Eyes-free Computing
Past, Present And Future

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Overview

Goal

AUI

Multimodal Web

Mobile Search

Smart Assistant

Conclusion

Efficient Eyes-free Access

Efficient Eyes-free Access

- Information — When we want,
- Information — Where we want,
- Information — The way we want!

This Journey Began 30 Years Ago.

Milestones Along The Way

Electronic Information Is Display-Independent!

- ASTER — Audio System For Technical Readings — 1990
- Emacspeak — The Complete Audio Desktop — 1995
- PDF — Capture and extract document structure — 1996
- Web — Design standards for multimodal interaction — 2000
- Search — Deliver results the way the user wants — 2005
- Mobile — Ubiquitous information access — 2008
- Google Assistant — eyes-free Interaction — 2014
- The best is yet to come!

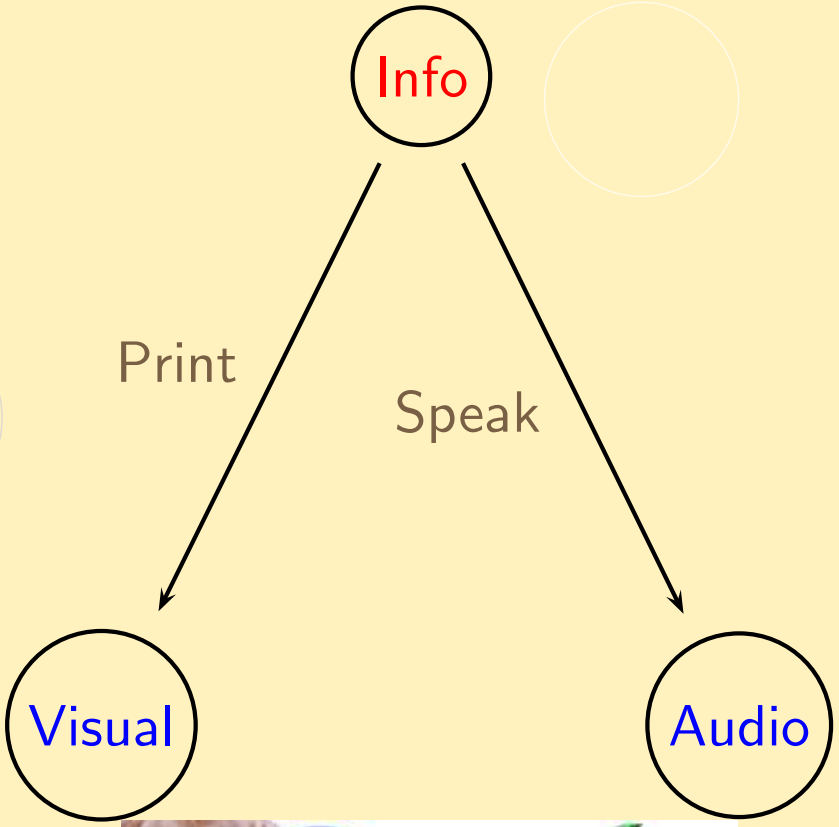
Auditory User Interfaces

ASTER — Audio System For Technical Readings

- Extracted logical structure from (LA)TEX documents
- Used Audio Formatting Language (AFL) to render result
- Interactive browser enabled multiple audio views

Electronic Information Is Display-Independent!

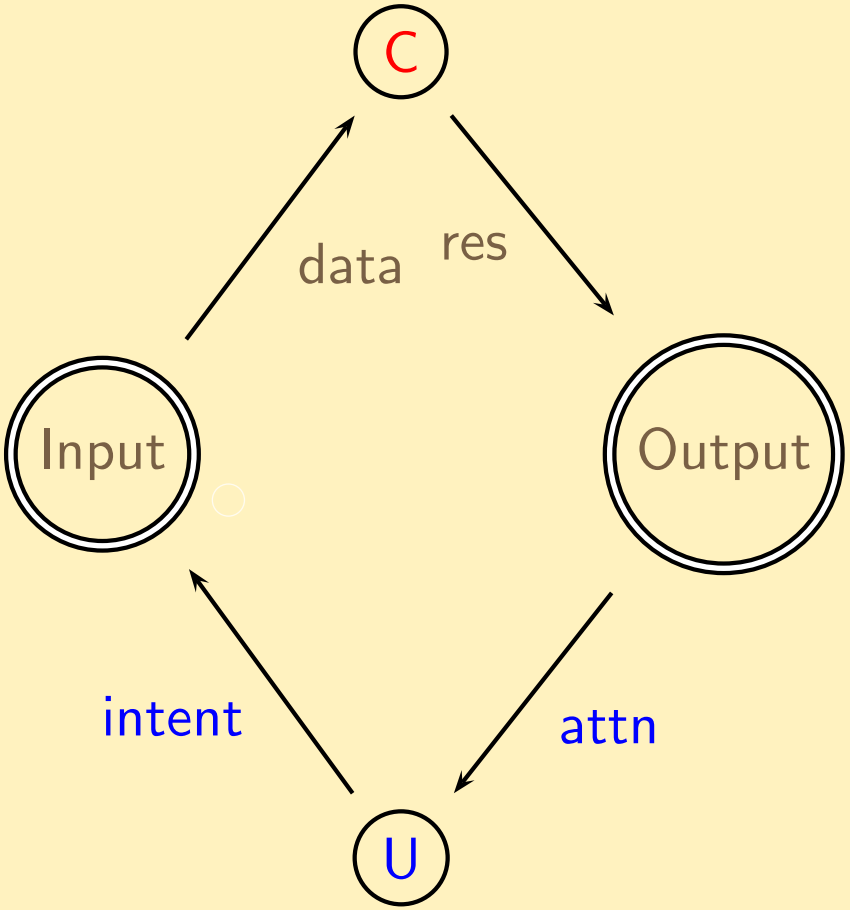
Single Source, Multiple Outputs



Speech-enabled applications

- Speak information —not its visual presentation
- Text-To-Speech leverages application context
- Audio formatting makes communication efficient
- Auditory icons enhance user experience
- Speech-enable all aspects of user interaction

UI —Capture Intent, Grab Attention



The Multimodal Web

2000 — The Multimodal Web

The Web the way you want (1st Edition)

- Limited forms of the Web were available on hand-helds
- Devices of the day —Smart PDAs, network-enabled phones
- Speech interaction was viewed as the *next-frontier*

Web: Separate application and Interaction Logic !

Opportunity: High-Level Semantics

- Anywhere, Anytime access requires rich content semantics
- Rich semantics is a pre-requisite for universal access
- Mainstreams a core Accessibility requirement

Multimodal Web (1st Edition) was ahead of its time!

Being Digital

From Atoms To Bits

- Physical world comes on-line —atoms change to bits
- Bits —electronic information —is computable
- Each atoms $\rightarrow$ Bits transition enables new functionality
- Bits $\rightarrow$ Atoms enables new forms of interaction

Each transition is an opportunity to innovate!

Opens up new Access opportunities

Example	Opportunity
Digital Maps	Explore the world
Digital Maps	Tactile graphics
Electronic Books	Access world's knowledge
Mathematical Content	Transform to multiple presentations
Scientific Diagrams	3D printing for exploration

Search And Mobile

Core Value Of Search

Effective, timely access to relevant information!

Effective Ensure rapid task completion.
Timely Deliver results as quickly as possible.
Relevant Interpret query, and rank results.

Metric: Task Completion

- Interpret user intent,
- Retrieve relevant information,
- Present it effectively to enable task completion.

Mobile Access

Enables true ubiquitous access (2008)

- All the world's information in the cloud,
- Computable and transformable,
- Viewable via a multiplicity of clients.

Android and ChromeOS

Mainstream Eyes-Free Access

UI Defines The Device

UI Peripherals determine size and shape of devices!

- Keyboards, Mice and Monitors defined the size and shape of computing.
- Smart phones turned these into flat shiny piece of glass.
- Smart speakers make computers *disappear*.
- Smart displays are information *appliances*.

Smart Assistant

- Enable ubiquitous hands-free, eyes-free information access.
- Speech interaction is a first-class citizen.
- Enable contextual in-the-moment assistance!

UI: Determine User Intent, Grab User Attention

- User-Aware Interfaces —eliminate friction in the UI.
- User-Awareness ↓
  - User location, *e.g.*, home, work,
  - Usage context, *e.g.*, driving,
  - User abilities, *e.g.*, hands-busy,
  - ⋮

UI optimized to the user's current context.

Ubiquitous Assistant

- Home appliances provide contextual assistance
- Smart home controlled via multiple interaction modalities
- Smart wearables that sense environment
- Smart wearables that effectively grab user attention
- Single Assistant, multiple access paths

Assistant maintains context across devices

Impact On Universal Access

- AI-powered Assistant is aware of user needs
- User-aware interfaces sense user context
- Control connected devices via a multiplicity of interfaces
- Deliver interface to match user's abilities

Conclusion

Conclusion

- Electronic information is display-independent
- UI determines size and shape of computing
- Ubiquitous information access requires User Aware UI

Watch Computing Take Off!