VIB: A Visual Interface Builder for Icon
Version 3

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1. Introduction

Construction of an interactive graphics application can require a large effort to specify the screen layout. For graphics programs written in Icon [1, 2], VIB eases this part of the project by providing an interactive layout tool.

An application built by VIB has two parts: the interface specification and the rest of the program. Both can be contained in the same source file. VIB edits the interface specification; any text editor can be used to maintain the rest.

When VIB edits an existing file, it alters only the interface specification (adding one if necessary) and leaves the rest of the file unmodified. When VIB creates a new file, it writes a complete program by providing a skeletal Icon program to accompany the interface specification. This program then can be edited to give function to the interface.

VIB provides a prototyping facility for testing the interface at any time. A functional mock-up of the interface is displayed, and activating any of the input objects produces a message showing the resulting callback. Prototyping is possible regardless of the state of the Icon code in the file being edited.

Applications built by VIB use the visual interface (vidget) library [3]. Not all of the vidget capabilities are supported by VIB; sophisticated applications can call vidget procedures directly to augment the VIB-built interface.

In addition to laying out the application as a whole, VIB also can be used to construct dialog boxes. This process is described in Section 5.

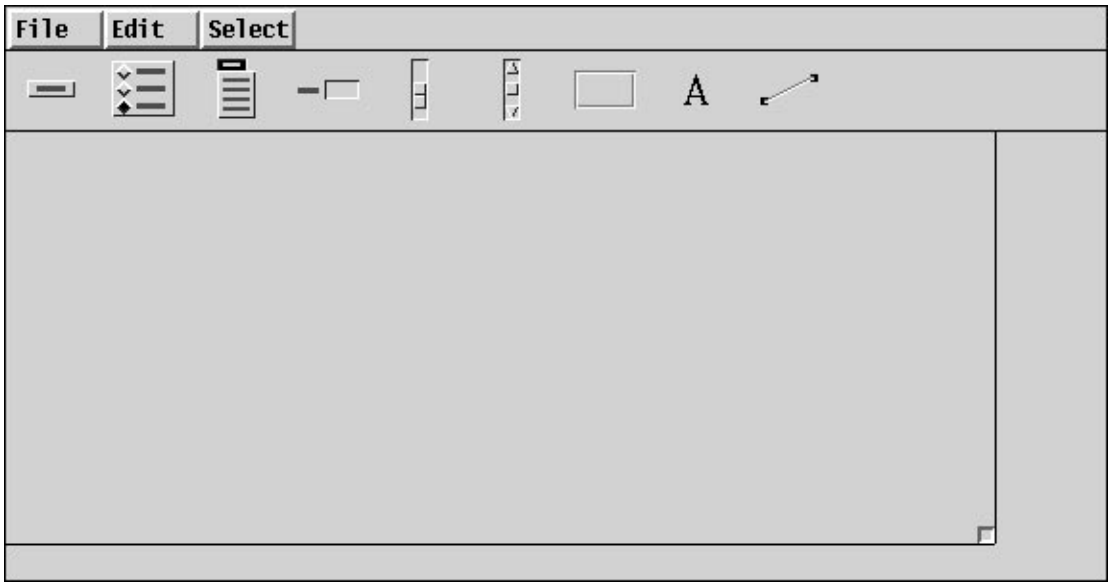
VIB is started by entering the command

vib [*filename*]

where *filename* is the name of an existing Icon source file or a new one to be created. If *filename* does not contain a suffix, .icn is appended. If *filename* is omitted, VIB generates a name.

2. The Palette

Upon startup, VIB presents a large window containing a menu bar, a palette of user interface objects, and a work area or canvas.



The palette contains pictorial icons for the following objects, from left to right:

Buttons are control devices that are activated by pressing the mouse while over the button. Several forms of buttons are available.

Radio Buttons are collections of buttons such that exactly one button within the radio button is set at any given time.

Menus are lists of buttons that appear temporarily on the screen and allow the user to select an item.

Text Input Fields gather textual input from the user. They consist of a label and an editable value.

Sliders select a scalar value within a range. Sliders can be oriented vertically or horizontally.

Scroll Bars also select values in a range, but provide buttons at both ends as well as a slider. Scroll bars can also be oriented vertically or horizontally.

Regions delimit rectangular areas of the window.

Labels display text strings; they do not receive events.

Lines decorate the interface; they do not receive events.

Instances of the objects above can be created by pressing the left mouse button upon the desired palette object; this creates an object within the canvas area that then can be dragged into position. Clicking the left mouse button upon an object *selects* the object. Selected objects are drawn with accentuated corners and can be manipulated as follows:

move drag left mouse button from object to new destination.

nudge press an arrow key (*up, down, left* or *right*) to move the object by one pixel.

resize drag left mouse button upon a corner of the object. The opposite corner is anchored.

copy select *copy* from the **edit menu**.

delete press the *delete* key or select *delete* from the **edit menu**.

align select *align vert* or *align horz* from the **edit menu**. This causes the mouse cursor to change to a double-ended arrow; pressing the left mouse button on objects when the cursor is an arrow moves them as indicated by the arrow to align vertically or horizontally with the selected object. Pressing the left mouse button on the window background

restores the original cursor.

attributes press right mouse button to display (and modify) the attributes of the object.

Not all objects can be resized, and other objects can be resized only within certain limits. For example, the size of a radio button is solely determined by its list of labels, and a slider's length must be at least three times its width.

In general, objects must not overlap. VIB does not enforce this restriction, but the results are unpredictable when the program is executed. However, objects may safely be placed within the interior of a region, allowing the use of regions for decoration.

VIB follows the standard Icon convention in which the upper-left corner of the window is at (0, 0), with the x coordinate increasing to the right and the y coordinate increasing in the downward direction.

The size of the generated interface window can be controlled by the *resize icon* that initially appears in lower-right corner of the canvas. This object can be dragged anywhere within the canvas via the left mouse button. Pressing the right mouse button over the object pops up an attribute sheet describing its current dimensions. If the VIB window is resized such that it is smaller than the interface window, the interface window is automatically made smaller. If an object instance does not fall entirely within the bounds of the interface window, it will appear clipped in the generated program as well. That is, there is no automatic repositioning of objects to fit within the interface window.

Above the tool palette are three menus. The **File** menu provides the following functionality:

new creates a new VIB file.

open loads a saved VIB file.

save saves the VIB interface to the current file.

save as acts like *save* but prompts for a file name.

refresh redraws the screen.

prototype writes a file with the VIB interface and a skeletal main program, then translates and executes it. Each callback generated by operating an object in the prototype window produces a line of output giving the vidget ID and the value. The prototype is exited by typing q in its window with the mouse cursor not over a region or text object.

quit terminates the VIB session.

The **Edit** menu provides the following functionality:

copy makes a copy of the selected object.

delete deletes the selected object.

undelete restores the most recently deleted object.

align vert aligns objects with the x-coordinate of the selected object.

align horz aligns objects with the y-coordinate of the selected object.

The **Select** menu lists the ID fields of all the objects, allowing an object to be selected by name.

Keyboard shortcuts are indicated on the **File** and **Edit** menus for most items. Holding down the *meta* key and pressing the appropriate character is equivalent to choosing the menu item. (The *meta* key is a special shift key. It is sometimes labeled with a diamond or propeller or the word ALT.) The notation **delete @X** on the edit menu, for example, indicates that *meta-X* is the shortcut for delete.

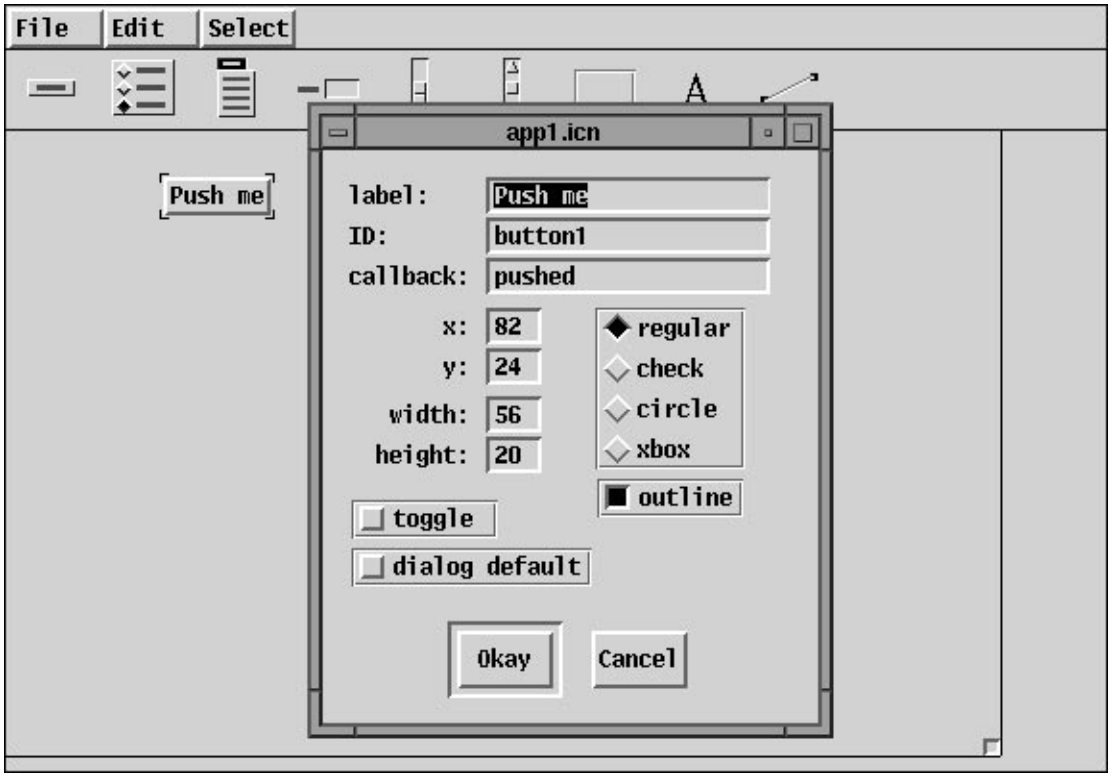
3. Attribute Sheets and Dialogs

VIB displays dialog boxes to specify attributes, gather information, and/or warn the user. The text fields of these dialog boxes can be edited; the tab key is used to move among them.

Attribute Sheets

As various objects are created, it usually is necessary to set attributes to customize the object to suit the needs of the application. The attribute sheet for an object is displayed by pressing the right mouse button upon the object. The editable features of an object are object-specific, but these usually include the x-y location of the object, the name of the object, a procedure to call when the object receives an event, and so forth. The Reference Section, later in this document, describes the editable attributes of each object in particular.

Attribute sheets also contain *Okay* and *Cancel* buttons. Pressing either of these buttons makes the attribute sheet disappear: The Okay button applies changes to the object while the Cancel button does not. The outline around the Okay button indicates that it is the default button on of the attribute sheet; pressing the return key has the same effect as clicking on the Okay button using the mouse.



If the Okay button is selected VIB checks to ensure that entered values are valid. For example, if there is no value entered into the x-coordinate field, an error dialog appears describing this error. The error dialog disappears when either the Okay button is selected or the return key is typed. This in turn redisplays the attribute sheet until the error is corrected or the Cancel button is selected.

Dialogs

When opening or saving a VIB interface, VIB displays a dialog box requesting (or verifying) a file name. If the Okay button is selected and the file name has no suffix, VIB appends the suffix .icn to the name before attempting to access the file. If the file cannot be opened, an error dialog appears describing the problem. The request can be canceled by selecting the Cancel button.

4. The Application Interface

VIB supports the development of *event driven* applications. When the application user activates an object on the screen, such as by clicking the mouse over a button, this event generates a *callback* to an Icon procedure associated with the object. The callback procedure for an object is provided separately by the programmer and its name is specified in the object's attribute sheet. The parameters depend on the type of object; details are contained in the reference guide that follows.

The interface specification provided by VIB consists of two Icon procedures ui_atts(), which returns a list of attributes for opening the application window, and ui(win,cbk), which creates the objects on the window. The optional win parameter supplies a window on which the interface is to be created. It is usually omitted, in which case the subject window, &window, is used. The optional cbk parameter provides a default callback procedure to receive events not processed by interface object callbacks.

The ui procedure returns a table of vidgets. There is one vidget for each interface object, indexed in the table by the **ID** name from the object's attribute sheet. There is also a root vidget that is the parent of all others. The user code that calls ui passes this root vidget to GetEvents() or ProcessEvent().

A simple VIB application, then, has the following outline:

```
link vsetup

procedure main(args)
   initialization
   (WOpen ! ui_atts()) | stop("can't open window")
   vidgets := ui()
   sophisticated applications might add or modify vidgets here
   GetEvents(vidgets["root"], evproc)
end

procedure evproc(e)    (optional)
   process Icon events not handled by vidgets
end

callback procedures
other procedures

VIB interface section (procedures ui_att and ui)
```

If the application is to modify the display or perform computations while awaiting input, a slightly more complex structure is required. The following code, which replaces the GetEvents call above, allows computation during the event loop under control of a paused flag that is presumably set or cleared by the user:

```
   paused := 1
   repeat {
      while (*Pending() > 0) | \paused do {
         ProcessEvent(vidgets["root"], evproc)
         }
      perform a small amount of computation here
      }
```

The skeletal main procedure generated by VIB for new files follows a similar pattern.

The name ui can be changed by editing the application attribute sheet, which is displayed by clicking the right-hand mouse button on the resize icon in the lower right corner.

5. Building Dialog Boxes

VIB can be used to construct dialog boxes for use in an application. The code for each dialog box is kept in a separate source file and linked as part of an application. The application itself need not be constructed using VIB, and a dialog box created by VIB can be used in more than one application.

Dialog mode is configured using the attribute sheet of the canvas. This is called up by clicking the right-hand mouse button on the resize icon in the lower right corner. Checking the **dialog window** box enables dialog mode. The dialog box is named by entering a value in the **name** field; this value becomes the name of the generated dialog procedure.

A dialog box must contain at least one button that is not a toggle. Pressing such a button is the way the user dismisses a dialog box. A dialog box cannot contain a menu or region; VIB does not prohibit these objects, but they are ignored when the dialog box is actually created.

To use a dialog box, the application calls the procedure generated by VIB. The dialog box is then displayed, temporarily obscuring part of the application window. When the user presses a non-toggle button to dismiss the box, the dialog procedure returns the label of that button. Additionally, the global variable **dialog_value** is assigned a table containing the values of the objects in the dialog box. The table is indexed by object ID.

The signature of a dialog procedure is as follows:

```
procedure dialog_name(win, deftbl)
```

where win is the window in which the dialog is to appear and deftbl is an optional table of default values. If win is null, the subject window, &window, is used. Values in deftbl, which is indexed by object ID, provide initial defaults used when the dialog box is first displayed; initial values set in VIB are not used.

6. Reference Guide

Buttons

Buttons are control devices that are activated by pressing the mouse while over the button. They may appear in four different styles: regular, check box, circle, and xbox. An outline is optional. A button can be flagged as a toggle, which maintains a state of *on* or *off*. The attribute sheet of a button contains the following editable features:

label is the label of the button. This may be an empty string.

ID is the name assigned to the object.

callback specifies the procedure to call, if any, when the button receives an event.

x specifies the x-coordinate of the upper-left corner of the button.

y specifies the y-coordinate of the upper-left corner of the button.

width specifies the width of the button.

height specifies the height of the button.

style specifies the appearance of the button. Four styles are supported: *regular*, *check box*, *circle*, and *xbox*.

outline specifies whether an outline is to be drawn around the button.

toggle specifies whether the button is a toggle button.

dialog default specifies whether the button is the default button of a dialog box. Only one button can be designated as the default.

The callback procedure associated with a button is called when the mouse is pressed and released while over the button. If the mouse is released while off of the button, no event is sent to the application. The signature of button callbacks is as follows:

```
procedure button_cb(vidget, value)
```

where vidget is the actual button vidget created by VIB and value is the current value of the button. A regular button does not maintain a state and therefore its value is insignificant. However, if the button is a toggle, the button does maintain a state. A non-null value indicates that the button is set or on, while a null value indicates that the

button is off.

Radio Buttons

Radio buttons are collections of buttons in which exactly one button is set at any given time; an exception is the initial configuration in which no buttons are set. Selecting one button automatically unsets the previously highlighted button in the group. The attribute sheet of a radio button contains the following editable features:

ID	is the name assigned to the object.
callback	specifies the procedure to call, if any, when the radio button receives an event.
x	specifies the x-coordinate of the upper-left corner of the radio button.
y	specifies the y-coordinate of the upper-left corner of the radio button.

The attribute sheet also contains *add* and *del* buttons. An add button inserts a new entry; a del (delete) button removes an existing entry.

The callback procedure associated with a radio button is called whenever one of its buttons is pressed. The signature of radio button callbacks is as follows:

```
procedure radio_button_cb(vidget, value)
```

where vidget is the actual radio button vidget created by VIB and value is the current value of the radio button. The value of the radio button is the label of the currently highlighted button.

Menus

Menus are lists of buttons that appear temporarily on the screen and allow the user to select one item from a list; they can contain an arbitrary nesting of submenus. A menu appears when its *menu button* is pressed. A menu button is simply the visual representation of the menu that is visible when the menu is not active. Defining a menu therefore involves two parts: defining the text and position of the menu button, and defining the menu that is displayed as the result of pressing on the menu button. The attribute sheet of a menu provides the means to define the menu contents. The editable features of a menu are as follows:

menu label	is the label that appears on the menu button.
ID	is the name assigned to the object.
callback	specifies the procedure to call, if any, when a menu item is selected.
x	specifies the x-coordinate of the upper-left corner of the menu button.
y	specifies the y-coordinate of the upper-left corner of the menu button.

The attribute sheet also contains *add* and *del* buttons. An add button inserts a new entry; a del (delete) button removes an existing entry.

A *create submenu* button turns a menu entry into a submenu header and displays an attribute sheet for the submenu. Submenu attribute sheets function the same way as menu attribute sheets. Submenus can be nested to arbitrary depth.

An *edit submenu* button appears beside a label representing an existing submenu header. The button label indicates the size of the submenu. Pressing the edit button brings up the attribute sheet for the submenu. A submenu is removed by deleting all of its entries.

Once a menu has been defined, it can be viewed within VIB by pressing the middle mouse button on the menu button. This allows the appearance and behavior of the menu to be simulated without fully prototyping the interface. Pressing the right mouse button on the menu button again displays the attribute sheet of the menu object, providing a quick edit/simulation cycle.

The callback procedure associated with a menu is called when the menu has been displayed and the mouse is released while over one of its choices. The signature of menu callbacks is as follows:

```
procedure menu_cb(vidget, value)
```

where vidget is the actual menu vidget created by VIB and value is a list of labels defining the menu path of the selected choice. For example, if the menu has *open* and *close* as its choices and *open* is selected, ["open"] will be the value passed to the callback. If the menu has *font* as a submenu label and *Helvetica* as a choice within the

submenu, then ["font", "Helvetica"] will be the value if *Helvetica* is selected. Thus choice names need not be unique across the entire menu, for they can be distinguished by their path strings.

Text Input Fields

Text input fields are used to gather textual input from the user of the application. They consist of a label and a value; the value is editable and can accept a limited number of characters, as specified by the *maximum value length* attribute. The attribute sheet of a text input field contains the following editable features:

ID is the name assigned to the object.

callback specifies the procedure to call, if any, when the text input field receives an event. This happens when the return key is pressed while the text input field has the focus.

x specifies the x-coordinate of the upper-left corner of the text input field.

y specifies the y-coordinate of the upper-left corner of the text input field.

label is the label of the text input field.

value is the default value of the text input field.

maximum value length specifies the maximum number of characters that the value can contain.

The callback procedure associated with a text input field is called whenever the return key is pressed. The signature of text input field callbacks is as follows:

```
procedure text_cb(vidget, value)
```

where vidget is the actual text vidget created by VIB and value is the current value of the text input field. The value of the object is the entered text string.

Sliders and Scroll Bars

Sliders are long rectangular buttons that display one or more scalar values as positions within a range. When the slidebar is clicked or dragged by the user, a scalar value is increased or decreased. Scroll bars are similar to sliders, with the addition of arrow buttons that increment or decrement the value by a fixed amount.

From a programming standpoint, sliders and scroll bars are very similar, and they are treated identically by VIB. The attribute sheet contains the following editable features:

ID is the name assigned to the object.

callback specifies the procedure to call, if any, when the object receives an event.

x specifies the x-coordinate of the upper-left corner of the object.

y specifies the y-coordinate of the upper-left corner of the object.

length specifies the length of the object.

width specifies the width of the object.

left/top specifies the left value of the range for horizontal objects or the top value of the range for vertical objects. This can be a positive or negative value of type integer or real.

initial specifies the initial value of the object. The initial value must be within the range established by the left/top and right/bottom values.

right/bottom specifies the right value of the range for horizontal objects or the bottom value of the range for vertical objects. This can be a positive or negative value of type integer or real.

filter filters out some of the events sent to the object, if set. This corresponds to the non-continuous mode as described below.

orientation specifies a *vertical* or *horizontal* orientation.

The application can control the number of events passed to the object. In *continuous* mode, the object receives events as the slidebar is pressed, dragged, and released. In *non-continuous* mode, the object receives a single event indicating the resulting value of the press-drag-release sequence. The slidebar can also be moved to a new location by clicking anywhere within the object region. In both modes, this results in the generation of a single event. The signature of object callbacks is as follows:

```
procedure object_cb(vidget, value)
```

where vidget is the actual object vidget created by VIB and value is the current numeric value of the object.

Regions

Regions are rectangular areas. They can be used for decoration, for receiving events, or for identifying output areas. (While nothing prevents an application from drawing anywhere in the window, reserving a space with a region helps direct the output to the right place.)

The attribute sheet of a region contains the following editable features:

ID	is the name assigned to the object.
callback	specifies the procedure to call, if any, when the region receives an event.
x	specifies the x-coordinate of the upper-left corner of the region.
y	specifies the y-coordinate of the upper-left corner of the region.
width	specifies the width of the region.
height	specifies the height of the region.
border	specifies the appearance of the region's border: *invisible*, *sunken*, *grooved*, or *raised*.

While most interface objects translate events into values that have meaning to the application, events in a region are sent directly to the callback procedure. The signature of the callback is as follows:

```
procedure region_cb(vidget, e, x, y)
```

where vidget is the vidget that VIB created, e is the Icon event code, and x and y are the mouse coordinates at the time of the event.

Labels

Labels display text strings. They do not receive events and do not have callbacks procedures. The attribute sheet of a label contains the following editable features:

label	is the text to display on the screen.
ID	is the name assigned to the object.
x	specifies the x-coordinate of the upper-left corner of the label.
y	specifies the y-coordinate of the upper-left corner of the label.

Lines

Lines decorate the interface. They do not receive events and do not have callbacks procedures. The attribute sheet of a line contains the following editable features:

ID	is the name assigned to the object.
x1	specifies the x-coordinate of endpoint one.
y1	specifies the y-coordinate of endpoint one.
x2	specifies the x-coordinate of endpoint two.
y2	specifies the y-coordinate of endpoint two.

7. Acknowledgements

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References

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