Fast And Robust Interface Generation for Ubiquitous Applications

The SUPPLE Project

University of Washington, Seattle

Krzysztof Gajos, David Christianson, Raphael Hoffmann, Tal Shaked, Kiera Henning, Jing Jing Long, and Daniel S.Weld

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 Adapt to device characteristics
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 Adapt to users and tasks

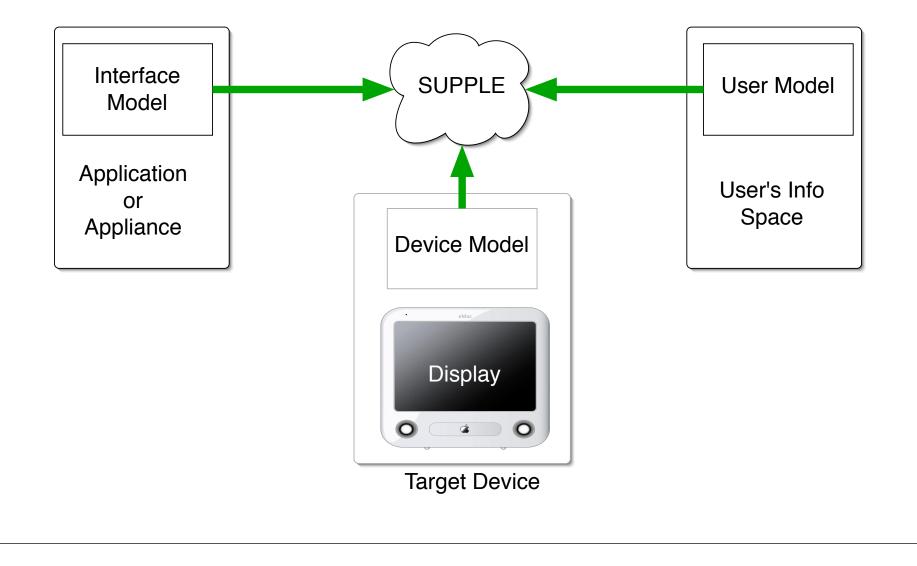
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⇒ Automatic interface generation is a scalable solution

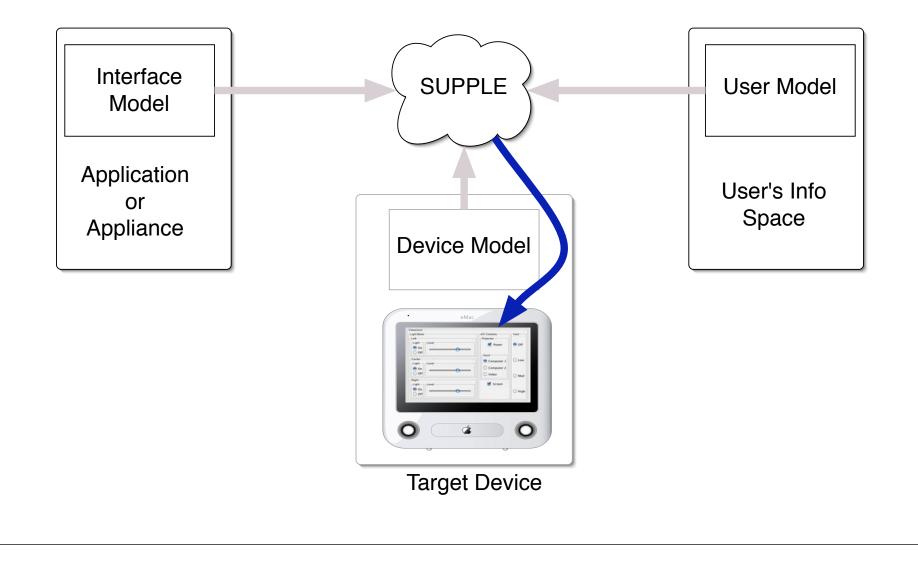
Approach

- Develop abstract representation for:
 - Interfaces
 - Display devices
 - Users
- Automatically generate interfaces from the abstractions

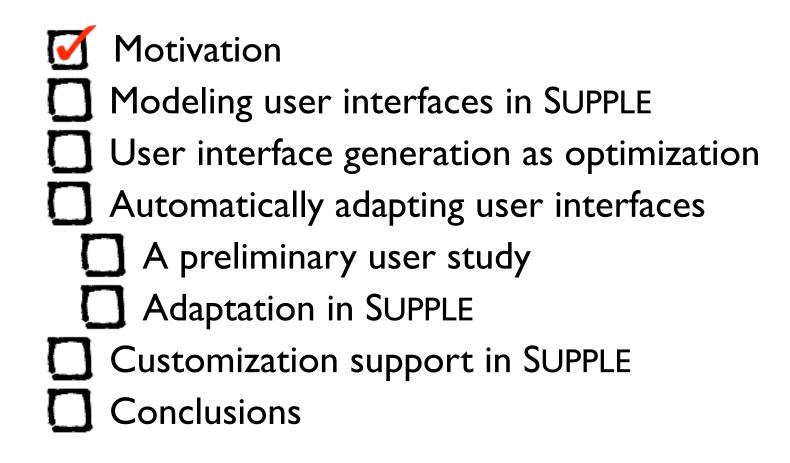
SUPPLE Architecture



SUPPLE Architecture

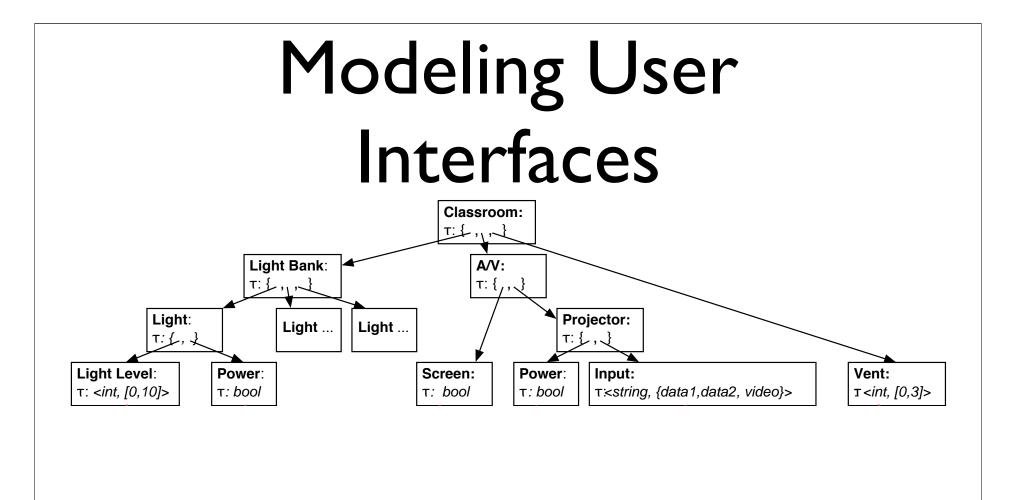


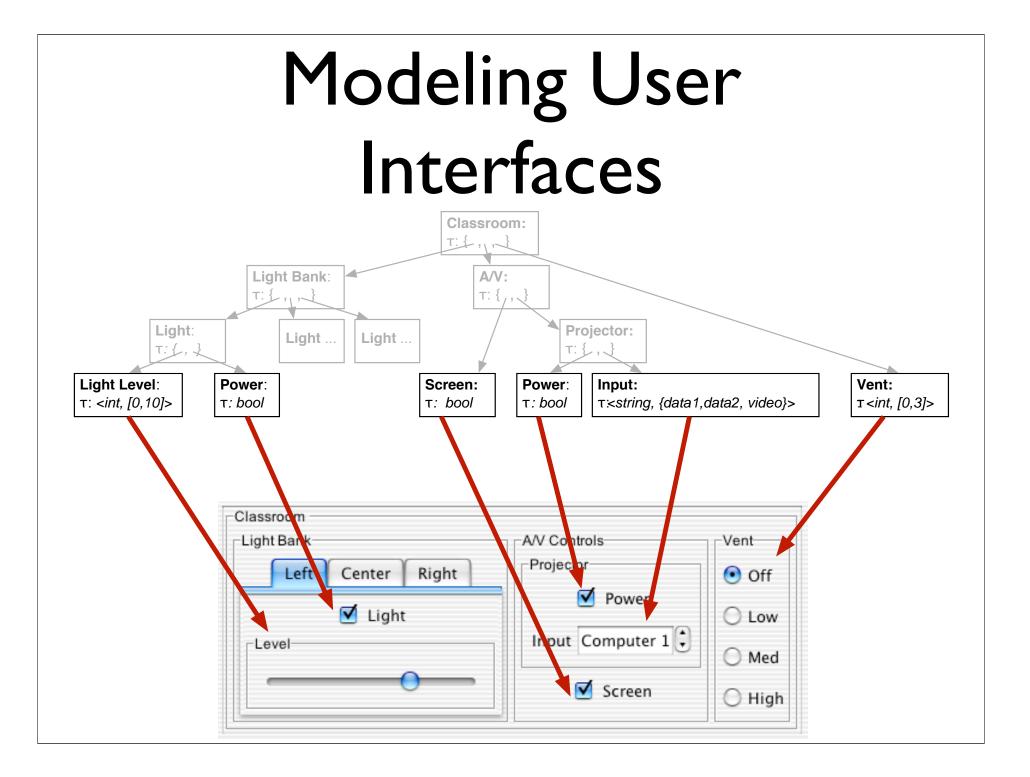
Road Map

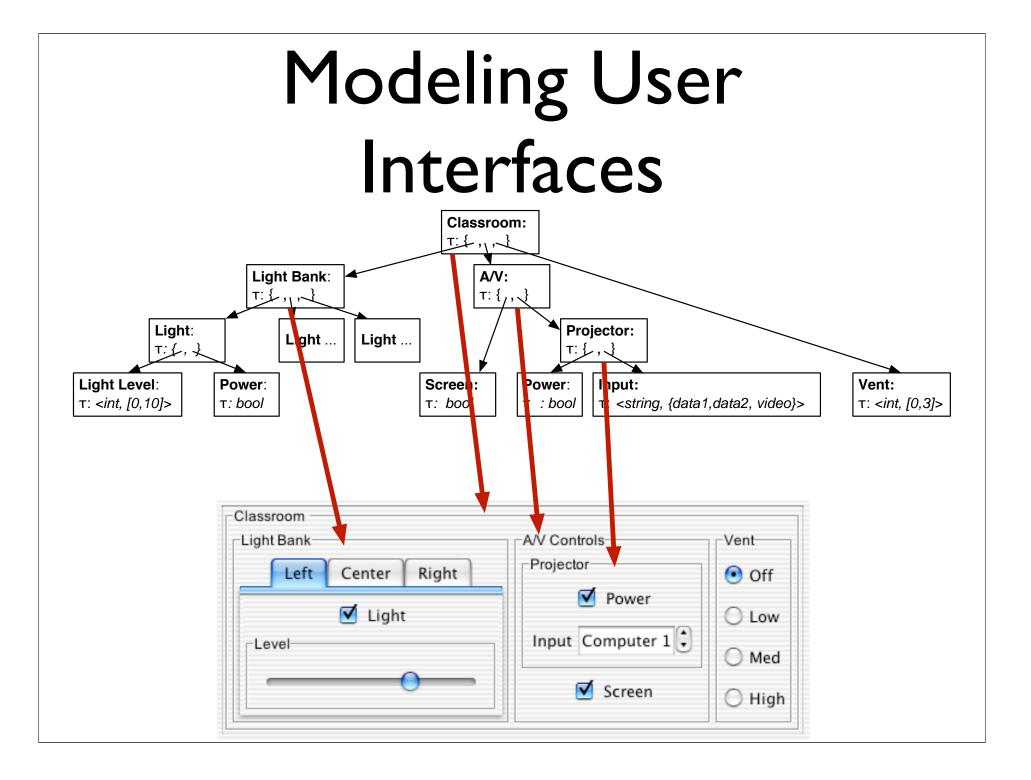


Modeling User Interfaces

- simple types: int|float|string|bool
- **media types:** *image*|*interactiveMap*
- containers: $\{\tau_i \ ^{i \in 1...n}\}$
- derivative types: $\langle \tau, C_{\tau} \rangle$
- vectors: $vector(\tau)$
- actions: $\tau_1 \rightarrow \tau_2$







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Folders	Messages	\varTheta \varTheta Configuration
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			Details

Model (UI, Device, User) - Algorithm - Results - Personalization (Adaptation, Customization) - Arnauld - Consistency - Task Models

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Supple: Email Example

Properties

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Properties

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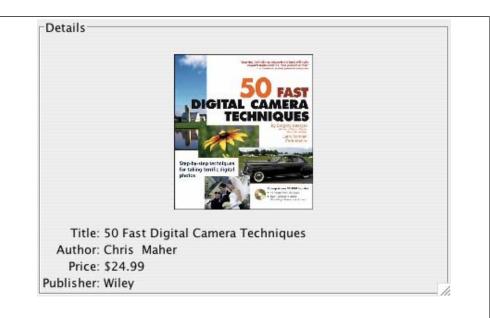
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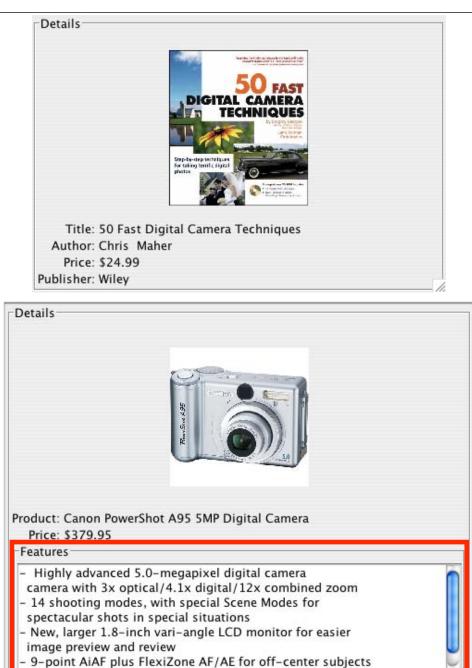
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- New Print/Share button for easy direct printing and downloads

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Road Map

Motivation Modeling user interfaces in SUPPLE User interface generation as optimization Automatically adapting user interfaces A preliminary user study Adaptation in SUPPLE **Customization support in SUPPLE Conclusions**

User Interface Generation as Optimization

Model (UI, Device, User) - Algorithm - Results - Personalization (Adaptation, Customization) - Arnauld - Consistency - Task Models

 Driven by a Cost function (\$) -- estimated user effort to manipulate a rendering of the interface

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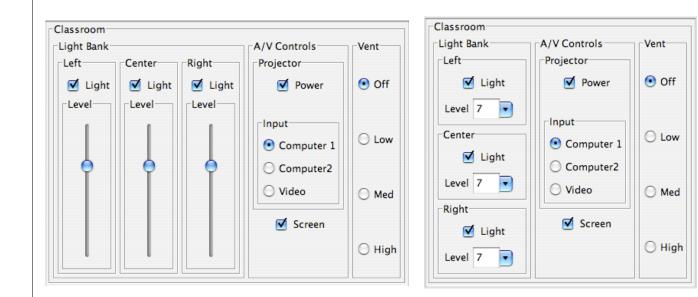
Model (UI, Device, User) - Algorithm - Results - Personalization (Adaptation, Customization) - Arnauld - Consistency - Task Models

- **Flexible** with respect to screen size
- Versatile: Same algorithm for different devices
- Allows new concerns to be included in the rendering process, e.g.:
 - Cross-device **consistency**
 - Adaptation to usage patterns

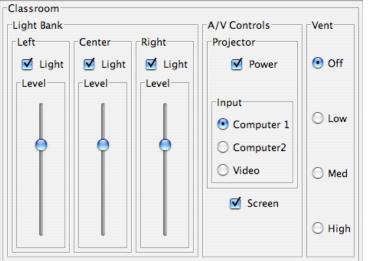
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Robustly Adapting to Different Screen Sizes



Robustly Adapting to Different Screen Sizes



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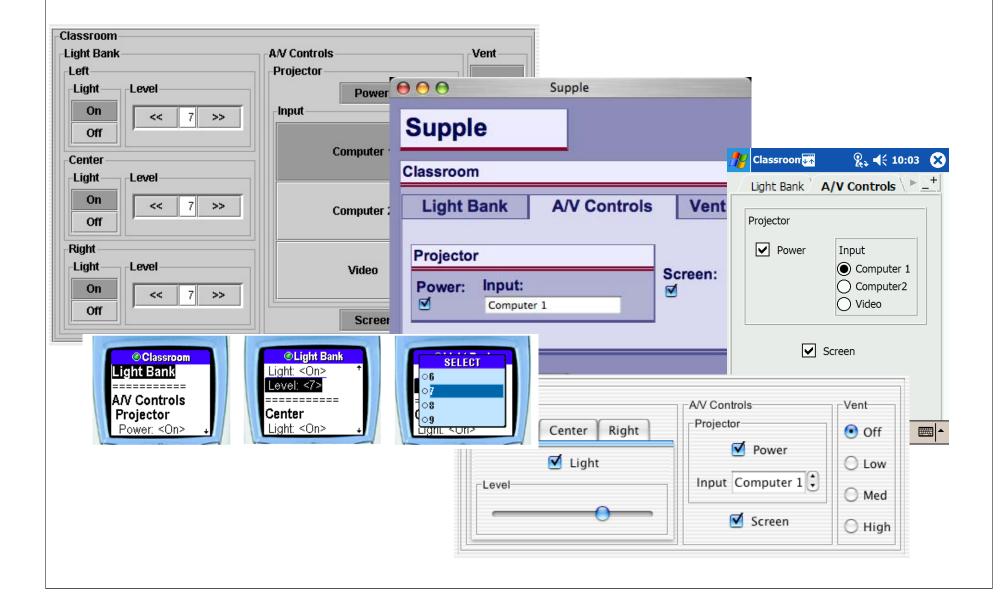
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Adapting To Usage Patterns

SUPPLE with an empty trace

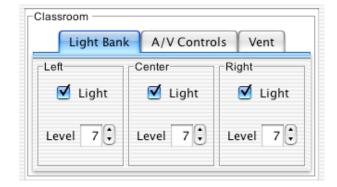
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Adapting To Usage Patterns

SUPPLE with an empty trace

Classroom		
Light Bank	A/V Controls	Vent
Left Center Right	Projector	🖲 Off
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Level	Input Computer 1	🔘 Med
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SUPPLE with a "lights-heavy" trace



Road Map

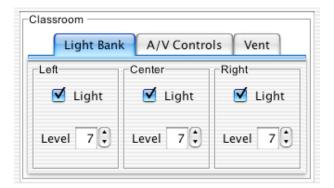
Motivation Modeling user interfaces in SUPPLE User interface generation as optimization Automatically adapting user interfaces A preliminary user study Adaptation in SUPPLE **Customization support in SUPPLE Conclusions**

Adapting To Usage Patterns By Complete Makeover

SUPPLE with an empty trace

Classroom		
Light Bank	A/V Controls	Vent
Left Center Right	Projector	🖲 Off
🗹 Light	Power	⊖ Low
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SUPPLE with a "lights-heavy" trace



Adapting To Usage Patterns By Complete Makeover

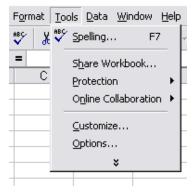
SUPPLE with an empty trace

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Left Center Right	Projector	🖲 Off
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Level	Input Computer 1	🔘 Med
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Is this the only way to adapt?

SUPPLE with a "lights-heavy" trace

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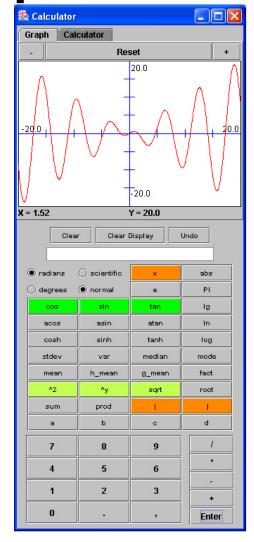
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Visual Popout

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Buenos Aires
Sydney
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Seattle
Caracas
Boston
Havana
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Singapore

Visual Popout

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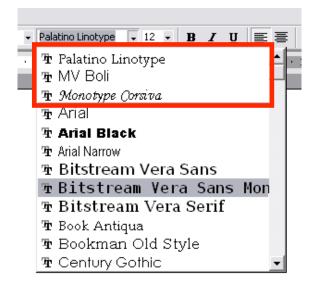


Split Interfaces



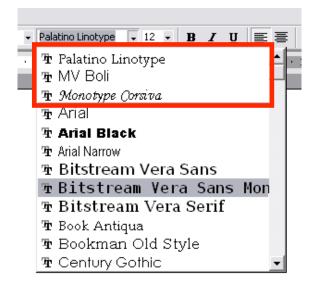
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Split Interfaces



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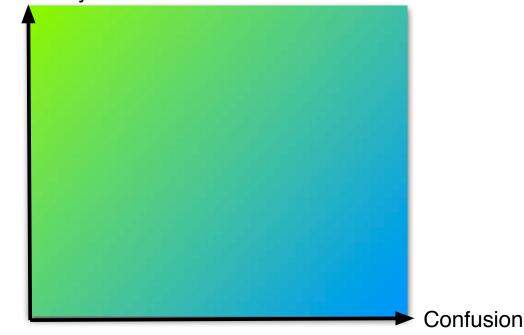
Split Interfaces

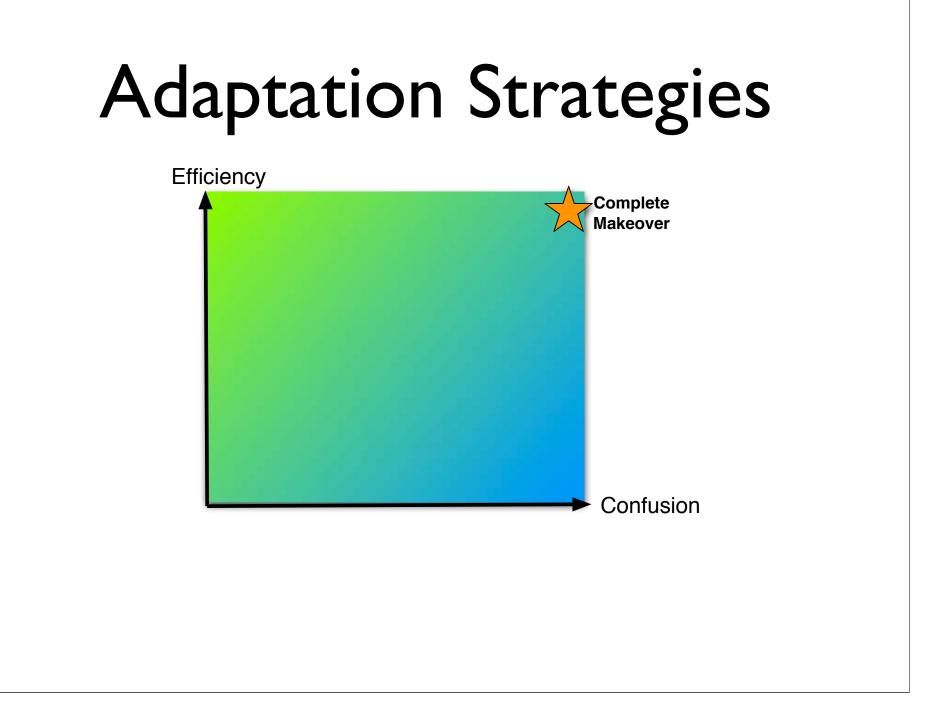


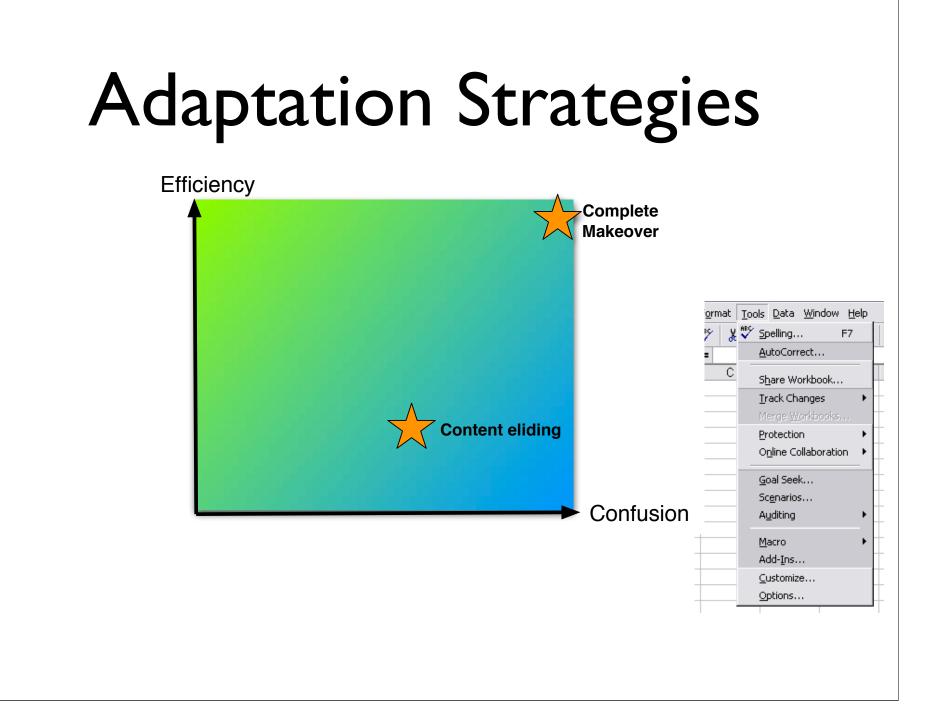
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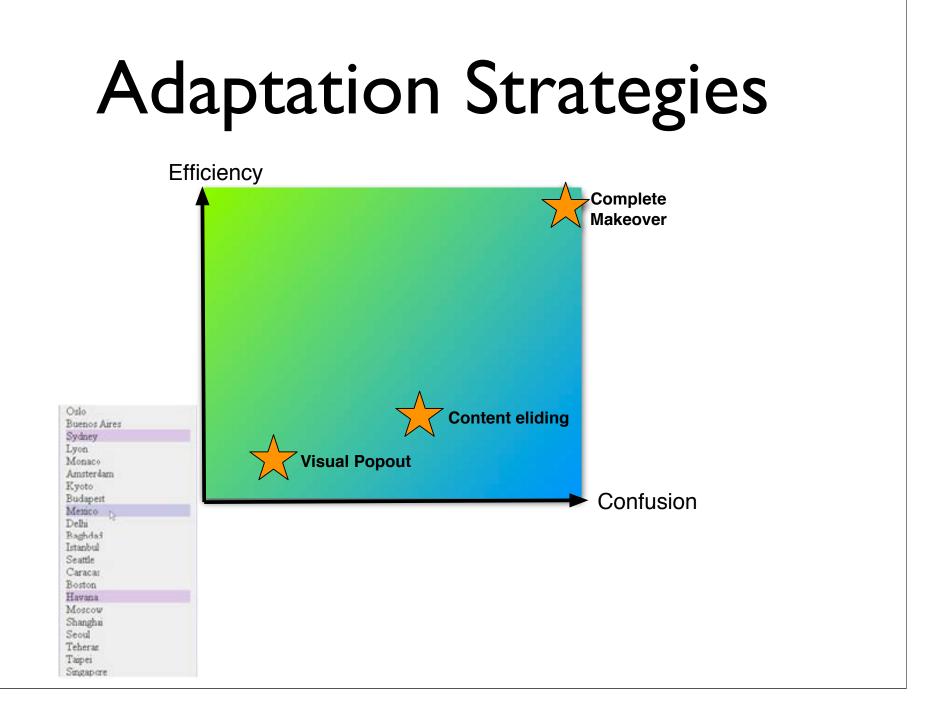
Adaptation Strategies

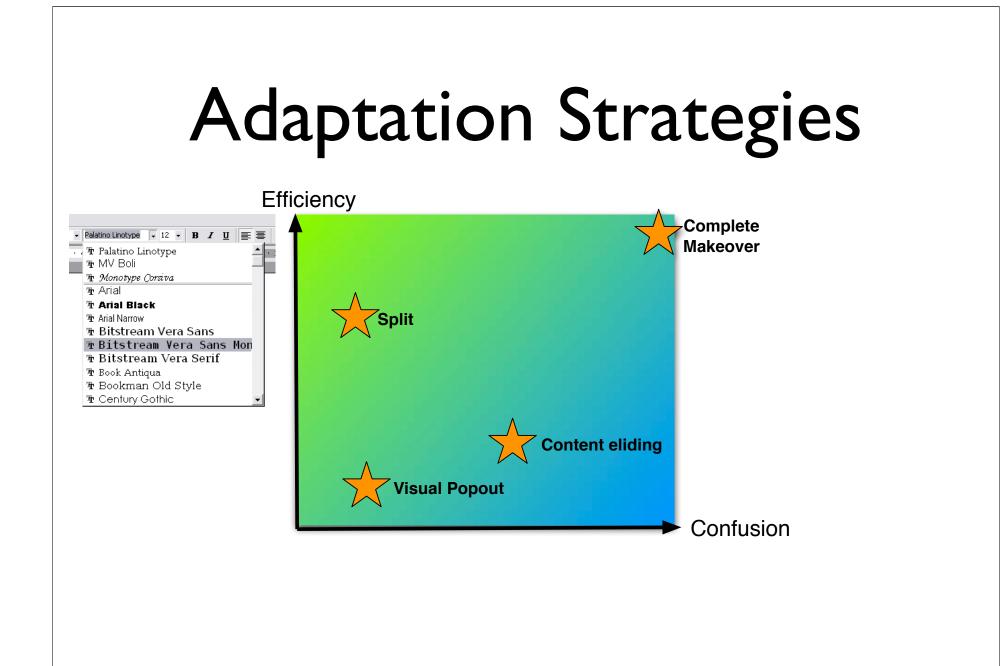
Efficiency



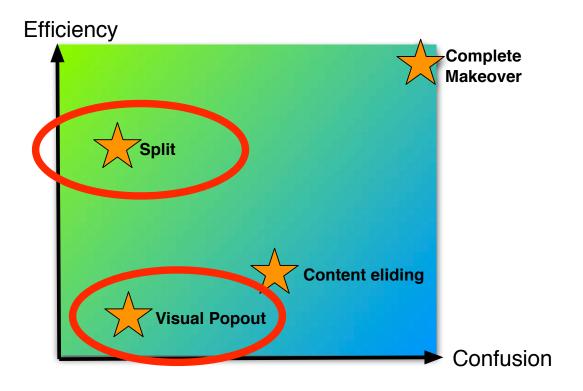








Adaptation Strategies



Preliminary User Study



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Preliminary User Study



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Preliminary User Study

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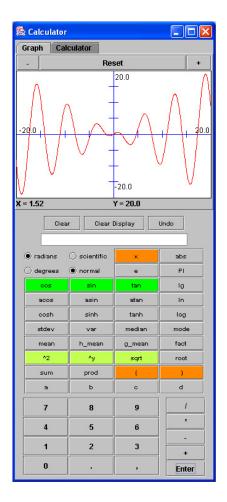
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Preliminary User Study

Split Interface

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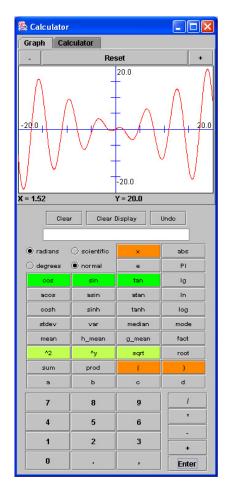


Preliminary User Study

Split Interface

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🕾 Calculator



Visual Popout Interface

• **Split Interface** strongly preferred over non-adaptive

- **Split Interface** strongly preferred over non-adaptive
- Both adaptive interfaces slightly faster than non-adaptive

- **Split Interface** strongly preferred over non-adaptive
- Both adaptive interfaces slightly faster than non-adaptive
- But: Visual Popout interface often found distracting

 In a different setting, we tested three adaptation strategies including Split Interface and Visual Popout Interface

- In a different setting, we tested three adaptation strategies including Split Interface and Visual Popout Interface
- Users strongly preferred and were significantly faster using Split Interface

- In a different setting, we tested three adaptation strategies including Split Interface and Visual Popout Interface
- Users strongly **preferred** and were significantly **faster** using Split Interface
- Users strongly **disliked** Visual Popout Interface

 Adapting by promoting hard-to-reach but frequently used functionality

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System-Vs. User-Initiated Adaptation: Customization

- Customizing any part of the interface with drag and drop
- Out of order undo
- Generalization

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Road Map

- Motivation
 - Modeling user interfaces in SUPPLE
- **S** User interface generation as optimization
- Automatically adapting user interfaces
 - I A preliminary user study
 - Maptation in SUPPLE
- Customization support in SUPPLE
- Conclusions

Conclusions

- A powerful, flexible and practical tool for automatically generating user interfaces for multiple devices
- Adaptation and customization offer the possibility of creating custom-made UIs for each user
- Support for distributed operation and caching makes it practical even on small devices

Can I Have It?

Can I Have It?



- We are awaiting permission to release SUPPLE as an **open source** toolkit
- Visit SUPPLE web site to sign up for the user's mailing list

Contributors



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More Information

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