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iSpace: A Web-Based Tool for Abstract UI Prototyping

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Abstract: GUI designs reach several points at which reviews are beneficial. When initial reviews present draft screen layouts, reviewer reaction to graphic elements usually obscures questions of whether the data and actions presented by the GUI are appropriate for the users' tasks. While review of graphic design is important, it is equally or more important to have substantial review of the workflow among and composition of interaction contexts, aside from any issues of graphical presentation. A solution to this problem is to conduct reviews using abstract UI prototypes – models that partition the application into smaller interaction contexts, which document the contents of each interaction context in terms of presented data and available actions, and which explicitly avoid decisions about graphical appearance. ISpace is a web-based application which allows UI designers to build, and conduct reviews of, abstract UI prototypes by interacting with a series of web pages.

Keywords: GUI design, abstract prototype, interaction context, participatory design, design review, walkthrough

The Problem

GUI designs reach several points at which reviews or walkthroughs are beneficial. Periodic reviews or walkthroughs help ensure that the UI as being designed will in fact meet the needs of the users. The content and outcome of a review, if adequately captured, provide valuable documentation of the evolving product design. In the author's experience, when initial walkthroughs present drafts of graphical screen layouts, reviewer reaction to graphic elements usually obscures questions of whether the data and actions presented by the GUI are appropriate for the users' tasks. This is not surprising; humans are influenced strongly by the visual, and most members of the review/walkthrough audience are not experts in UI design; we cannot expect them to ignore the powerful visual elements in front of them. While review of graphic design is important, it is equally or more important to have substantial review of the workflow among and composition of the GUI's screens, or interaction contexts, aside from any issues of graphical presentation.

(The utility of this distinction between UI content and its esthetic presentation is not confined to graphical UIs; development of an audio UI [e.g., a phone menu] can also benefit from reviewing the UI's content before, or separately from, issues such as gender, tone & volume of the recorded speaker's voice.)

A Solution

One mechanism which the author has found effective for presenting, reviewing and documenting UI content apart from graphical elements is the UI content model or so-called "abstract UI prototype" [Constantine, 1998]. After user roles and essential use cases have been identified, it is often helpful to build these abstract UI prototypes, which focus on the tools and materials needed by users to accomplish theirs tasks.

Abstract UI prototypes are models that:

- partition the application into smaller interaction contexts (i.e., screens, windows or dialogs in a graphical UI);
- document the contents of each interaction context in terms of presented data (i.e., materials) and available actions (i.e., tools);
- explicitly avoid decisions about graphical appearance, layout, or specific GUI widgets.

The essence of the abstract UI prototype is a linked sequence of list pairs: for each interaction context in an application, there is a list of the presented data items and a list of the available actions. Each action may or may not represent a transition (link) to another interaction context.

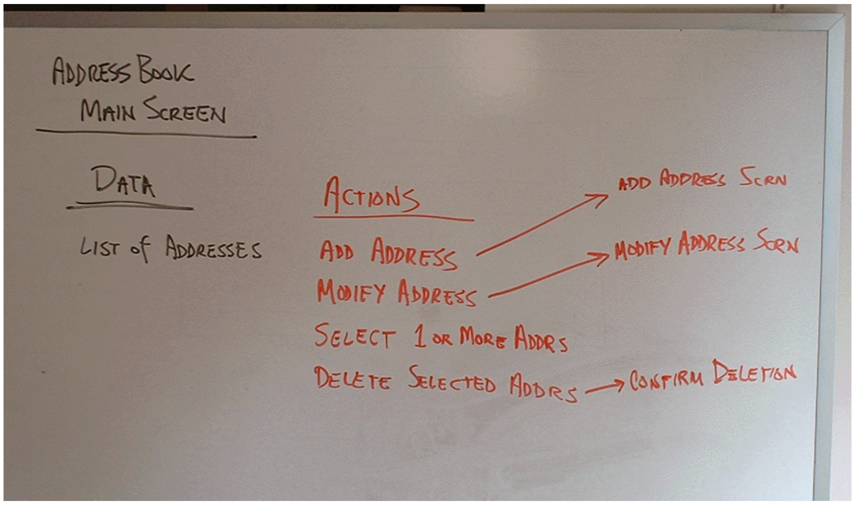
These abstract UI prototypes allow subsequent reviews to focus on the tools (i.e., actions) and materials (i.e., data) required to support essential use cases and user roles, w/o getting distracted by issues of layout, look and feel, esthetics, color, font, etc. Following the review, they also can form the basis for the next stage of the design.

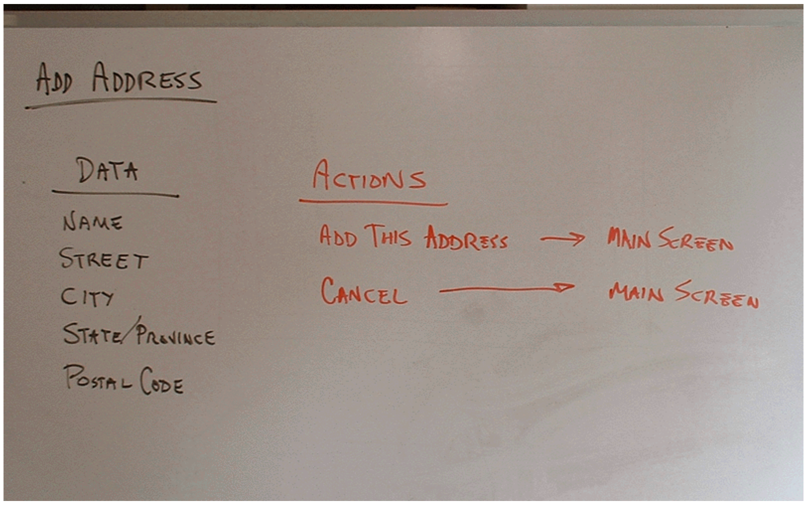
Jakob Nielsen talks about prototypes as being reduced in functionality "horizontally" or "vertically" compared to a full system. A "vertical" prototype presents only a severely limited subset of the features of the whole system, but that subset is presented in depth and with near-full functionality. A "horizontal" prototype presents nearly all the features of the whole system, but those features are presented at a very shallow level.

> "Cutting down on the number of features is called *vertical prototyping* since the result is a narrow system that does include in-depth functionality, but only for a few selected features. … Reducing the level of functionality is called *horizontal prototyping* since the result is a surface layer that includes the entire user interface to a full-featured system but with no underlying functionality. A horizontal prototype is a simulation of the interface where no real work can be performed." [Nielsen, 1993, pg. 95]

The abstract UI prototype can be considered an extreme form of horizontal prototype.

Traditional approaches to abstract UI prototyping may involve drawing on a white board, or posting adhesive notes on a paper easel (or even a wall). The advent of digital cameras has greatly eased capture and distribution of the result. Abstract UI prototyping may also be done by composing tables in a word processor. Below are some examples of traditional abstract UI prototypes for a simple address book application.





One weakness of most traditional approaches is their poor ability to simulate the context transitions traversed by the user in the course of executing essential use cases. This is sometimes modeled by pasting all the paper screen prototypes on a wall, then running colored string from screen to screen.

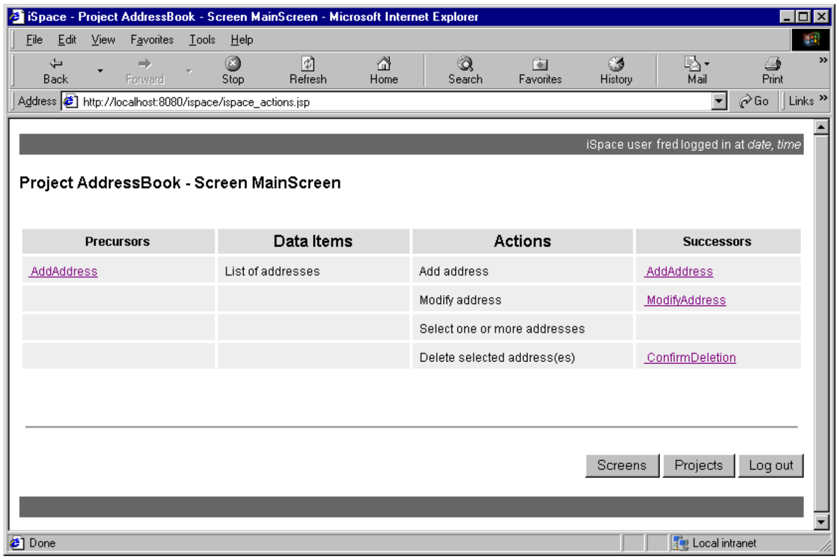
iSpace

ISpace is a web-based application which allows UI designers to build abstract UI prototypes by interacting with a series of web pages. Reviews of the completed (or in-process) models may also be performed via the same web site. Reviewers see each interaction context on a single web page, with the following items broken out:

- Name & description of current interaction context
- Data presented in the current interaction context

- Actions available in the current interaction context
- Interaction contexts that could lead to the current one
- Interaction contexts that could follow the current one

Preceding and succeeding interaction contexts are listed as hyperlinks; clicking the link takes the user to that interaction context. The correspondence between actions and subsequent interaction contexts is also presented on the web page. This facilitates walkthroughs. Below are some screen shots of the address book abstract UI prototype as it appears to a reviewer in iSpace:

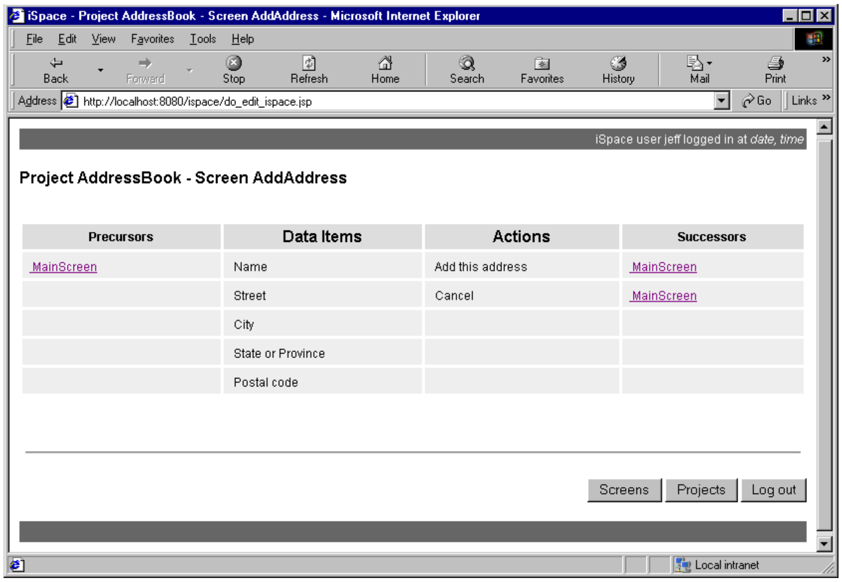

iSpace - Project AddressBook - Screen MainScreen - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Forward
Stop
Refresh
Home
Search
Favorites
History
Mail
Print
Address
Go
Links
Done
Local intranet

http://localhost:8080/ispace/ispace_actions.jsp

iSpace user fred logged in at *date, time*

Project AddressBook - Screen MainScreen

Precursors	Data Items	Actions	Successors
AddAddress	List of addresses	Add address	AddAddress
		Modify address	ModifyAddress
		Select one or more addresses	
		Delete selected address(es)	ConfirmDeletion


iSpace - Project AddressBook - Screen AddAddress - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Forward
Stop
Refresh
Home
Search
Favorites
History
Mail
Print
Address
Go
Links
Local intranet

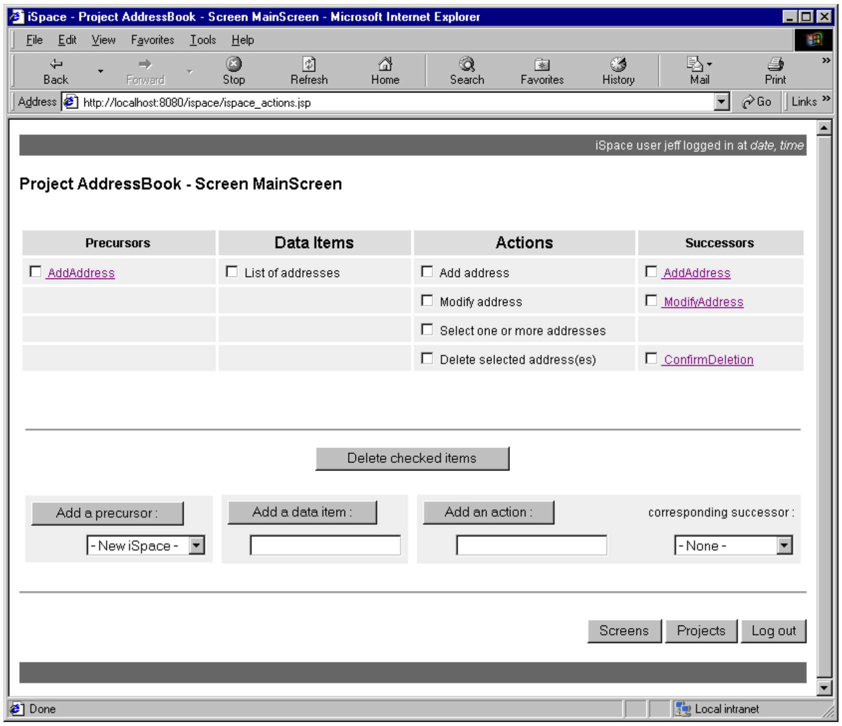
http://localhost:8080/ispace/do_edit_ispace.jsp

iSpace user jeff logged in at *date, time*

Project AddressBook - Screen AddAddress

Precursors	Data Items	Actions	Successors
MainScreen	Name	Add this address	MainScreen
	Street	Cancel	MainScreen
	City		
	State or Province		
	Postal code		

Below are screen shots of the same prototype as it appears to an author in iSpace:

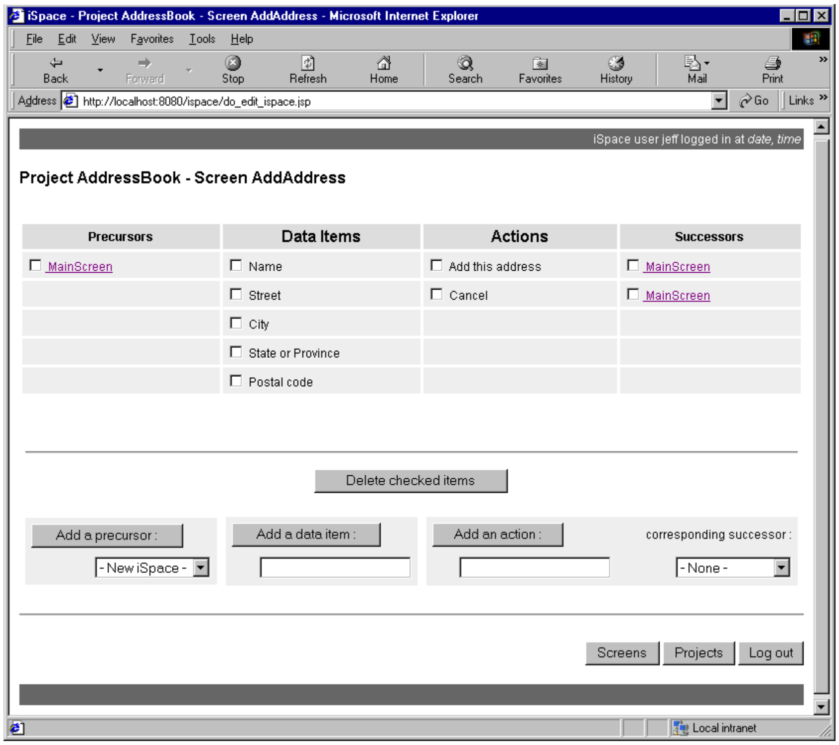

iSpace - Project AddressBook - Screen MainScreen - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print
Address http://localhost:8080/ispace/ispace_actions.jsp
Go Links

iSpace user jeff logged in at *date, time*

Project AddressBook - Screen MainScreen

Precursors	Data Items	Actions	Successors
□ AddAddress	□ List of addresses	□ Add address	□ AddAddress
		□ Modify address	□ ModifyAddress
		□ Select one or more addresses	
		□ Delete selected address(es)	□ ConfirmDeletion

Delete checked items
Add a precursor :
- New iSpace -
Add a data item :
Add an action :
corresponding successor :
- None -
Screens
Projects
Log out
Done
Local intranet


iSpace - Project AddressBook - Screen AddAddress - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print
Address http://localhost:8080/ispace/do_edit_ispace.jsp
Go Links

iSpace user jeff logged in at *date, time*

Project AddressBook - Screen AddAddress

Precursors	Data Items	Actions	Successors
□ MainScreen	□ Name	□ Add this address	□ MainScreen
	□ Street	□ Cancel	□ MainScreen
	□ City		
	□ State or Province		
	□ Postal code		

Delete checked items
Add a precursor :
- New iSpace -
Add a data item :
Add an action :
corresponding successor :
- None -
Screens
Projects
Log out
Local intranet

iSpace Features

ISpace allows designers to log in and edit the abstract UI prototype; it allows reviewers to log in and review (but not modify) the prototype. Designers are also able to see the view presented to reviewers.

ISpace groups all users into organizations. Within an organization, users are either reviewers or authors; reviewers can view prototypes but not modify them, while authors can edit prototypes. One user in each organization is the administrator, and can create and delete other users.

ISpace groups all abstract prototypes into projects. Projects belong to an organization. Users can see all projects in their organization, but none of the projects in other organizations. Each project is composed of "screens," and each screen represents an interaction context.

Authors can create and delete projects; within a project, they can create and delete screens. Authors can also modify the contents of screens, navigate among screens, and modify the relationships between screens.

Reviewers can view projects and screens and can navigate among screens within a project.

Pros & Cons of iSpace

ISpace makes building models easy. Projects and screens are composed by filling out a few short web forms.

ISpace facilitates collaboration. All models are stored on a central server, and can be viewed by anyone who can access that server with a web browser.

ISpace facilitates quick navigation among interaction contexts. This allows authors and reviewers to examine workflow and context transitions w/o building a more detailed and expensive interactive software prototype. This is also useful during the walkthrough meeting – no more searching madly through slides for the next screen!

ISpace allows reviewers to examine the abstract prototype independently and asynchronously on-line. They can do this at any time, and without requiring the UI designer to be present. The walkthrough meeting, with all parties in one room, no longer need be the first time most participants see the design.

By allowing reviewers to access to the UI prototype at any time, iSpace facilitates participatory design, the benefits of which have been widely documented [Nielsen, 1993, pg. 88] [Mayhew, 1999, pg. 200-201] [Beyer & Holtzblatt, 1998, pg. 370-371] [Torres, 2002, pg. 87-102].

ISpace enforces a tabular and non-graphical presentation of screen contents. This absolutely eliminates graphical elements from the review. However, it also eliminates any possibility of capturing and expressing information via such techniques as location, spatial grouping, and color, which are readily available when using lower-tech methods such as paper easel and adhesive notes.

The activities of choosing the content of interaction contexts, devising workflows, and designing graphical screen layouts, in reality of course have no rigid boundary between them. There is a creative energy that can arise when people juggle all these tasks at the same time. Use of a tool such as iSpace for initial composition of interaction contexts can hamper such creativity. This does not, however, mitigate its benefits at review time.

Revising models built with iSpace is easy, but components of such models cannot be manipulated as directly as adhesive notes on paper or white-board. However, models built in iSpace will not fall to the floor if accidentally brushed by an elbow.

Future Improvements

Printing. Currently iSpace relies on the web browser to print an interaction context as seen in the browser. Printing all interaction contexts for an entire project can be laborious. ISpace should provide a mechanism to print the entire project.

Overall navigation map. Currently iSpace does not provide a view of the overall navigation map for an entire project. This view is often useful and should be provided by iSpace.

Correlation of interaction contexts to essential use cases. Currently iSpace does not support this except informally via comments entered into the description of each interaction context. ISpace should provide better support for this.

References

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