

ACQR: Acoustic Quick Response Codes for Content Sharing on Low End Phones with No Internet Connectivity

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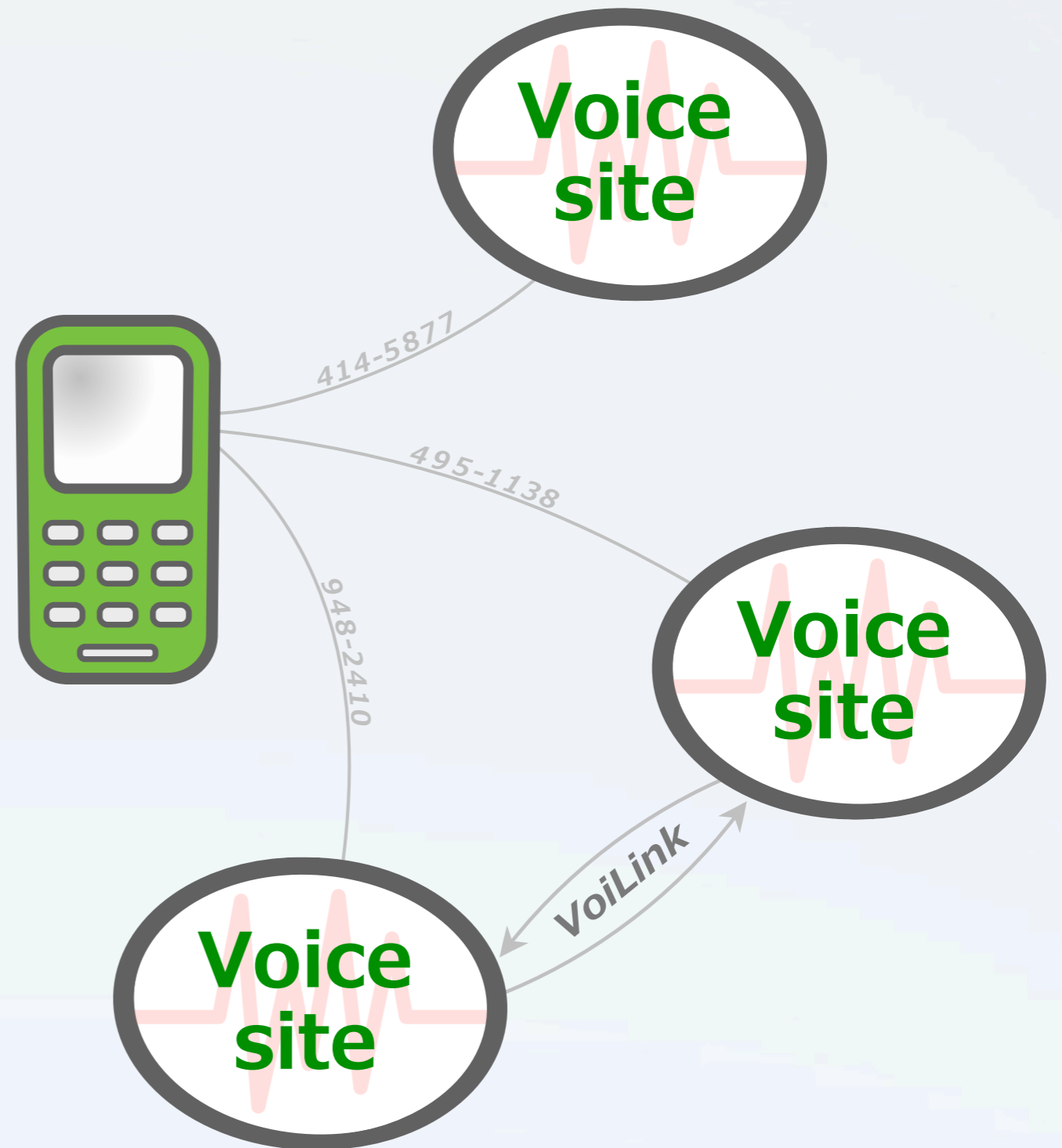
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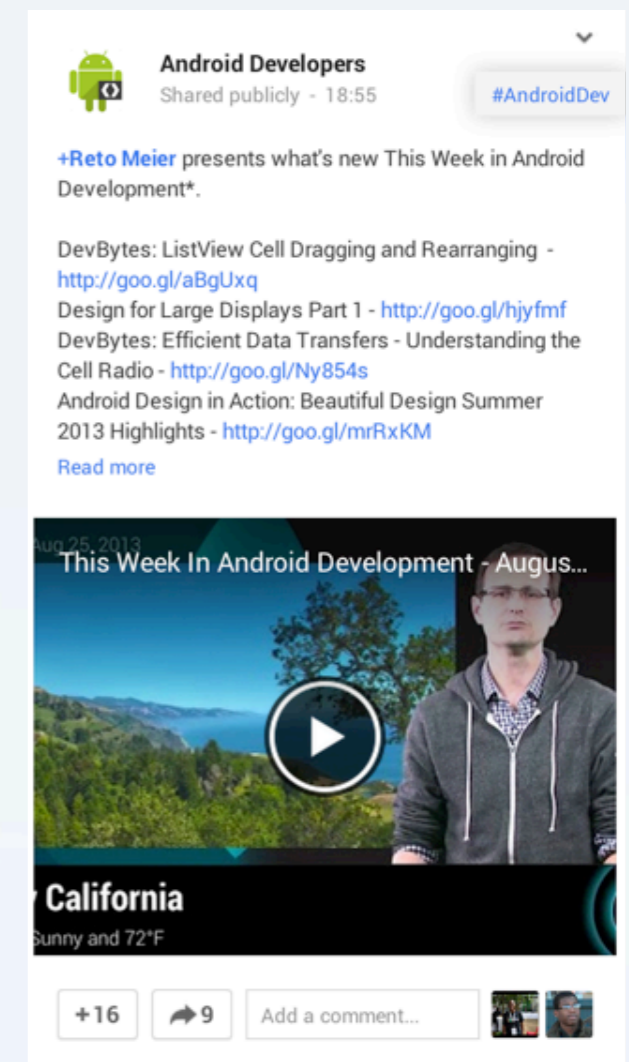
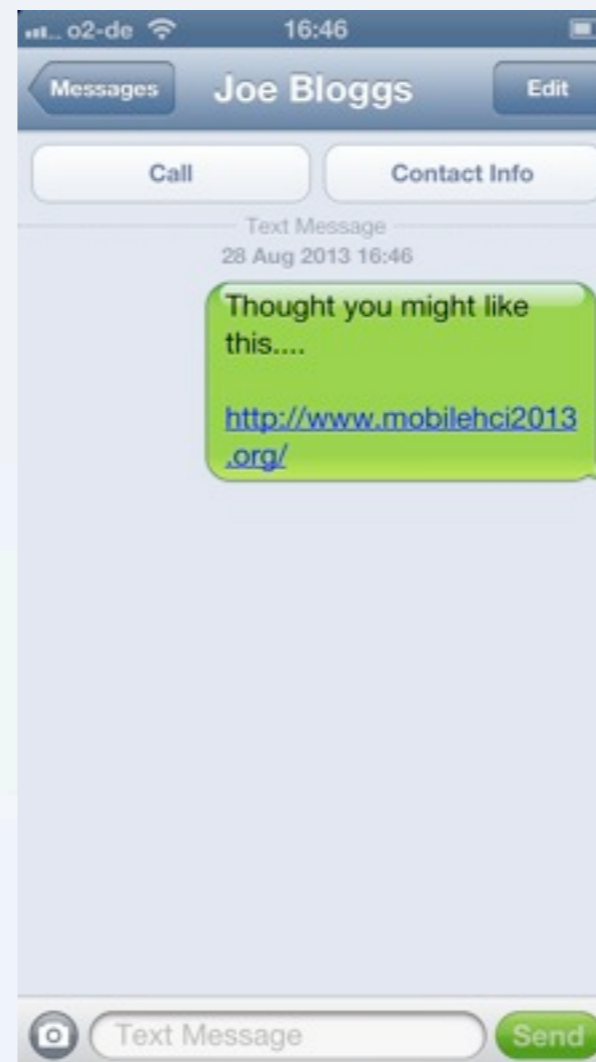
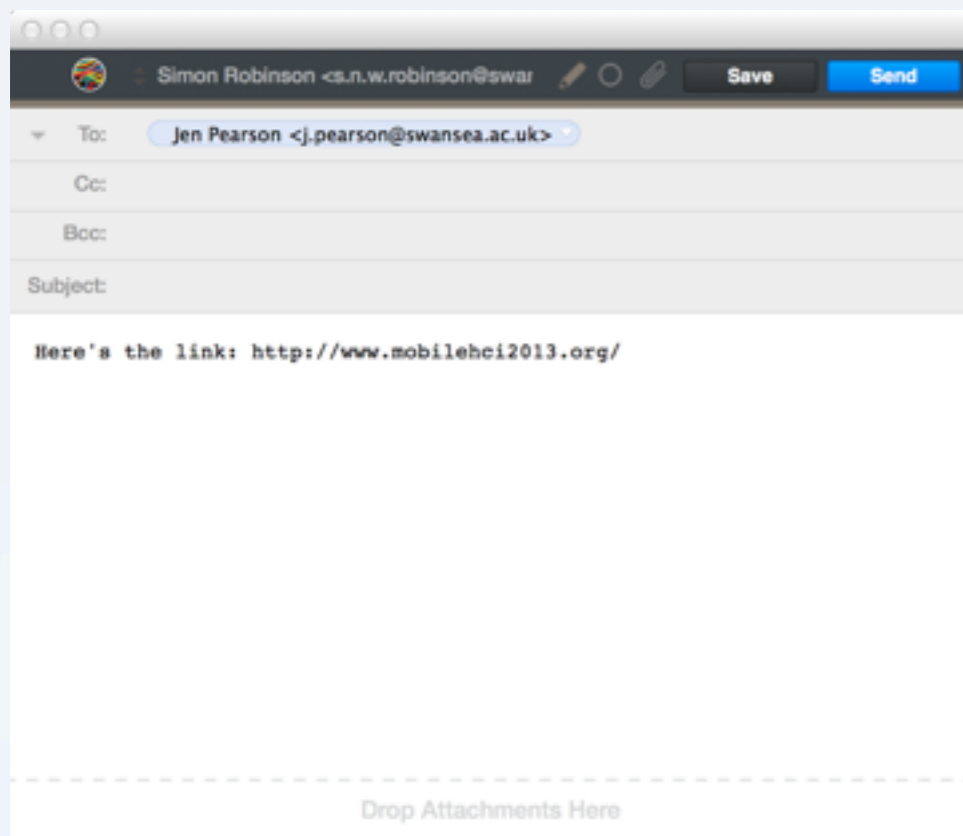
Spoken Web

- IVR telephone system
 - Dial-up voice sites
 - Interactive
 - Interconnected



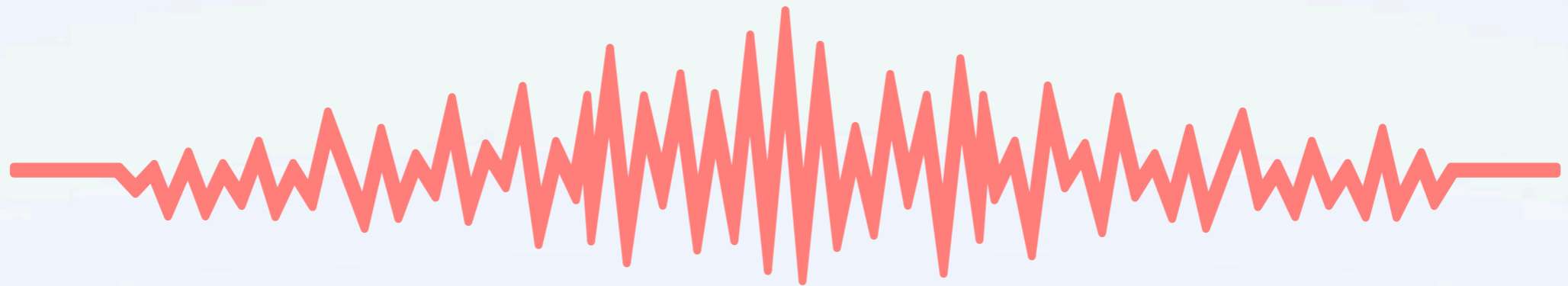
Sharing

- Sharing locations on the internet = easy
- Usually: send a link



Sharing

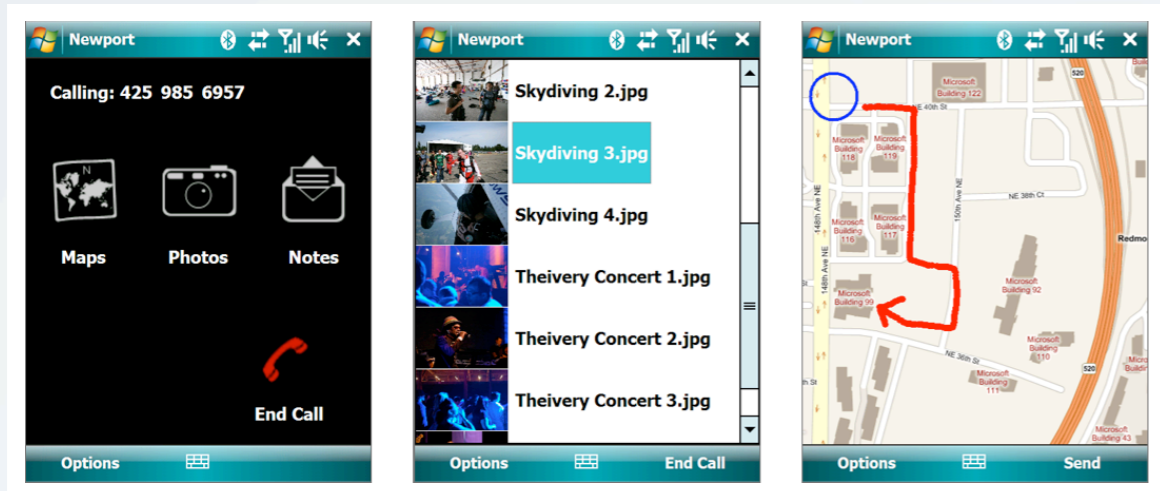
- Sharing locations on the Spoken Web = difficult
- No way to share a specific location
- Spoken Web is:
 - a complex hierarchy
 - not easily searchable



Study: existing sharing

- Eight current users interviewed
- Shared via:
 - Memorisation
 - Playback
 - Phone number
 - Navigation instructions
- A demonstrated need for a better solution

Related work



Sharing during calls
[7]




High-end inputs; low-end devices [29]



Audio-based sharing [34]

Our approach

- **AC**oustic **Q**uick **R**esponse codes: ACQR
- Synchronise via DTMF tones
- Completely service-side
- Usable on any phone

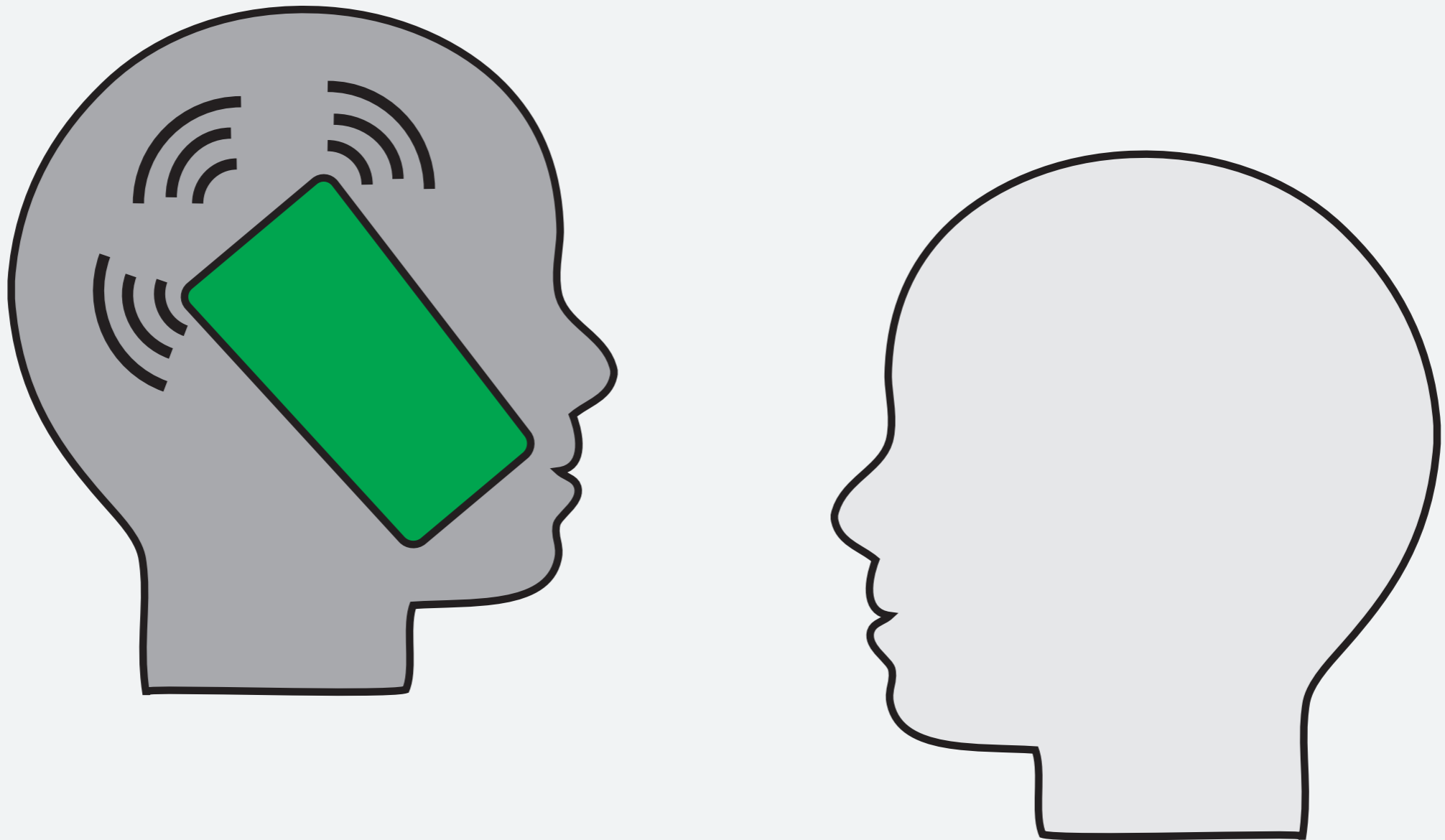
A hand is holding a silver flip phone against a background of green grass. A white speech bubble with a black border is positioned above the phone's screen. The text inside the bubble reads "Welcome to the 'voice of experienced farmers' system". The phone is open, showing a black keypad on the left and a black screen on the right.

Welcome to the
"voice of experienced
farmers" system

(video)

User Interaction

- Audio codes for sharing: ACQR



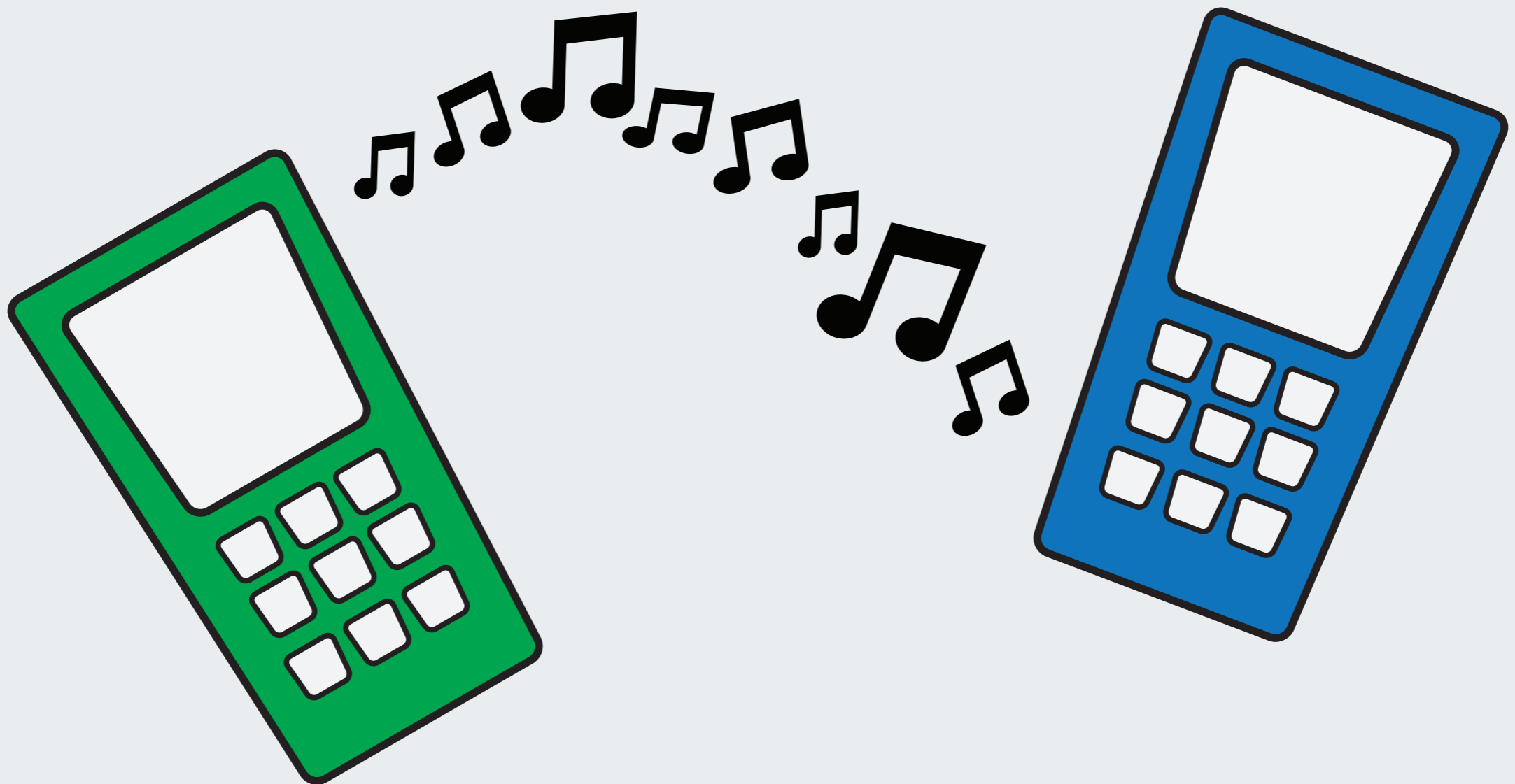
User Interaction

- Audio codes for sharing: ACQR



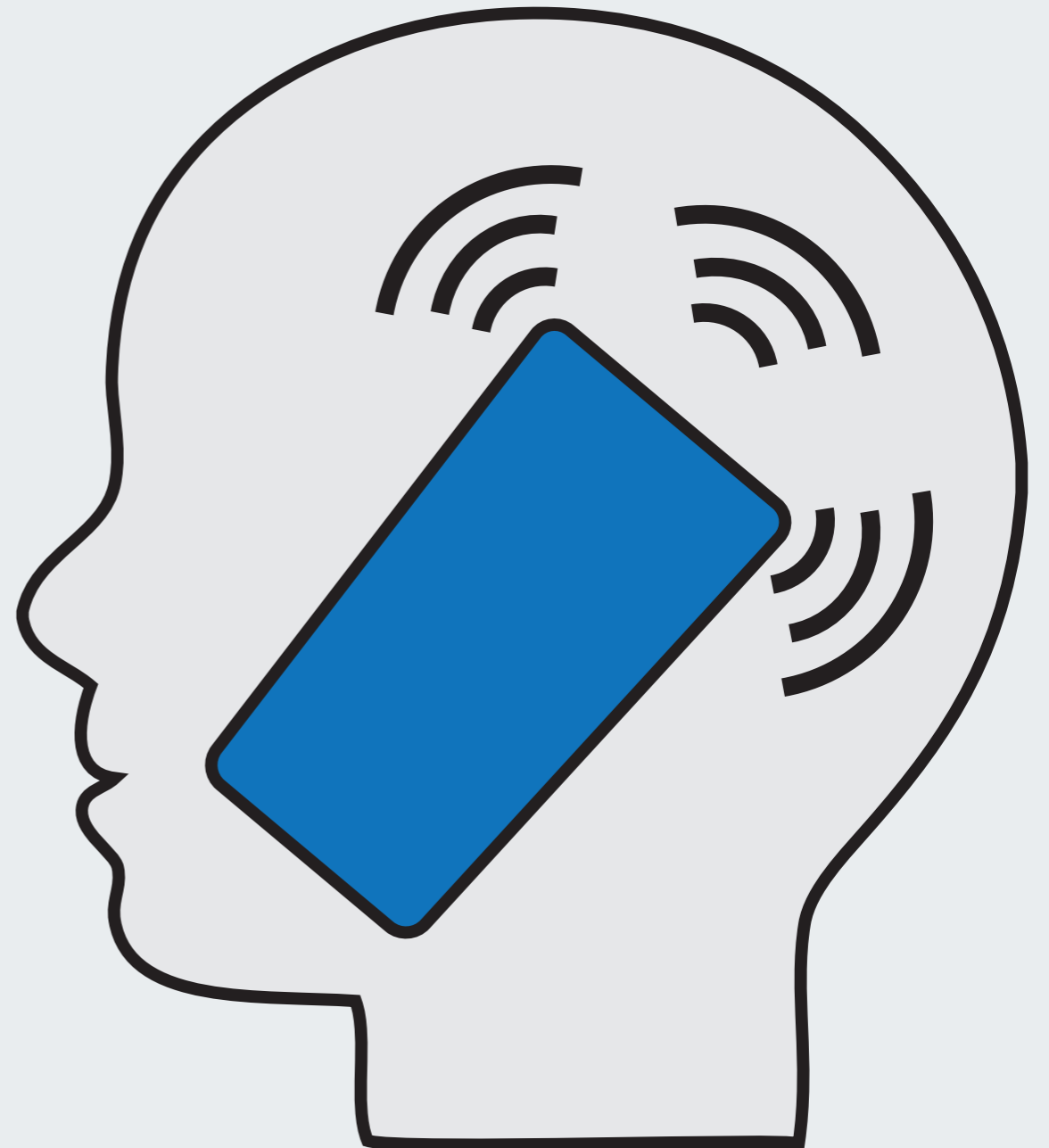
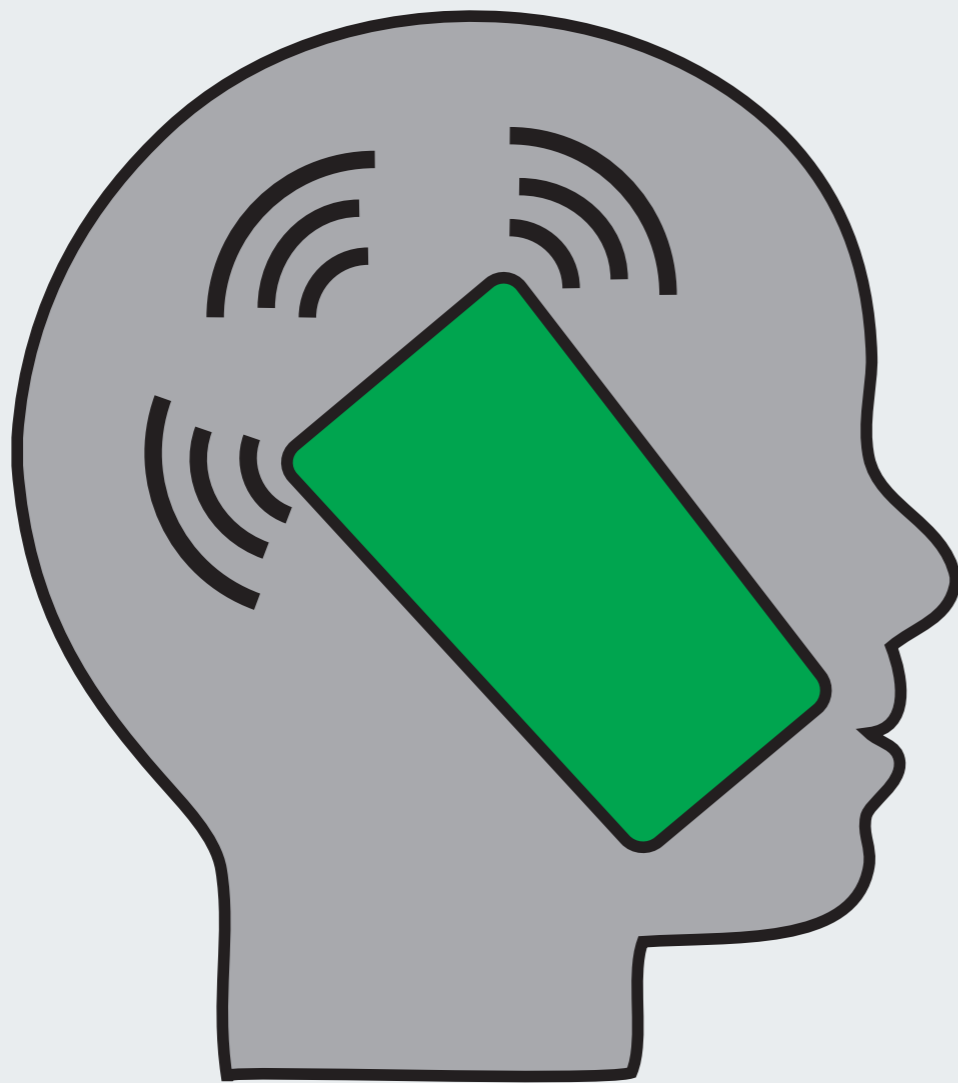
User Interaction

- Audio codes for sharing: ACQR



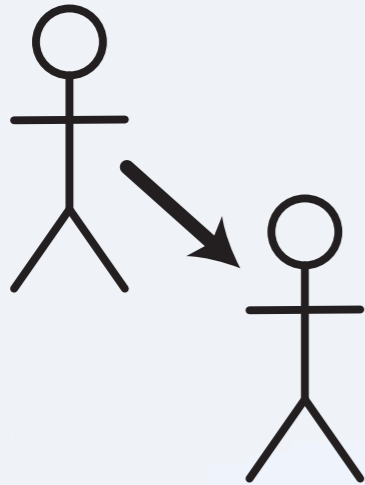
User Interaction

- Audio codes for sharing: ACQR

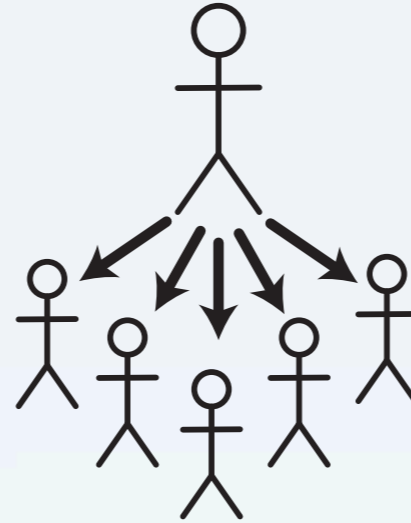


Scenarios

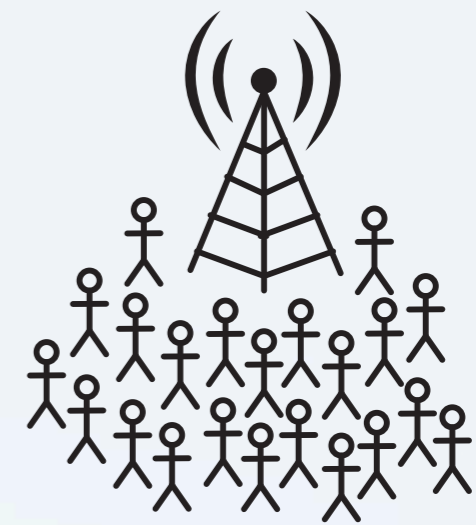
- Use of audio supports multiple sharing relationships



One-to-One



One-to-Several



One-to-Many

Robustness Evaluation

- Recognition testing
- Various environments with differing ambient noise.
- 200 sharing tasks in each environment

Robustness Evaluation

Environment	Ambient noise (dB)	Recognition rate (%)
Inside, quiet room	26	99.5
Outside, quiet park	46	99.5
Inside, information radio show	62	98.5
Inside, busy marketplace	69	98.0
In car while driving (50mph)	77	98.0
Outside, alongside busy highway	79	97.0
Inside, loud music	82	98.0
Inside, very loud music	101	84.5
Average		96.6

Focus groups, Rural India



Findings

- “very helpful. 100% useful”
- “[the ACQR service] saves a lot of time, it is efficient and good for sharing between farmers”
- “this is [an] extremely useful medium where we can share with each other very fast”

Long-term Field Deployment

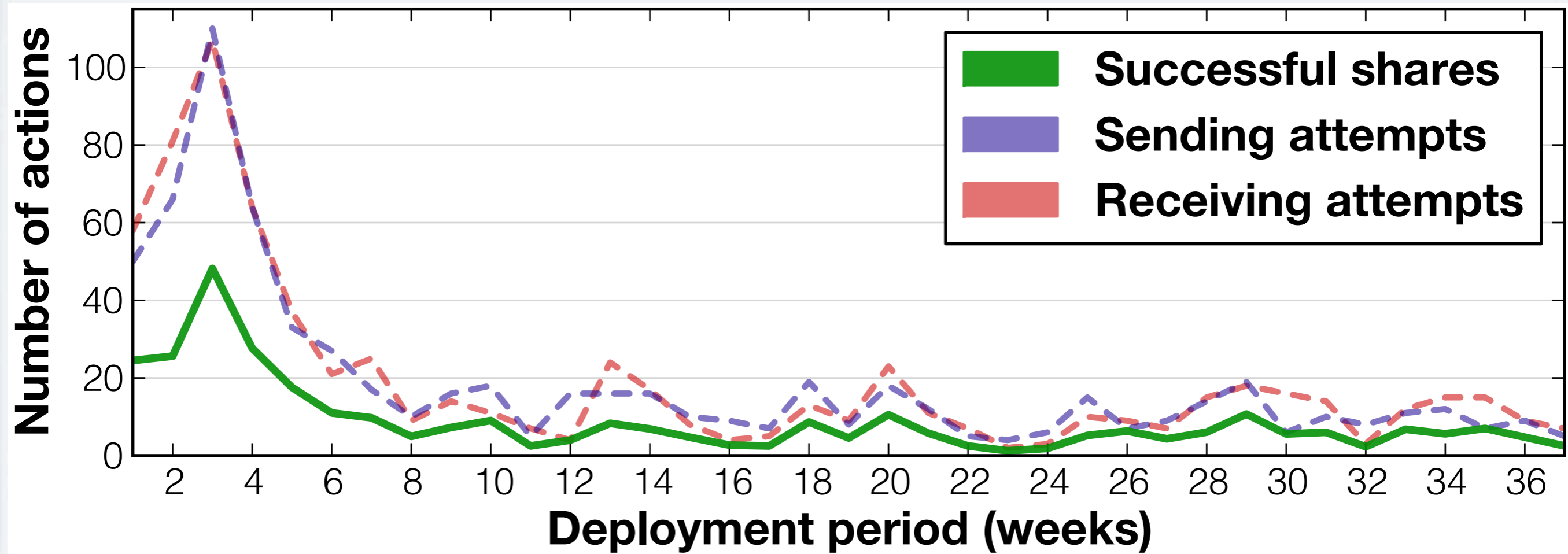
- Continuously available to Spoken Web users for 8 months (at time of writing)
- Main users: Gujarati speaking farmers, mixed literacy, from rural Gujarat, India

Findings

- Used by 358 individuals (35% of the 1033 unique callers over the period)
- 246 tried sharing; 267 tried receiving; many tried both:
 - Send actions: 1202
 - Receive actions: 1004

Usage

- To date: 294 successful sharing actions



Conclusions

- New ways of interacting with audio-only services
- Re-seeing existing infrastructure