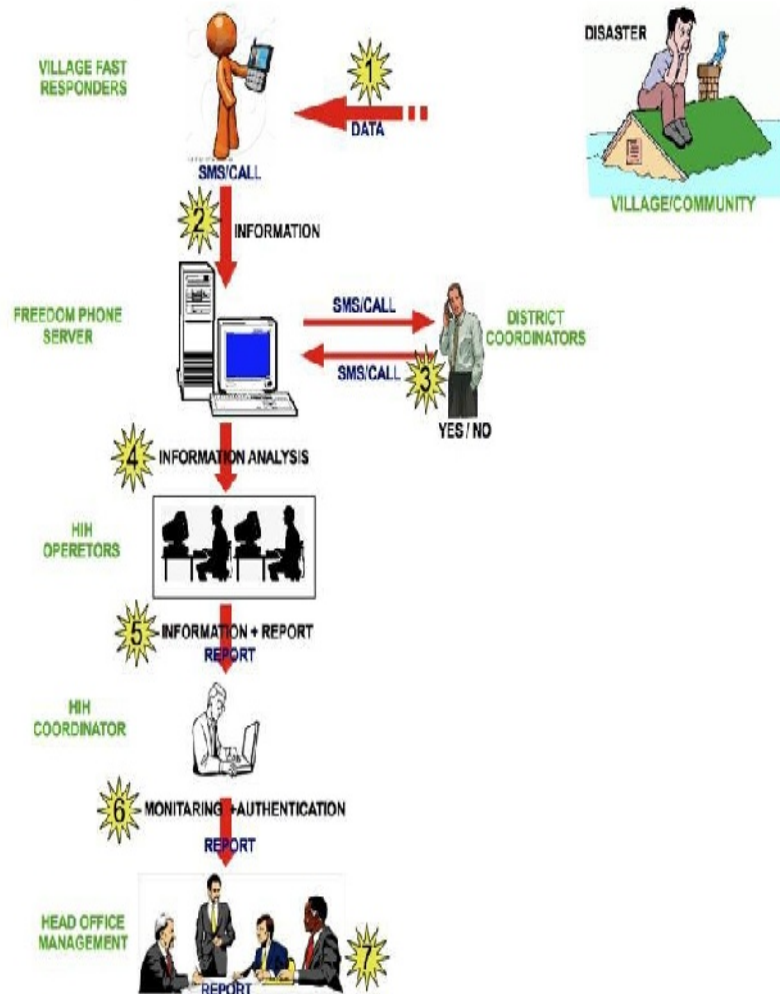
- LIRNEasia is in EWS space of DM; i.e. **HazInfo:**
  - Webhamuwa, NEWS:SL, Dam-safety, LM-HWS, CB, Biosurv, FF4EXL
- Bleeds in to "preparedness" and "response"
  - "plans w/o drills and drills w/o plans are useless"
- Advocate interoperability
  - common procedures (reg. of alert autho)
  - data standards (e.g EDXL)



# Sarvodaya Emergency Communication Needs



## Situational Information Communication Procedure



- Community members (victims or associates)
  - call the District or Head Office
  - report of incidents.
- Collect ground truth
- 2011 Floods, SCDMC dispatched youth with cameras, laptops, and dongles
- Blog situation on [www.sarvodaya.org](http://www.sarvodaya.org)
- Get word to media and donors
- Secure response resources

**Sarvodaya** | HOME | VIDEOS | ABOUT | ACTIVITIES | EVENTS | FINANCE | DONATIONS | BLOG | SEARCH

**Sarvodaya's relief efforts continue**

Sarvodaya sends a relief team of professionals to the region hardest-hit by the floods for support, fact-finding and needs assessment. Most urgent needs remain food and shelter. Technical and needs assessments are vital.

On January 16, as part of its response to the disaster situation, Sarvodaya p.c. together a group of experts to travel to Thiruvananthapuram in the Eastern province. The team completed during emergency medical professional disaster management professionals specializing in water purification and waste disposal; and social workers. The contingent travelled to Jambhaka to engage in relief efforts and provide medical support to flood victims.

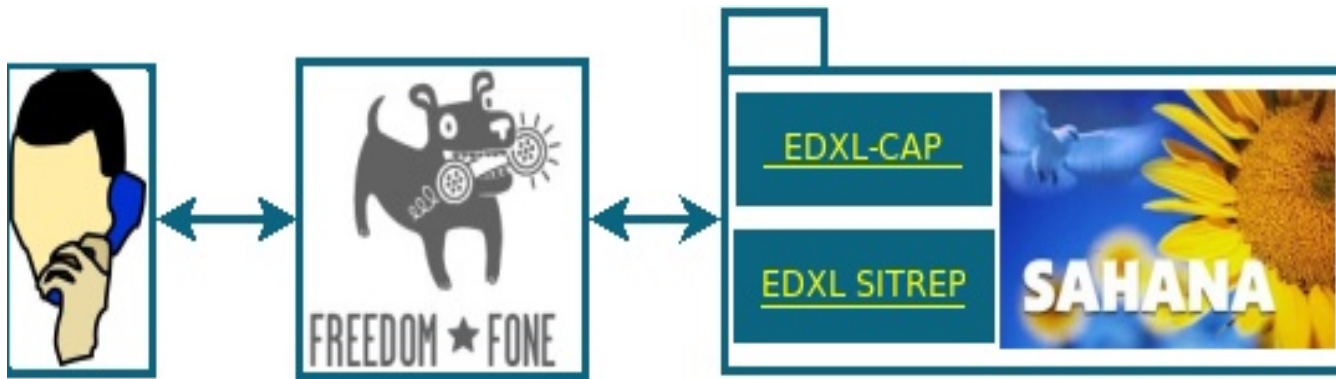
After meeting with the Security Force Commander for the Eastern Province, General Romance Pereira, the team was asked to assist in the needs of the 1,50,000 people in Thiruvananthapuram. Assistance was possible only by

Recent Photos

Make A Donation

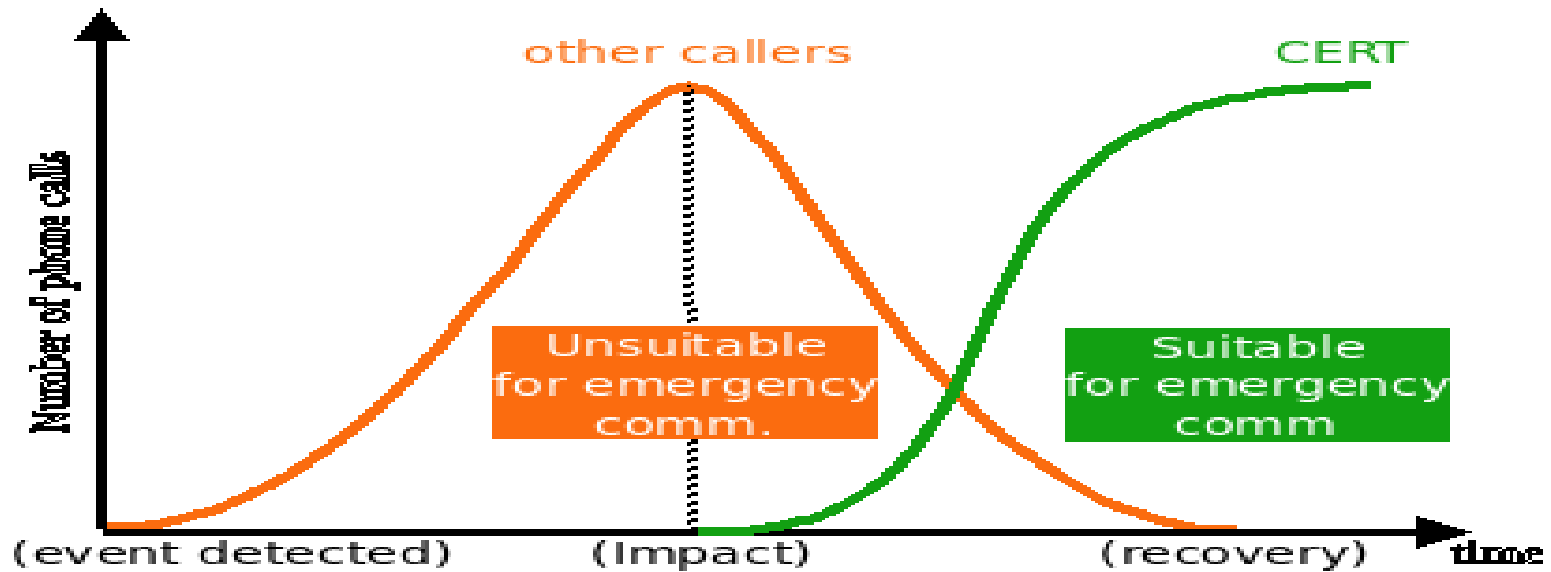
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# Software Components



- Sahana Disaster Management System ([www.sahanafoundation.org](http://www.sahanafoundation.org))
  - FOSS humanitarian ICT tool
  - supported by a global community of software engineers and emergency managers
  - categorical data important for decision support
  - Believes in interoperability
- Freedom Fone ([www.freedomfone.org](http://www.freedomfone.org))
  - FOSS IVR tool
  - Don't need Internet
  - Infrastructure: GSM modem + cheap PC
  - User Interface: standard telephones (mob + fix)
- Audacity
  - FOSS tool for making audio files

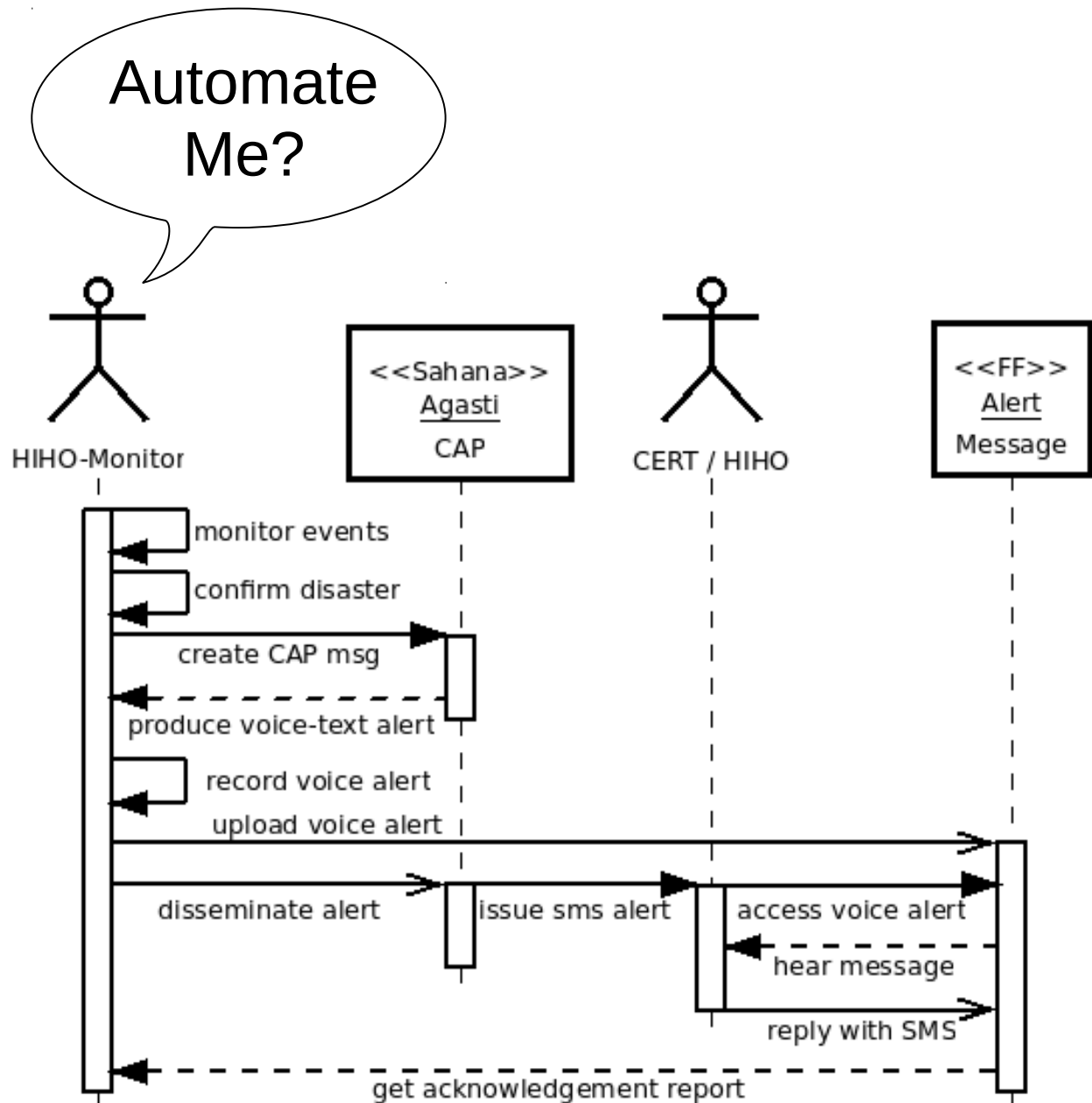
# Positioning Voice for Emergency Communication



- Dropped calls are high during hazard events
  - voice best after the 6th hour from disaster impact
  - Recommended for **disaster response phase** (rescue and relief)
  - Can be used for other none critical disaster management activities
- Canadians use IVR for rapid on-set tsunami warnings (< 60 min window)
  - But too expensive for developing countries
  - Definitely not for community-based organizations
- **IVR** removes language and computer literacy barriers
  - **less burden on training regime**

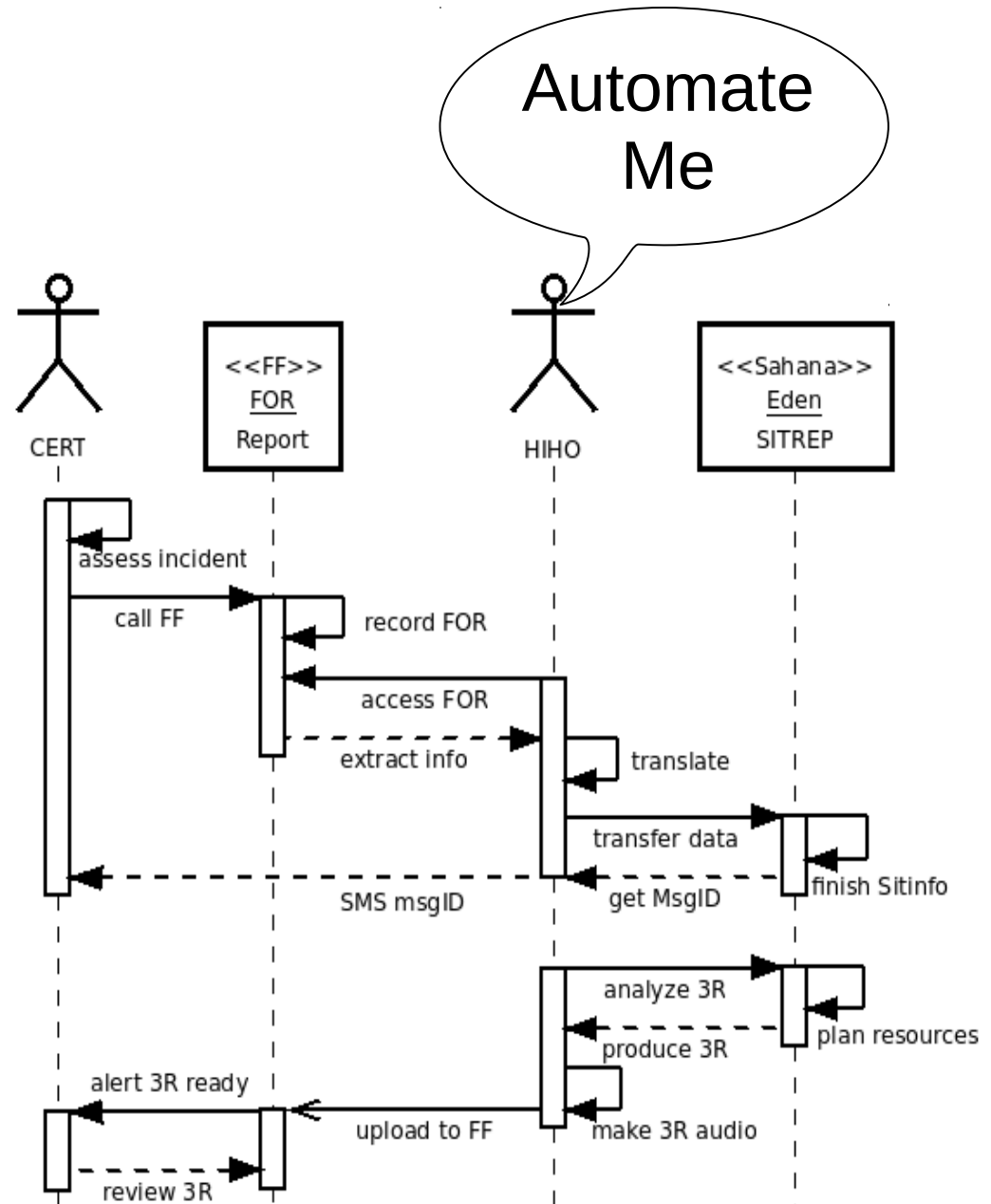
# Alerting sequence (downstream)

- Incident management center (i.e. HazInfoHub) generates EDXL-CAP messaging
- Transform that to a localized audio alert
- Upload audio file to IVR and revise menu
- Issue SMS to wake up first-responders
- They listen to localized descriptive alert



# Reporting sequence (upstream)

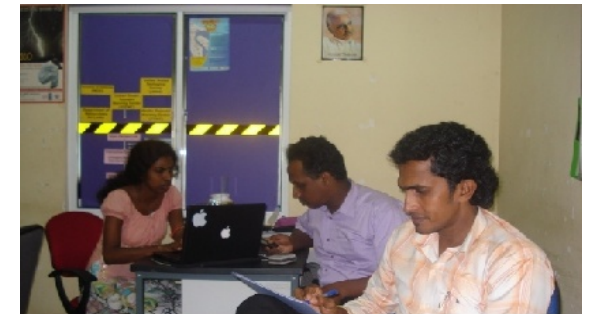
- 1) CERT members record, local lingo Field-Observation voice reports in Freedom Fone IVR
- 2) Incident coordinators (HazInfoHub Operators) translate/transform those voice messages to EDXL-SITREP categorical info
- 3) Then enter that plus other info in Sahana SitRep module
- 4) Incident managers derive Response Resource reports for actions





# Research Design

- Principal: Lanka Jathika **Sarvodaya** Shramadana Sangamaya
  - Sri Lanka's largest community development NGO
  - Also provide humanitarian services
- Hazard Information Hub @ Community Disaster Management Center, Moratuwa, HIH Manager, 3 HIH Operators
- Four Districts: Colombo, Matara, Nuwara-eliya, Ratnapura, ~ 10 - 13 CERT members from each district: Divisional/District Coordinators, Staff

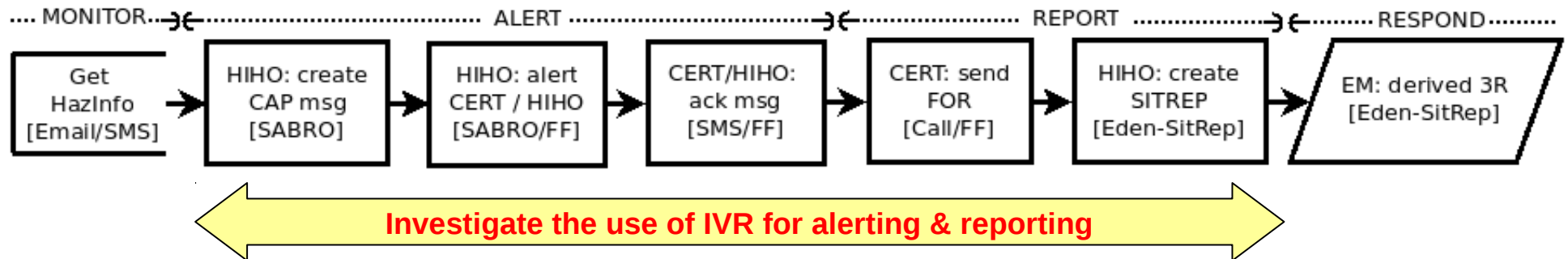




# Evaluation Method

## Controlled Exercises (human action cycle)

- Discussed operating procedures (goal, intention, action)
- Executed those procedures (execution, perceiving, interpreting SoW)
- Evaluated the outcomes (Performance, Usability)



## Complexity:

- Interaction techniques (HCI)
- Reliability - mean time to completion & **voice quality (ITU-T)**

## Usability:

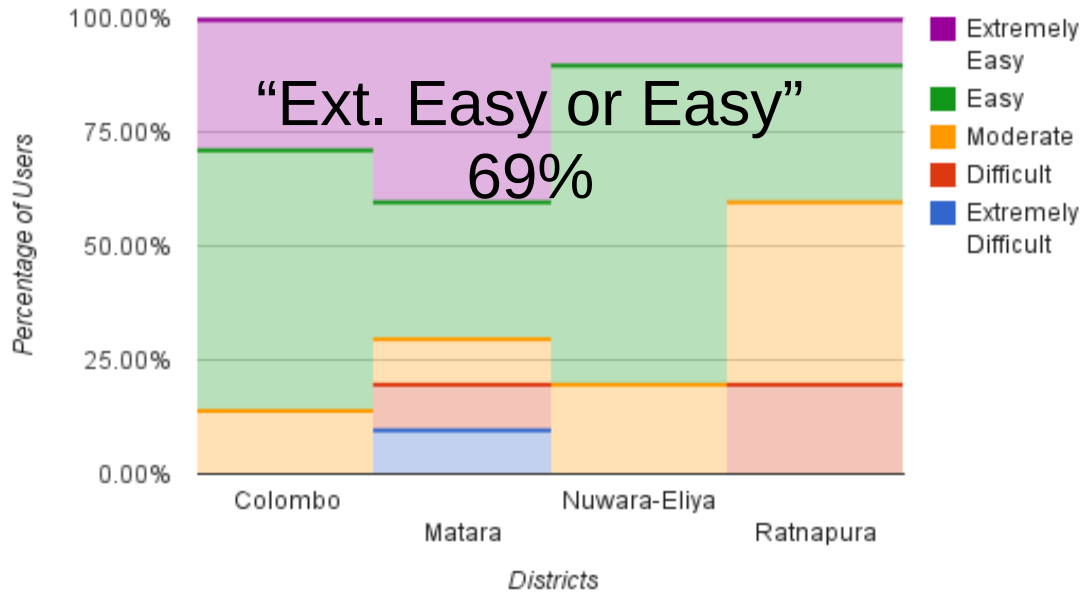
- **Human action cycle (HCI)**
- **Gulf of execution/evaluation (HCI - what system allows/understanding of SoW)**

## Utility:

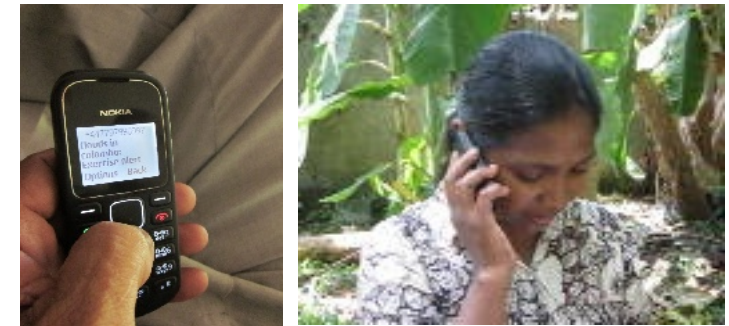
- Ease-of-Use, Usefulness, and Attitude (TAM)

# Alerting with Freedom Fone (IVR) - downstream

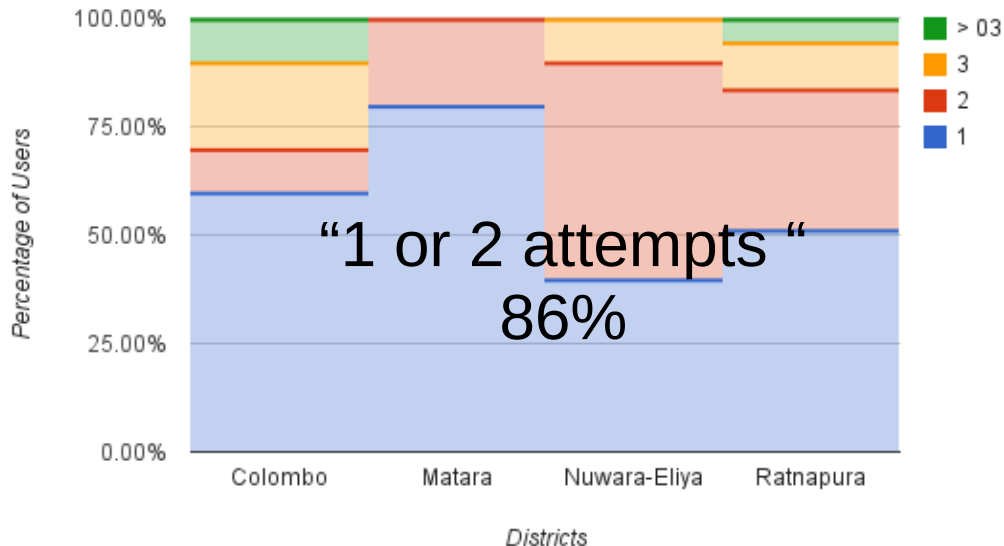
CERT Complexities Interacting with Freedom Fone to receive Alerts (n=37)



**Avg. Call Time: 2:13 min**  
**Avg. Msg Time: 1.59 min**



CERT Number of Attempts to receive Alert from Freedom Fone (n=37)

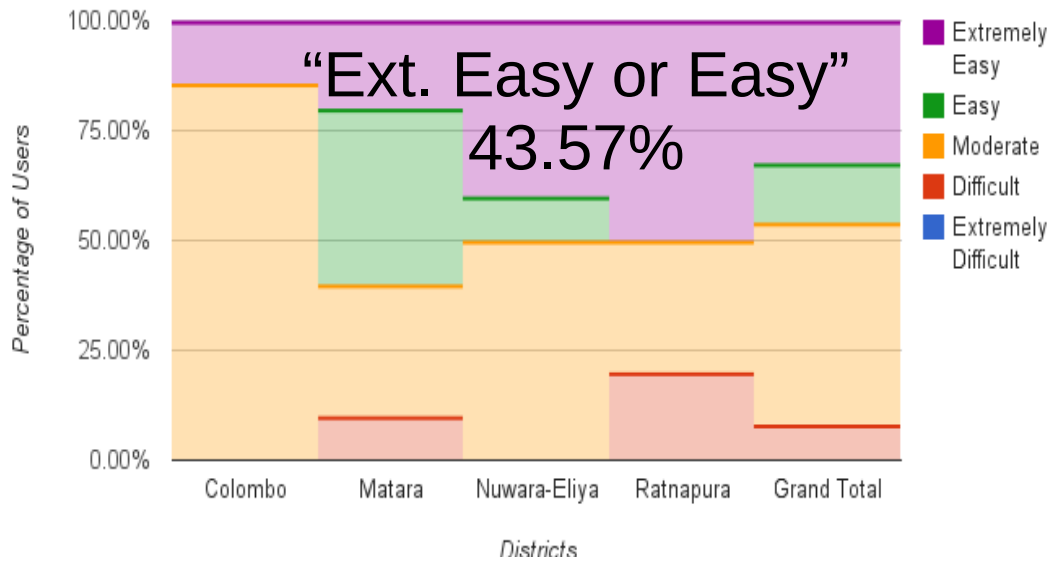


## Menu selection sequence:

1. Language (press #1 for sinhala)
2. Alerts list (press #1 for Alerts)
3. Select alert (press #2 for "landslide in Ratnapura 2011 Nov 10)

# Reporting with Freedom Fone (IVR) - upstream

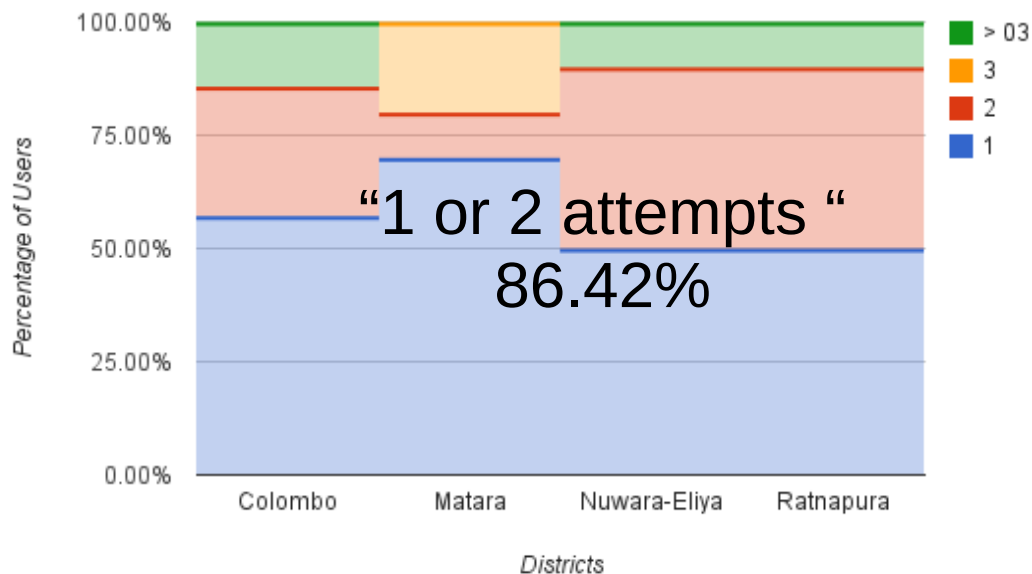
CERT Complexities Interacting with Freedom Fone to submit Report (n=37)



**Avg. Call Time: 2:33 min**  
**Avg. Msg Time: 1.38 min**



CERT Number of Attempts to submit Report with Freedom Fone (n=37)



## Menu selection sequence:

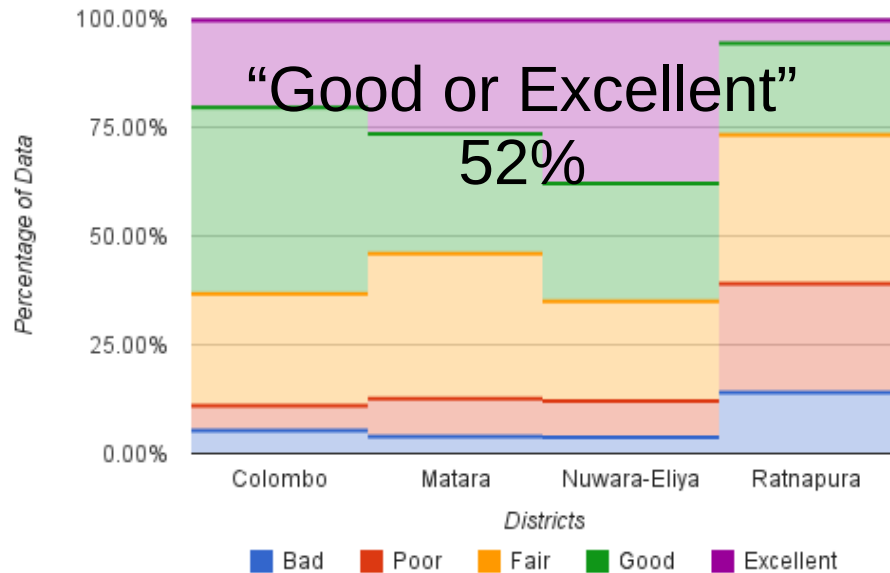
1. Language (press #1 for sinhala)
2. Submit a Report (press #2 for reporting)
3. Begin recording after the beep
3. Save report (press # to save, press #1 to listen, press \* to delete)

# General observations

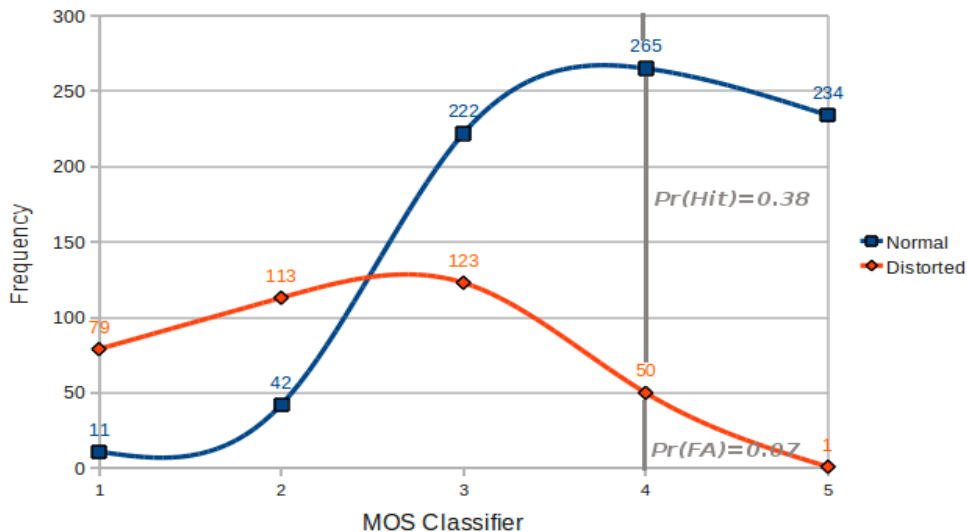
- First IVR experience for many users
  - Although telcos offer downstream IVR services
- Users want less instruction to save on call time
  - “don't give us dummy proof lengthy explanation”
- IVR has no display to visualize the transition state
  - can get lost in the menu tree
  - users terminate call, then try again
- One or two unbranded cheap phones not interacting well
- Some providers not forwarding DTMF tone
  - IVR not responding to phone key pad
  - e.g. press 1 to select menu, nothing happens
- Users forgetting to press special keys
  - e.g. press # key to save a voice recording

# Mean Opinion Score

Distribution of Opinion Scores (n=41, m=7)



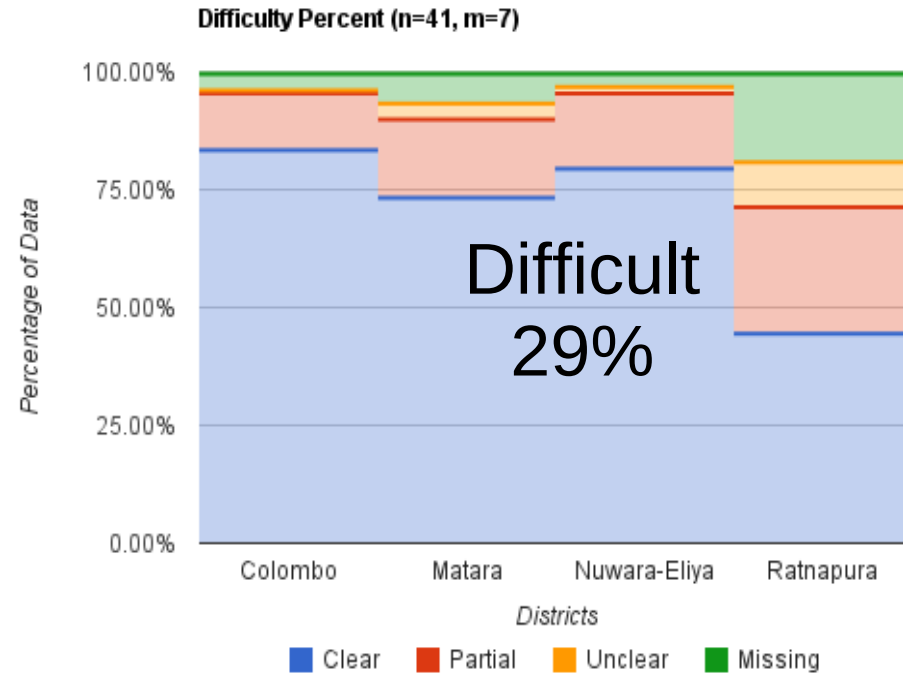
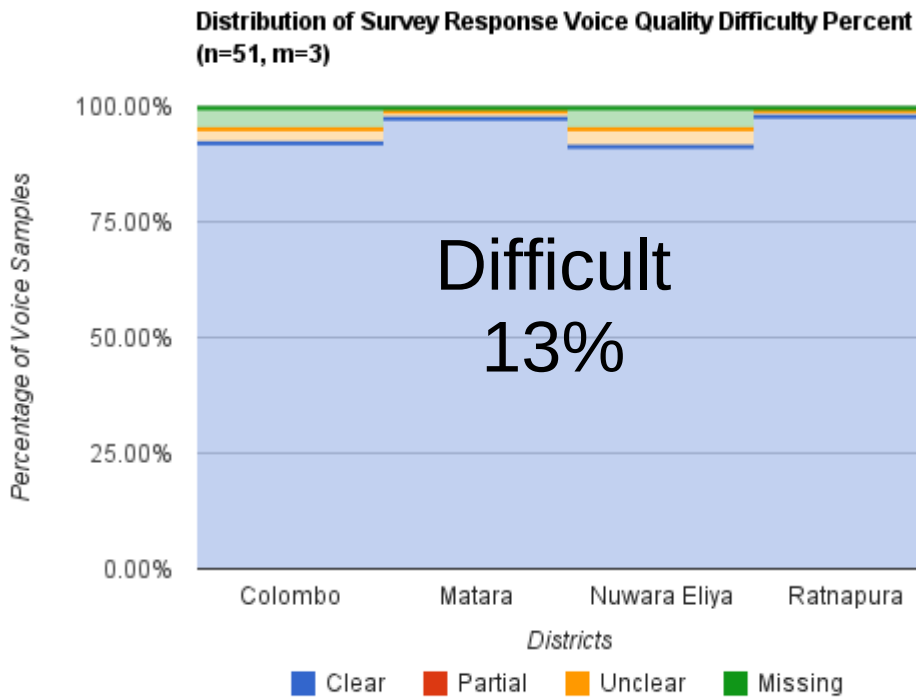
Frequency of Normal and Distorted Voice Samples



- Circuit (mechanical) and environmental noise prevalent
- Approx. 50% bad, poor, and fair
- MOS = 3.52
- MOS cut-off = 4.0 is a reliable choice for setting a distinguishing between good and bad emergency comm IVR applications
- Calling CERT member to confirm info would be inefficiencies



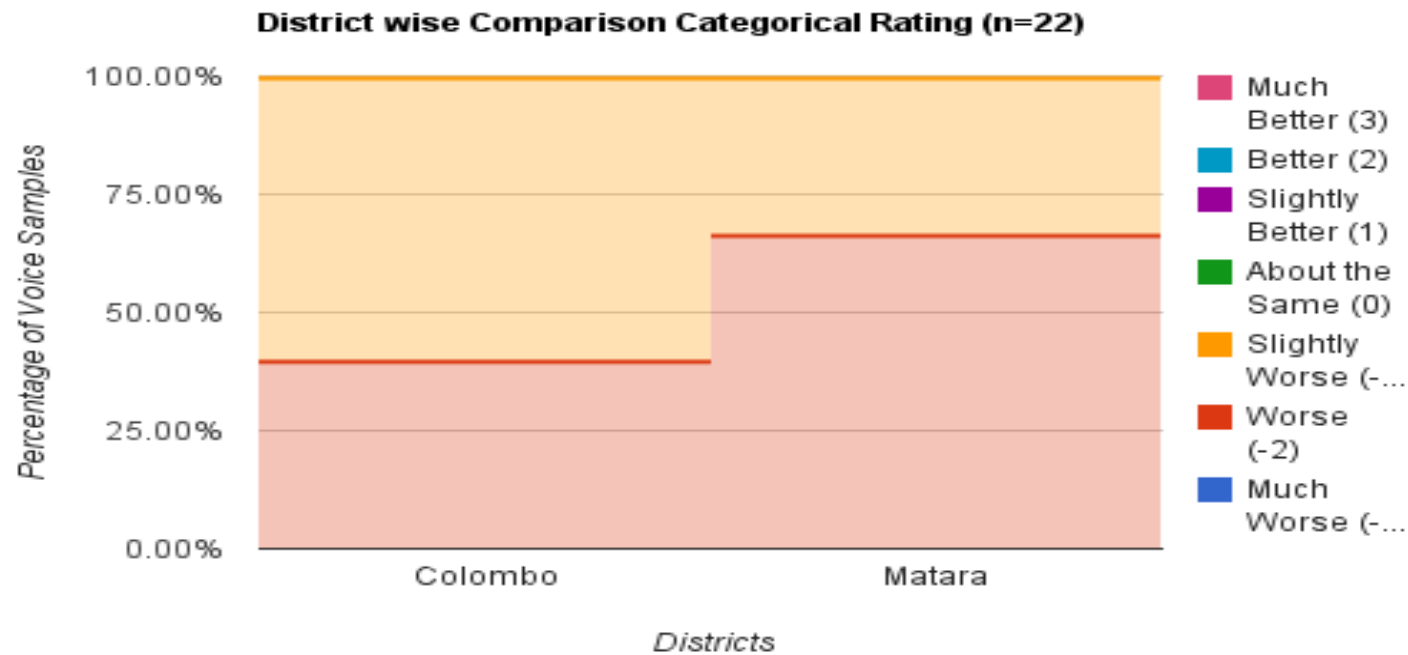
# Percent Difficulty



Speaker-dependent ← Emulates → Speaker-Independent

- Partial, Unclear, or Missing emergency info can lead to false predictions/actions
- Speaker-dependent: survey with set words to speak
  - Evaluators could predict (**trained**)
- Speaker-independent: gave reporting attributes but free to speak
  - Evaluators unaware (**untrained**)
- User variability → speaker-dependent unfavorable (i.e. impractical to train each user)
- Perhaps a hybrid

# Comparison Categorical Rating



- Voice samples received in IVR worse than on-site digital recording
- **Push** (IVR-to-Phone): **clearly heard**; why?
  - high quality recording with computer (MP3)
  - Human brain can process a lot more (*waht oredr the ltteers in a wrod are can sitll raed*; we do same with sound – *Auditory Illusion*)
- **Pull** (Phone-to-IVR): **unclear**; why?
  - mobile handset sampling at lower frequency
  - multiple CODECs in network topologies degrade quality
  - Machines can't reason (at least not yet)

# Conclusions

- Forget about Speech-To-Text or Text-To-Speech
  - STT/TTS still primitive for Sri Lankan local languages
  - Voice quality too bad for automating transformation
  - FCC has suspended TTS for EDXL-CAP voice messaging
- VoIP quality is better (i.e. can achieve MP3 quality)
  - may take us closer towards automation with TTS/STT
  - Don't need to invest in GSM modems (unreliable and expensive)
- Sarvodaya members attitude towards Freedom Fone (IVR):
  - Useful, easy-to-use, good & wise choice, and positive
- Daily use of IVR in Sarvodaya business
  - will make it always “on” and “ready to use”
  - Opportunity for users with difficulties to improve
- Adopting for Sarvodaya project monitoring & evaluation
  - Same process emergency alerting and reporting:
    - project managers post project information for task-handlers to refer
    - task-handlers call and leave-a-message on project status
    - data center process the voice and convert to categorical text data
    - project managers analyze project status info to make decisions

More visit: <http://lirneasia.net/projects/2010-12-research-program/ff4edxl/>