Smart Documents
Timely Information Access For All

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Outline

- The Information REvolution.

- Information is not just for viewing!

- Interactive multimodal interfaces.
Information Evolution

Scrolls → Documents

Information
The Written Word

Represents:

- The repository of information.
- The vehicle for information exchange.
Availability

- More information is available.
- Information is available to more.

A level playing field!
Half-Life Of Information

Publications increase in frequency:

yearly → Monthly → Daily → News Ticker

Information goes out of date faster.
Printed Documents

• Rely on a passive intermediary.

• Store and convey content.
Information exchange is:

- Mediated by an active agent.
- Separates repository and agent.

Information Is Display Independent!
The Digital Age

- Information originates digitally.
- Print is *only* one display.
- Information remains *live!*
Smart Documents

Profound impact on information:

- Generation, Archival, Retrieval

Produce, consume multimodal content.

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Computable Information

Electronic Information Is Computable!

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Electronic Information

Documents not just for printing!

<table>
<thead>
<tr>
<th>Electronic</th>
<th>Printed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logical Structure</td>
<td>Layout Structure</td>
</tr>
<tr>
<td>Dynamic</td>
<td>Static</td>
</tr>
<tr>
<td>Customizable</td>
<td>Fixed</td>
</tr>
<tr>
<td>Interactive</td>
<td>Non-Interactive</td>
</tr>
<tr>
<td>Active</td>
<td>Passive</td>
</tr>
</tbody>
</table>

Information Comes Alive!
Formatting Structure

- Lists, Mathematics, Tables, ...

Formatted output:

- Permits direct perception.
- Reduces cognitive load.
Example

\[
\begin{align*}
&\text{a, plus the fraction} \\
&\text{whose numerator is,} \\
&\text{b plus c, end} \\
&\text{numerator, and} \\
&\text{whose denominator} \\
&\text{is, d plus e, end} \\
&\text{denominator, plus x.}
\end{align*}
\]
Example

\[ a + \frac{b + c}{d + e} + x \]

a, plus the fraction whose numerator is, b plus c, end numerator, and whose denominator is, d plus e, end denominator, plus x.
Information is display independent.
Spoken Access

Speak Information,
AND NOT
Screen Contents!
Screen Access

User explores visual display to:

- Construct mental model of the interface.
- And interpret intent of the UI.

Aural output from visual display.
Screen Access Design

- Encapsulate display in off-screen model.
- Present this model aurally.
- Enable navigation of this model.

Feedback is application independent.
Available Screen Access

Character-based interfaces . . . GUI.

Richer layout of GUI

↕

Harder to build OSM

↕

But richer OSM

↕

Enables possibly richer feedback

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Screen Access Innovations

- Speak specific areas of the screen.
- Attach meaningful labels to icons.
- Navigate window hierarchy.

Access separate from application.
What Is UI?

1. Obtain user input,

2. Compute on the information, and

3. Display the results.

\[ \text{UI} = \text{Input} + \text{Output}. \]
Speech Enabling Applications

- Treat speech as a first class medium.
- Application produces its own feedback.
- Exploit features of the spoken medium.

Independent Audio and Visual Output.
## Contrasting Approaches

<table>
<thead>
<tr>
<th>Read Screen</th>
<th>Speech Enable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speak display</td>
<td>Speak information</td>
</tr>
<tr>
<td>No context</td>
<td>Full context</td>
</tr>
<tr>
<td>Independent</td>
<td>Integrated</td>
</tr>
<tr>
<td>Global scope</td>
<td>Local context</td>
</tr>
<tr>
<td>Uses display</td>
<td>Uses environment</td>
</tr>
</tbody>
</table>
Advantages

• Produce intuitive feedback.

• Provide a simpler user model.

• Reduces users cognitive load.

One –not two– applications.
Example

<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
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<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
</tr>
</tbody>
</table>

March 1996

Easy to see relevant information.

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Global Digital Libraries

- Structurally rich content,
- Mediated by an intelligent agent,
- Enable smart documents.
Client Server Systems

Information is accessible

- where the user wants,
- when the user wants, and
- the way the user wants!
Speech And Audio

A New Dimension In UI!

Enrich Our Information Experience!