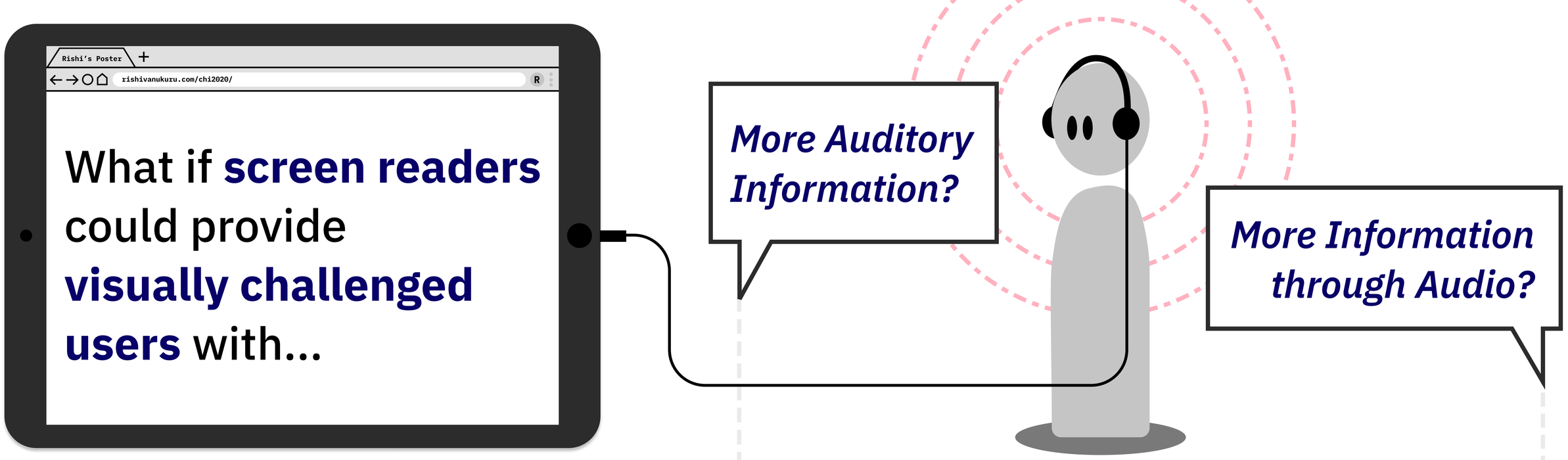
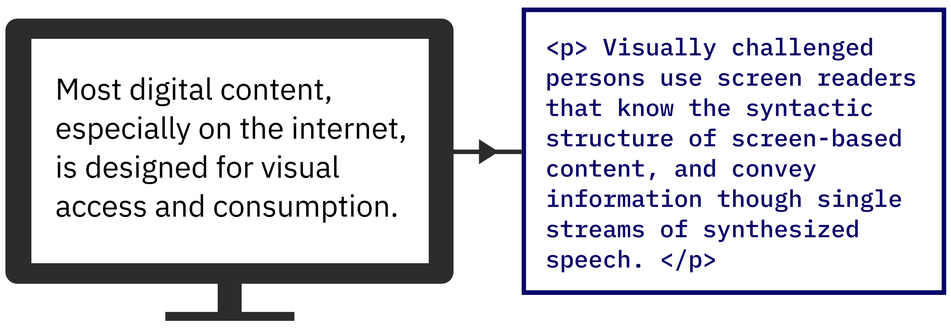
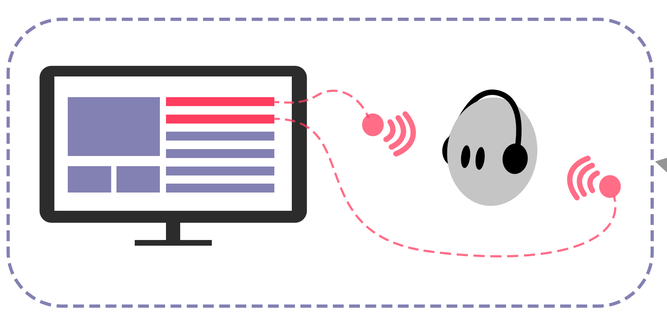



## 1 The Problem

**Search and Browse** tasks can be s**low and cumbersome** while using screen readers. It is **difficult to understand layouts** and visual metaphors.




## 2 The Idea: Concurrent Speech & Spatial Audio

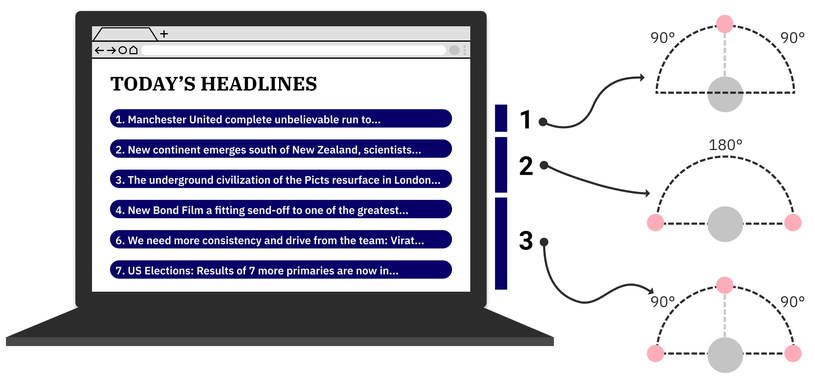



We built a **screen reader app** that allowed users to listen to **multiple streams of speech**[1] at the same time, making use of the Cocktail Party Effect[2] *(more auditory information)*.

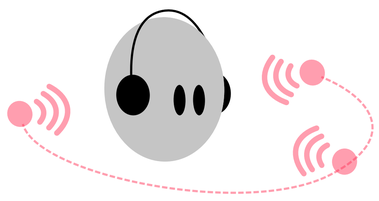
We designed **Spatial Auditory Torch prototypes**[3][4] to convey layouts *(more information through audio).*

## 3 The Study

We asked 4 visually challenged and 4 sighted participants to **search for particular news headlines...**



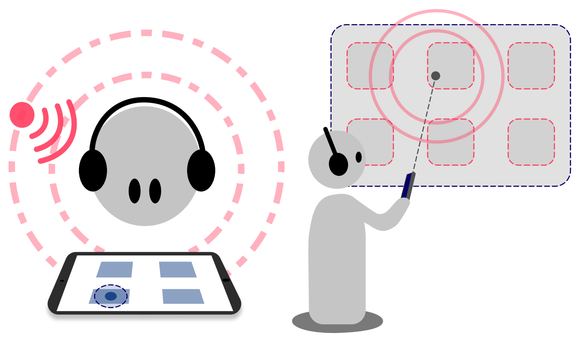

...while listening to them **individually, two at a time, and three at a time**, and with **same or different screen reader voices**



***Above:*** *Illustrations of the speaker positions*

***Left:*** *Top view of the concurrent stream sources*

...and also **while using the Auditory Torch prototypes** to infer the layout *(another real use case of concurrent speech).*



***Above:*** *Illustrations of Auditory Torch prototypes*

## 4 Key Insights

### ■ Users have different listening strategies



**Simultaneous Listening**
When **all streams are being heard together**, in search of keywords.

**Windowed Listening**
When listeners **tune in and out of separate streams** on relevance.

Across users, there were

### ■ Differential Effects of Screen Reader Voices




Instead of perceiving screen reader voices as **same or different**, the factor of **familiarity versus unfamiliarity** played a bigger role.

The importance of

### ■ Grounding Research in Real Tasks

Users **responded better to the Auditory Torch prototypes**, and suggested that **concurrent speech be compared to faster speech**, or used as **supplementary information for Screen Magnifiers.**




Comparing **Concurrent Speech** with **Faster Speech**, and with status quo.

**1. Concurrent Speech:**

The idea of listening to multiple streams of speech at the same time. This project was significantly influenced by related recent work-

*Guerreiro, J. (2016). Towards screen readers with concurrent speech: where to go next?*

**2. Cocktail Party Effect:**

This explains how when surrounded by multiple conversations and sound sources, we have the ability to focus on a single stream of audio that we deem to be important.

*Cherry, E. C. (1953). Some experiments on the recognition of speech, with one and with two ears.*

**3. Spatial Audio:**

The technological rendering of digital audio to appear as if it were coming from the space around a listener. For this, we used Google's Resonance Audio API in Unity.

**4. Auditory Torch:**

Accessing auditory icons in a manner that allows users to specify their focus, while also keeping track of surrounding information.

*Donker, Klante, & Gorny, (2002). The design of auditory user interfaces for blind users.*

# Accessible Spatial Audio Interfaces

## A Pilot Study into Screen Readers with Concurrent Speech

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