

The AutoCAD®
Visual LISP®
Developer's Bible
2011 Edition

David M. Stein



The Visual LISP Developer's Bible, 2011 Edition

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Revision History

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December 2002 Sixth release (added ObjectDBX, Xrecords content)
March 2003 Seventh release (updated for AutoCAD 2004)
October 2003 Eighth release (addition information and sample code added)
January 2011 Ninth release (woke up, scratched my ass, updated it for AutoCAD 2011)

About the Author

I was born and raised in the Commonwealth (State) of Virginia, United States, having worked in the IT field for over twenty years as both a Systems Engineer and a Software Developer of various kinds. I am currently working as a Senior Consultant for an IT services company supporting Microsoft platform services. However, I still get tapped on the shoulder to help with Autodesk deployments, FlexLM/FlexNet license server environments, Active Directory, Group Policy, Wise Packaging, writing scripts and building crazy software things that make some people rub their chins and say "hmmmm".

Prior to this realm of IT work, I was immersed in the Autodesk Developer Network world for about ten years. Most of his work involved AutoLISP, Visual LISP, a pinch of VBA, a wiff of .NET, and various external interfaces to automate design processes for the U.S. defense shipbuilding industry. In my spare time I enjoy reading, backpacking, bicycling, kayaking, drinking coffee and beer (not at the same time though), blabbering endlessly about meaningless crap, and spending as much time with my family as possible. I never have any spare time.

Introduction

This book is aimed at helping experienced AutoLISP programmers better understand and use Visual LISP. What? You mean AutoLISP and Visual LISP are *not* the same thing? No! They are not! This book will cover topics such as ActiveX, Compiling Code, Debugging, Formatting, Deploying and using advanced features such as reactors and namespaces. AutoLISP fundamentals are left for other books to cover as that topic has been aptly covered elsewhere already. This book will focus solely on the Visual LISP extensions to AutoLISP and the unique capabilities and features Visual LISP provides.

For this book, you will need to have access to using AutoCAD 2011 or other Autodesk products that include the Visual LISP toolset such as AutoCAD Map 3D, AutoCAD Mechanical, AutoCAD Civil 3D or whatever. In case you're wondering: AutoCAD LT won't work.

What is Visual LISP?

Visual LISP began life as a product of Basis Software, originally named *Vital LISP*. Vital LISP had a solid and hard core following, which gained the attention and respect of Autodesk, who purchased the full rights to Vital LISP during the late stages of AutoCAD R14 and renamed it *Visual LISP*. It was then available as a separate add-on to AutoCAD R14. With the release of AutoCAD 2000, Visual LISP replaced the older *Proteus* AutoLISP interpreter module and became an integral part of AutoCAD. It was then incorporated as the LISP interpreter in all AutoCAD-based vertical products, such as Map, Mechanical and Mechanical Desktop.

Visual LISP is more than simply a replacement for AutoLISP, in fact it still works with older AutoLISP code just fine, but it also includes many new improvements. Among the differences are a built-in syntax-aware code editor, dialog previewing, debugging tools, formatting tools, online development references, a compiler and compiler wizard, workspace project management and more.

But the most significant changes to the language itself are due to the addition of ActiveX interface functionality. This effectively puts Visual LISP *potential* on par with other ActiveX technologies such as Visual Basic for Applications (VBA). While Visual LISP still lacks many of the sophisticated tools VBA has, it does possess the capability to interface with ActiveX providers and consumers such as Microsoft Office, Microsoft Windows, and even AutoCAD itself, in ways not possible with AutoLISP alone.

While Autodesk has revised Visual LISP somewhat from its origins in Vital LISP, most of Vital LISP features have not changed much. Visual LISP could be improved to make it an even more powerful development platform, but it seems Autodesk is more interested in other technologies such as VBA, ObjectARX and XML, than ugly old LISP.

Autodesk chose to exclude support for many features in Vital LISP when moving it to Visual LISP. This is unfortunate and unfounded given that the overwhelming majority of development is still done in LISP or Visual LISP. While many Vital LISP features still exist in Visual LISP, their documentation is not available and this makes certain features risky to use, let alone just figure out. If you happen to be an old Vital LISP user, you should be aware of this. Some of these features will be explained later in this book.

Comments used Throughout This Book

Some notations will be shown throughout this book that denotes specific types of information. For example...

TIP - will denote information that may not be documented elsewhere or may be difficult to find.

NOTE - will denote a stupid, otherwise meaningless comment, but was probably something I felt like bringing up for some stupid reason.

WARNING - will denote information that you should be aware of in order to avoid problems or errors in your programming code.

"VLIDE" will be used as an abbreviation for "Visual LISP Integrated Development Editor" (or "Environment" or whatever). It also happens to be the command you type in to open the VLIDE console.

"VLISP" will be used as an abbreviation for "Visual LISP". We're lazy and anything that starts with "VL" amuses us. Deal with it.

The Future?

There are two futures for Visual LISP as far as I can see: Autodesk's and Unrealistic Potential. The Unrealistic Potential future would be if Autodesk put some effort into shoring up what's missing in the VLIDE and the language itself. In fact, they could proliferate the VLISP platform as an alternative to Powershell, VBScript and KiXtart. I did say "unrealistic" after all. There's technically nothing

preventing that from becoming a reality. Now, putting down the bong and focusing on reality, points us to the Autodesk future of Visual LISP: dying slowly on the vine. Nevermind that versioning has shown the pains of upgrading code for ObjectARX/ObjectDBX and even VBA, while Visual LISP code remained comparatively consistent and portable between host application version upgrades. Some VLISP code required updating, but not nearly to the significance of what ARX and VBA code required (nor the recompile headaches).

The rest of this paragraph is leftover from the 2003 edition: In my humble opinion, Visual LISP is an extremely powerful, flexible and dynamic language to develop upon with respect to CAD applications. It could do much more if given a little nourishment, but it seems the refrigerator is a bit empty lately. Until something comes along that can fully replace it without any limitations, I will continue using it along with the dozen or so other languages I strap on each day to do my work.

Chapter 1 - The Visual LISP Development Environment

The VLIDE is a combination of tools to help make coding, testing, debugging and compiling output easier and more productive. To invoke the VLIDE, type in VLIDE at the AutoCAD command prompt. This will load the VLISP ObjectARX application interface (vlide.arx) that loads and enables the IDE for use while AutoCAD is in use. Because Visual LISP is an integral part of AutoCAD, you cannot use the VLIDE without AutoCAD being in use.

NOTE: Users of the 'AutoCAD Classic' Workspace can use AutoLISP/Visual LISP Editor on the TOOLS pop menu. Ribbon Users can find Visual LISP Editor on the Applications Panel of the Manage Ribbon Tab.

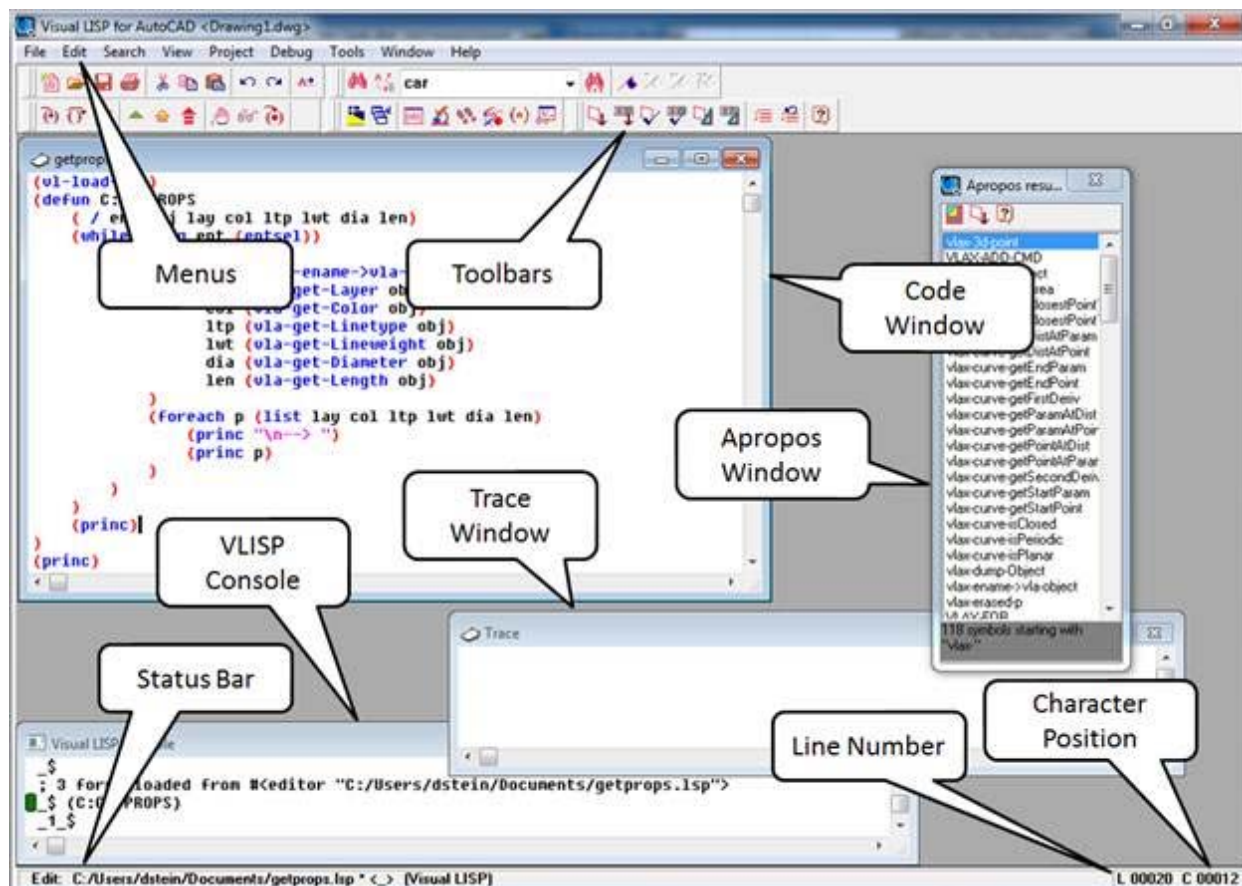


Figure 1-1 – The Visual LISP IDE

Note the VLIDE features shown in Figure 1-1 above. The top portion includes the IDE pull-down menus and toolbars. The mid-section includes the Build Output, Visual LISP Console and Trace windows. This

is also where open program code is shown and edited in separate windows (one per file). Other windows (not shown above) include the Watch window, and Object Inspection.

NOTE: An interesting "feature" of VLIDE is that the colors of the toolbar icons will often change each time AutoCAD is closed and reopened. Not when VLIDE is closed and reopened however. The colors seem to rotate through the basics: red, blue, green, yellow, magenta, cyan, black. If you don't like the colors, simply shut down AutoCAD and reopen again. This has been the behavior since VLIDE was added to AutoCAD years ago. For what reason, who knows? Consider it a bonus feature!

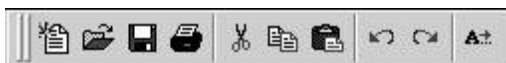
The bottom edge of the VLIDE window contains the Status bar. This is where messages are displayed following every action in the IDE. The bottom-right panel is the code editor cursor location display. This shows the current position of the cursor in the code file where *L nnnnn* is the line number and *C nnnnn* is the character offset number. In this example, the cursor is positioned on line 20 on the twelvth character of that line.

The Visual LISP IDE Toolbars

There are four individual VLIDE toolbars available. You can move them, dock or undock (float) them as well as hide or show each of them to suit your particular tastes. The toolbars do not exactly match their corresponding pull-down menu features to be careful not to assume that everything exists on a toolbar for being accessed in the VLIDE window. You may find that pull-down menus are more effective.

Toolbar: STANDARD

The STANDARD toolbar includes general file management features. This includes from left to right:



- New
- Open
- Save
- Print
- Cut
- Copy
- Paste
- Undo
- Redo

- Complete Word

Toolbar: TOOLS

The TOOLS toolbar contains general editor features. This includes from left to right:



- Load File
- Load Selection
- Check File
- Check Selection
- Format File
- Format Selection
- Comment Selection
- Uncomment Selection
- Help

Toolbar: DEBUG

The DEBUG toolbar contains tools for testing and debugging code during controlled execution. This includes from left to right:



- Step Into
- Step Over
- Step Out Of
- Continue
- Stop
- Quit
- Toggle Breakpoint
- Add Watch
- Last Break
- **Note:** The icon to the farthest right has been removed and is simply a blank button that does nothing (the status indicates "Source POSITION Indicator" however)

Toolbar: VIEW

The VIEW toolbar contains options. This includes from left to right:

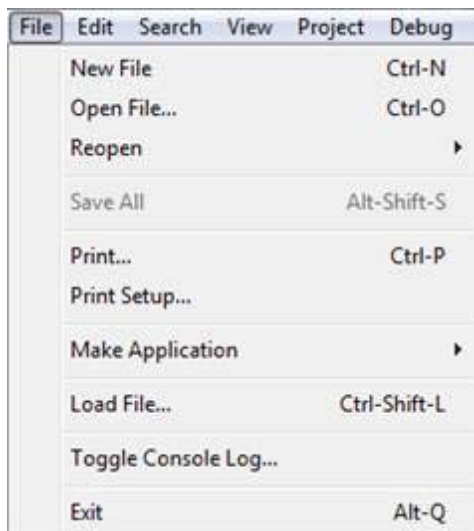


- Activate AutoCAD (switch to AutoCAD editor)
- Display LISP Console
- Inspect Object
- Trace Window
- Symbol Service
- Apropos
- Display Watch Window

The VLISP IDE Pull-Down Menus

The VLIDE pull-down menus are always available by default within the VLIDE window, whereas the toolbars can be moved, hidden and so forth. As was mentioned in the section above, the pull-down menus contain much more in terms of VLISP editor commands than do the toolbars. For this reason, you may find using the pull-down menus more efficient and effective for daily coding chores.

Menu: FILE



The FILE menu contains standard file management options such as Open, New, Save, Print and Exit. It also provides useful commands like Revert, Close All, Save All and Load File. The Make Application features are discussed later in Chapter 13.

NOTE: This is a dynamic menu, so certain commands will only be visible when relevant.

Figure 1-6 - File

Menu: EDIT

Now, after you've taken the time to look through the pull-down menus and scanned through the various

commands, you may get a strange feeling that the commands are not exactly located in a logical manner. That's because they're not. But don't worry, you'll rarely use most of them anyway.

VLIDE Configuration

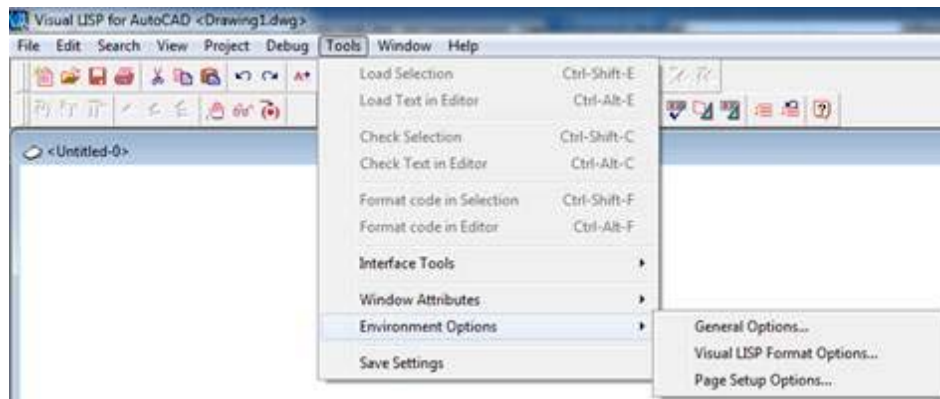


Figure 1-15 - Tools / Environment Options

General Options

To configure VLIDE preferences for fonts, colors, layouts, tabs and spacing, and so on, use the Tools menu and select one of the Environment Options items. The General Options dialog (figure 1-16) provides various Editor, Desktop and symbol management options.



Figure 1-16 - General Options

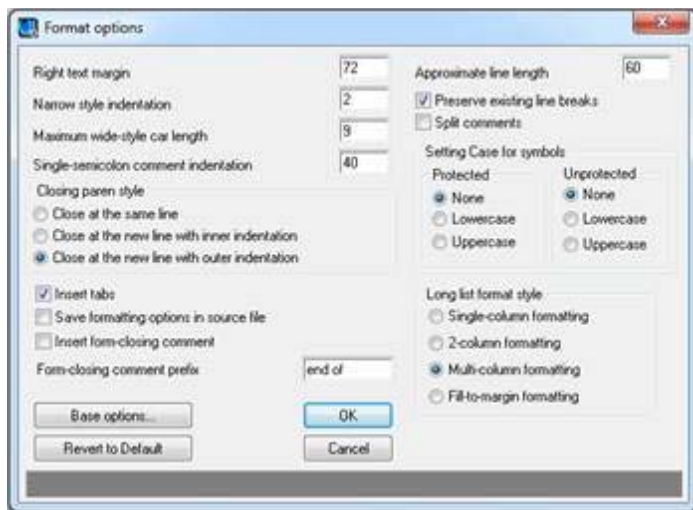


Figure 1-17 - Format Options

The dialog in Figure 1-17 is what you see when you click the "More options..." button in the base dialog.

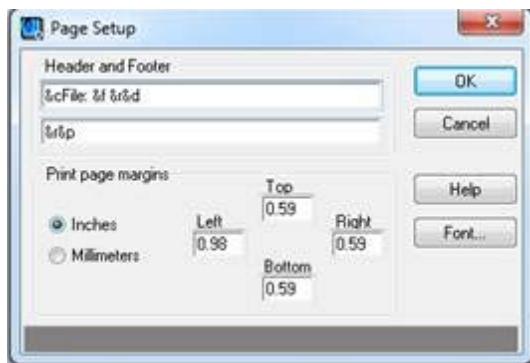


Figure 1-18 - Page Setup Options

Chapter 2 – Basic Coding in Visual LISP

In this chapter we will begin writing some basic code using Visual LISP and walking through a simple process for coding, testing, debugging and compiling your code into a finished product. For the sake of trying to at least remain relevant to what a CAD programmer expects, this will not involve the customary "Hello World" coding stuff.

(vl-load-com)

In order to use any of the cool ActiveX functions in Visual LISP, you must first initialize the ActiveX interface by using the (vl-load-com) function. This can be included in every file or every function definition, it doesn't matter. Once it has been executed, subsequent calls do no harm whatsoever.

```
(vl-load-com)

(defun C:SHOWLAYER ( / ent)

  (while (setq ent (entsel))

    (princ

      (strcat "\nLayer: "

        (vla-get-Layer

          (vlax-ename->vla-object (car ent)))

        )

      )

    )

  )

  (princ)

)
```

Command: Select object:

Layer: Alpha

The code shown above demonstrates how to get the layer assignment of a selected entity and display it in a simple alert box. Load this code into AutoCAD and type SHOWLAYER at the command prompt to run it. You will be prompted to select an object on screen "Select object to view layer name:" upon which the object's layer name is then displayed as follows...

While the differences between how you might traditionally access the layer name using DXF entity access is only slight, the user does not need to know that DXF field 8 is the layer assignment. They can instead use (vla-get-layer) which is a bit more intuitive. This is the crux of what makes the ActiveX features in VLISP attractive: clarity.

TIP: You can add (vl-load-com) to your startup suite in many ways. You can add it to your acad.lsp or acadodc.lsp file. You can make a small LSP file and select it in APPLOAD as part of your "startup suite". You can also include it in any .MNL file. Calling (vl-load-com) multiple times in a given session produces no negative effects.

Peter Seibel states it best when he describes LISP as a "programmable programming language", because you can always extend and enhance it by adding your own touches. For example, if you're used to functions like to-upper() or Ucase() from other languages, and find it odd to use (strcase "dog") or (strcase "dog" t) for upper and lower (respectively), you can easily write a function of your own to provide an alias to names you're more familiar with.

```
(defun Ucase (myString)
  (strcase myString)
)

(defun Lcase (myString)
  (strcase myString t)
)
```

Comparing AutoLISP to Visual LISP/ActiveX

Both of the expressions shown below will accomplish the same thing. While the first expression is a bit wordier, and actually consumes slightly more system resources to execute, the increased baggage is ultimately negligible in most respects.

```
Command: (vla-get-Layer (vlax-ename->vla-object (car ent)))
```

```
Command: (cdr (assoc 8 (entget (car ent))))
```

Once the initial access is made to either root collection of properties (namely, entget or vlax-ename->vla-object), which is normally done once per object manipulation, the rest is actually simpler to write in ActiveX form. The following code example:

```
(defun GETLAYER (entity / elist)
```

```
(cdr (assoc 8 (entget entity)))
)
```

...is functionally identical to the following code example...

```
(defun GETLAYER (entity / obj)
  (vla-get-Layer (vlax-ename->vla-object entity))
)
```

This is not a comprehensive comparison by any means, since this doesn't demonstrate how the ActiveX object model allows you to navigate relationships in a logical manner. For example, the following code shows how you can retrieve a property setting from the Preferences/Files collection:

```
(vla-get-SupportPath
  (vla-get-Files
    (vla-get-Preferences (vlax-get-acad-object))
  )
)
```

The above capability is not possible to accomplish with AutoLISP alone. It is made possible by ActiveX and the object model of AutoCAD, and the fact that Visual LISP and VBA can access these features through their ActiveX interface to AutoCAD.

Using another example of accessing a particular LINE entity's properties, you can see how the ActiveX interfaces provide very easy to understand names that make coding more intuitive:

```
(setq ent (car (entsel "\nSelect line object: ")))
(setq objLine (vlax-ename->vla-object ent))
(vla-get-Layer objLine)
(vla-get-Color objLine)
(vla-get-Lineweight objLine)
(vla-put-Layer objLine "0")
(vla-put-Color objLine acRed)
```

As you can see from this example, it is much more intuitive to access and modify entity properties through ActiveX than by using the more cryptic DXF code numbers. Also, it is worth noting that while the DXF 62 code is transient, the Color property of an entity is persistent. To put this yet another way:

An entity that has color=ByLayer has no DXF 62 field in the (entget) data list. Only when a color is applied to override the layer defaults will the entity (entget) data list have a DXF 62 field. However, if you access the same entity through ActiveX, even with color=ByLayer, the return value will be **acByLayer**.

As an example of how this might be of use to you as the developer, consider the following function that copies layer, color and linetype properties from one entity to another:

```
(defun CopyLayerColor1 (obj1 obj2)
  (vla-put-Layer obj2 (vla-get-Layer obj1))
  (vla-put-Color obj2 (vla-get-Color obj1))
)
```

You'll notice that we don't have to rely upon DXF codes, nor do we need to use (subst) or (entmod) functions to update the entity properties. This same function written in AutoLISP might look something like the following example:

```
(defun CopyLayerColor2 (ent1 ent2 / elist1 elist2 lay1 coll)
  (setq elist1 (entget ent1)
        elist2 (entget ent2)
        lay1   (cdr (assoc 8 elist1))
  )
  (setq elist2 (subst (cons 8 lay1) (assoc 8 elist2) elist2))
  (if (assoc 62 elist1)
    (progn
      (setq coll (cdr (assoc 62 elist1)))
      (if (assoc 62 elist2)
        (setq elist2 (cons (cons 62 coll) elist2))
        (setq elist2 (subst (cons 62 coll) (assoc 62 elist2) elist2))
      )
    )
  )
  (entmod elist2)
)
```

Notice the additional checking required for the DXF 62 code existence in both the source and target

entity data lists. As you can see, Visual LISP and ActiveX can dramatically reduce the amount of code required to perform many common tasks. Reducing code also reduces the potential for errors. Reducing errors also reduces the amount of effort required to test and debug code. All of this results in faster, easier and more productive programming with better quality results. And this makes for happier customers!

Mixing Code

While you can easily entwine both traditional AutoLISP and newer Visual LISP code within a given program or even within a given function or statement, it is not recommended. In fact, you can create some very strange problems mixing things like (entmake) and certain objects within Visual LISP. I strongly recommend that you make a conscious decision to go one way or the other and not both except in rare cases. One exception I rely upon is (ssget) and the various selection set functions, which are far easier to implement in older AutoLISP than with the SelectionSet object properties and methods in ActiveX, which are more like Group objects than ad hoc collections.

Nesting Object References

While it is easy, and entirely allowable to nest object references in a given statement, there are good reasons to not do it implicitly. By this, I mean that you should always store an object reference in a variable (symbol) as opposed to simply passing it up the chain to the next property or method invocation. You'll see me use nested code like this throughout this book; however, I strongly recommend NOT doing that. Refer to the two examples below:

Bad Example:

```
(setq oFiles
  (vla-get-Files
    (vla-get-Preferences
      (vlax-get-Acad-object)
    )
  )
)
```

Good Example:

```
(setq oFiles
```

```

(vla-get-Files
  (setq oPrefs
    (vla-get-Preferences
      (setq oAcad (vlax-get-Acad-object))
    )
  )
)
)
)
)

```

Alternate Good Example:

```

(setq oAcad (vlax-get-Acad-object)
      oPrefs (vla-get-Preferences oAcad)
      oFiles (vla-get-Files oPrefs)
)

```

Why would this matter to anyone? Well, when you pass implicit object references, you are calling an external interface function each time and throwing it away. If for some reason you need to access a nested object again you will need to fetch it again. Each time you are adding overhead to your processing. When you save the object to a symbol, you allow for repeated access to it with much less processing overhead. In addition, it provides you with explicit control over the lifespan of that object reference. You can decide when to discard it, or "release" it, in object parlance.

Exploring Object Properties and Methods

If you haven't already discovered the various properties and methods provided by objects within AutoCAD, a very good way to start is by getting familiar with the `(vlax-dump-object)` function. This function requires one argument, the *object*, to request the object properties, and an optional argument, a flag (anything non-*nil*) to request the object methods.

(vlax-dump-object object [show-methods])

Example of dumping the contents of the AcadApplication object:

```
#<VLA-OBJECT IAcadApplication 01877c20>
```

```
Command: (vlax-dump-object acad t)
```

```

; IAcadApplication: An instance of the AutoCAD application
; Property values:
;   ActiveDocument = #<VLA-OBJECT IAcadDocument 0f1e89b0>
;   Application (RO) = #<VLA-OBJECT IAcadApplication 01877c20>
;   Caption (RO) = "AutoCAD 2011 - [Drawing1.dwg]"
;   Documents (RO) = #<VLA-OBJECT IAcadDocuments 11120b08>
;   FullName (RO) = "C:\\Program Files\\Autodesk\\AutoCAD 2011\\acad.exe"
;   Height = 726
;   HWND (RO) = 983660
;   LocaleId (RO) = 1033
;   MenuBar (RO) = #<VLA-OBJECT IAcadMenuBar 111172b4>
;   MenuGroups (RO) = #<VLA-OBJECT IAcadMenuGroups 0736a890>
;   Name (RO) = "AutoCAD"
;   Path (RO) = "C:\\Program Files\\Autodesk\\AutoCAD 2011"
;   Preferences (RO) = #<VLA-OBJECT IAcadPreferences 110cd4bc>
;   StatusId (RO) = ...Indexed contents not shown...
;   VBE (RO) = AutoCAD: Problem in loading VBA
;   Version (RO) = "18.1s (LMS Tech)"
;   Visible = -1
;   Width = 1020
;   WindowLeft = 2
;   WindowState = 1
;   WindowTop = 2
; Methods supported:
;   Eval (1)
;   GetAcadState ()
;   GetInterfaceObject (1)
;   ListArx ()
;   LoadArx (1)
;   LoadDVB (1)
;   Quit ()
;   RunMacro (1)
;   UnloadArx (1)
;   UnloadDVB (1)

```

```

;   Update ()
;   ZoomAll ()
;   ZoomCenter (2)
;   ZoomExtents ()
;   ZoomPickWindow ()
;   ZoomPrevious ()
;   ZoomScaled (2)
;   ZoomWindow (2)

```

Example of using this function on a standard CIRCLE entity as follows:

```

_$(setq ent (entsel)); pick a CIRCLE entity
Command: Select Object: (<Entity name: 7ef035d8> (16.3954 9.95463 0.0))

_$(setq obj (vlax-ename->vla-object (car ent)))
#<VLA-OBJECT IAcadCircle2 110f4404>

_$(vlax-dump-object obj T)
; IAcadCircle2: AutoCAD Circle Interface
; Property values:
;   Application (RO) = #<VLA-OBJECT IAcadApplication 01877c20>
;   Area = 372.878
;   Center = (12.6177 20.245 0.0)
;   Circumference = 68.4524
;   Diameter = 21.7891
;   Document (RO) = #<VLA-OBJECT IAcadDocument 0f1e89b0>
;   EntityTransparency = "ByLayer"
;   Handle (RO) = "1B3"
;   HasExtensionDictionary (RO) = 0
;   Hyperlinks (RO) = #<VLA-OBJECT IAcadHyperlinks 1116f494>
;   Layer = "0"
;   Linetype = "ByLayer"
;   LinetypeScale = 1.0
;   Lineweight = -1
;   Material = "ByLayer"

```

```

;   Normal = (0.0 0.0 1.0)
;   ObjectID (RO) = 2129671640
;   ObjectName (RO) = "AcDbCircle"
;   OwnerID (RO) = 2129665272
;   PlotStyleName = "ByLayer"
;   Radius = 10.8945
;   Thickness = 0.0
;   TrueColor = #<VLA-OBJECT IAcadAcCmColor 11159f90>
;   Visible = -1

; Methods supported:
;   ArrayPolar (3)
;   ArrayRectangular (6)
;   Copy ()
;   Delete ()
;   GetBoundingBox (2)
;   GetExtensionDictionary ()
;   GetXData (3)
;   Highlight (1)
;   IntersectWith (2)
;   Mirror (2)
;   Mirror3D (3)
;   Move (2)
;   Offset (1)
;   Rotate (2)
;   Rotate3D (3)
;   ScaleEntity (2)
;   SetXData (2)
;   TransformBy (1)
;   Update ()

```

As you can see, this is a very helpful function for inspecting entities for their properties and methods. It is also helpful for inspecting *any* other objects, including application objects, documents, collections, and so forth. A very handy trick is to define a utility function that will dump any object you specify with

less typing:

```
(defun dump (obj)
  (cond
    ( (= (type obj) 'ENAME)
      (vlax-dump-object (vlax-ename->vla-object obj) t)
    )
    ( (= (type obj) 'VLA-OBJECT)
      (vlax-dump-object obj t)
    )
  )
)
```

To use this, simply do your magic at the command prompt and define objects assigned to symbols and dump them in the following general manner...

```
Command: (setq e (car (entsel)))
Select object: <pick something>
. . . <blah blah>
Command: (setq o (vlax-ename->vla-object e))
. . . <blah blah>
Command: (dump o)
. . . <bang! Dumps all the goodies here...>
```

ActiveX vs. DXF?

Can ActiveX do everything you need in VLISP to handle all your programming chores? No. Can DXF do everything ActiveX can accomplish? No. There are quite a few situations where the older AutoLISP approach is the only solution to a given problem, and vice versa. In some situations, you could use either one, but the AutoLISP approach will turn out to be the most efficient or *manageable* choice. You may reply "Oh sure, that's what you think." But let's look at some scenarios.

Selection Sets

You can create and iterate selection sets, or more properly named *picksets*, using either AutoLISP or Visual LISP. However, you will quickly find that dealing with selection sets in AutoLISP is far easier and less problematic than with VLISP.

Point Lists

Actually, any LIST structure is easier to manipulate in AutoLISP than is the case with an array using VLISP. While both are powerful and flexible, constructing and modifying LIST structures in LISP is much simpler than that of ARRAY structures using VLISP.

Entity Properties

While most properties are easier and more intuitive to access with ActiveX using VLISP, some are not exposed and are therefore only available from DXF code values using AutoLISP. For example, dimension line control points of Linear DIMENSION objects (acDbRotatedDimension), control points of LEADER objects, and the infamous BLOCKDEF description property (which isn't completely available to either AutoLISP or VLISP, it is only accessible using a separately loaded function library).

Rather than bore you to tears with detailed examples, which I may do later on anyway, suffice it to say that there are still situations that warrant using AutoLISP even though Visual LISP adds so much power and potential to what you can do.

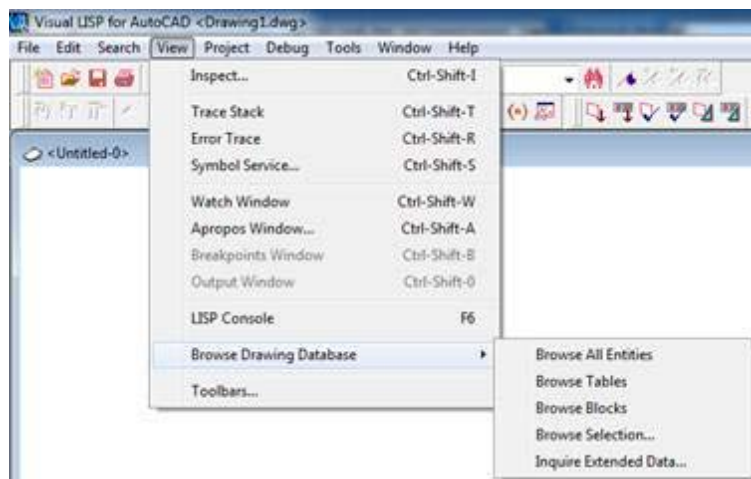


Figure 2-1

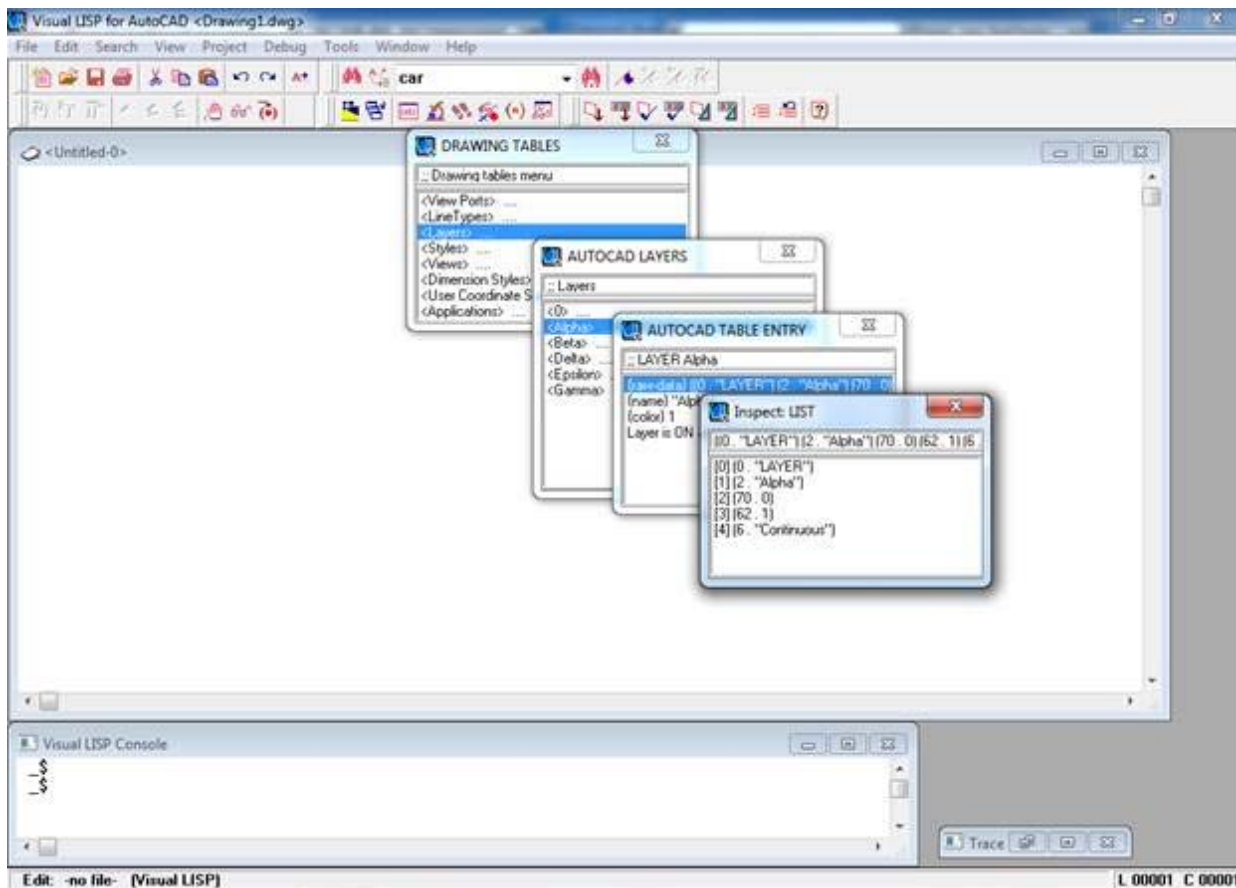


Figure 2-2 - Drawing Database Browser

The Drawing Database Browser is handy for drilling down into tables and table entries to inspect the current drawing. While it doesn't handle ActiveX properties, it will show the legacy DXF properties. Once you have reached the content you are looking for, you can right-click and select "Log" to save the output to the Trace window for copy/paste editing into other locations.

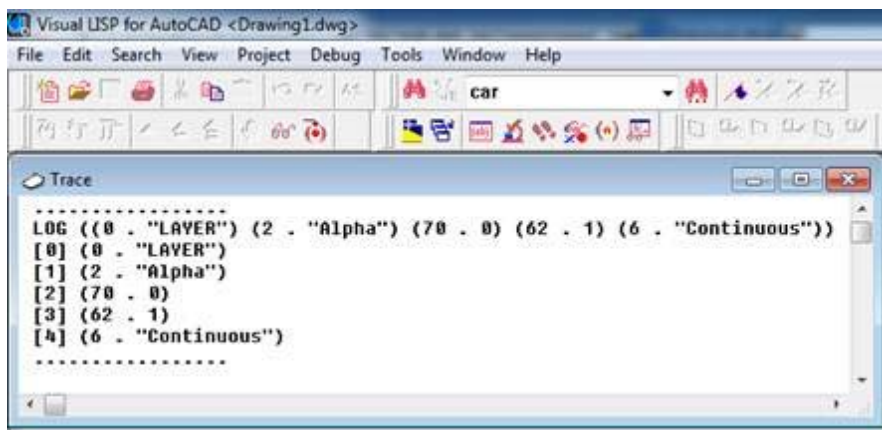


Figure 2-4 - Trace Window dump

And the Winner Is...

You! You win because you have more options available to you to reach your goals in shorter time, with

more robust options, and with more predictable and reliable results. The oldest argument in the world of AutoCAD programming is what language or API is the "best" to work with. The argument itself is stupid and makes no meaningful point. Is a pipe wrench the "best" tool? Maybe for mauling pipes, but not for driving nails. Different tools are intended for different jobs. Master the ones that you need to build the best product possible. You'll find that no one tool can do it all unless you're doing very little to begin with.

LISP itself was intended for very rigorous flexibility and extensibility. Like all programming languages, you can do things with LISP that you simply CANNOT do within other languages. For example, it is not a simple feat to define a recursive self-redefining function in VBA, nor a nested function structure. List manipulation in LISP is easier and more efficient than in other languages because that is the crux of what LISP was built to handle. Some reading this might retort "*why would you want to do those things anyway?*" and snicker, with their pinky in the air, sipping their glass of \$10 wine. Well, once you've found the power in using these capabilities, your eyes will open and your voice will say "Ahhhhhhhhhh, that's cool!"

While Auto/Visual LISP lacks many of the modern amenities such as dialog form tools, it does provide a crude DCL form building programming language for building forms the stone age way: brute force coding. Its elegance is subtle and obtuse, not overt and aesthetic, with just a hint of minty freshness.

So, what is the best tool? They all are. Well, except possibly COBOL, but even it has its uses.

Chapter 3 – Using ActiveX with Visual LISP

In this chapter we'll discuss more examples using ActiveX capabilities within Visual LISP. First, we'll start off with the technological environment of ActiveX, including things like objects, object models, collections, properties, methods and so forth. Then we'll dig into the details of certain parts of ActiveX technologies. Understanding ActiveX functionality is essential to working with it using any language.

ActiveX is basically an object-oriented medium, meaning that it behaves in a manner that uses objects and object relationships. I am not going to explain object-oriented issues in depth, that's best left for more focused text books and what-not. However, I will attempt to give an overview of some of the basic object-oriented aspects for the sake of gaining a basic understanding.

Classes

Everything in an object-oriented environment begins with *Classes*. Classes are abstract frameworks, or templates, for describing what form objects should take and how they should behave and interact. Classes define categories of object types in a sense. For example, an automobile might be a class of vehicles. Vehicles could be the *parent* class and automobile would then be a *sub-class*. In turn, you can get more specific and define additional sub-classes such as station wagons, vans, and sports cars.

Classes do not address specific instances; they describe aspects about the instances in advance of their use. When you use a class you are said to *invoke an instance* of that class. The result of invoking a class is usually that of creating an object. An object can be a single entity or a container that holds yet more objects within it.

Examples:

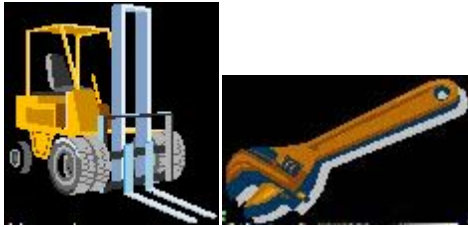
Class: MechanicalTool

Sub-Classes: Power-Assisted, Manual

Derived Classes: MechTool/Power-Assisted/Gas-Powered/Lifting

Derived Classes: MechTool/Manual/Handheld

Instances:



Derivation and Inheritance

It's probably easiest to explain derivation, or sub-classing, using the analogy of a tree structure. As you drill down into lower levels of, say, a folder structure, you will most often discover it is a virtual model from general to specific as you descend downward. The top-most folder is very general, and each level of sub-folder below it is gradually more specific in nature. This is very much like derivation. Each sub-class, or derived class, is a further refinement or specification of a more general class from which it descends from.

The aspects of how each derived class inherits the qualities of its parent class is referred to as inheritance. This implies that the sub-class contains all of the aspects of its parent class from which it was derived. This includes properties, methods and events (reactor types in VIsip speak). This is much more relevant and apparent when working with languages like VB, VBA and C/C++/C#, which make the object relationships more easily viewed and understood. Visual LISP by contrast does nothing to make this apparent and you as the programmer should be aware that you must rely upon additional studying and tinkering to fully understand the object class relationships you will deal with.

While it may seem contradictory to the intent this book, I would strongly recommend that you keep the VBAIDE open while programming in VLISP, so that you can quickly access the Object Browser in VBAIDE. By pressing F2 in VBAIDE, you can open the Object Browser and have instant access to class documentation, properties, methods, events and more. It would have been nice if Visual LISP included the Object Browser, but you are left to dig with a shovel using (vlax-dump-object) β more on this later.

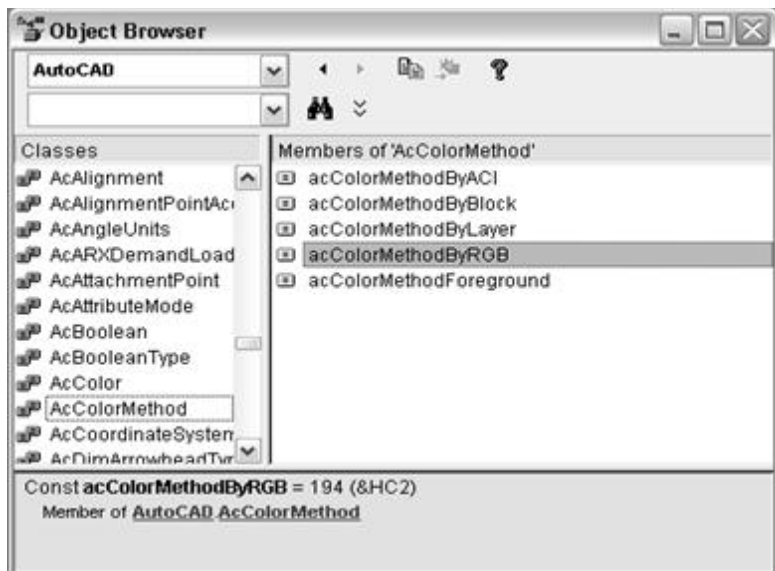


Figure 3-1 - The VBA Object Browser

NOTE: The Drawing Database Browser doesn't show the ActiveX/COM side of things, it only shows the legacy DXF structures and content.

Objects

An *object* is an instance of a class. A class describes the rules for what an object must support in order to be one of its members. An object has inherent *properties*, and may also have inherent *methods* and *events*. Properties are attributes that define how the object behaves or reacts. Methods are built-in functions for accessing or modifying object properties or certain behaviors. Events are notifications sent by objects in response to specific actions they perform or actions that are performed upon them.

Using the automobile class example above, an object might be a particular car. Say, *your* car, which has a distinct configuration (make, model, color, options, and ID number). You could say that *your* car is an *instance* of the automobile class, or some class *derived* from the automobile class, such as a "junk-car" class.

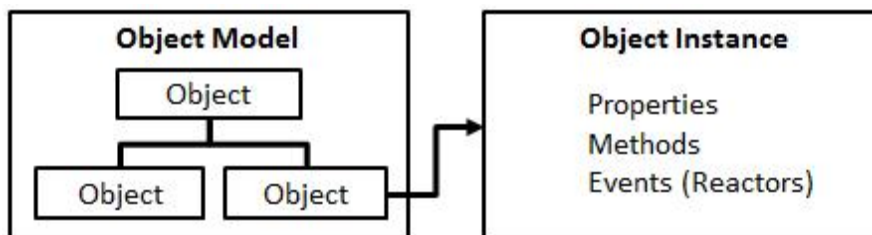


Figure 3-2 - A simple Object Model

Object Models

An *Object Model* is an arbitrary schema, or arrangement of class relationships that define a hierarchy and means for deriving one object from a higher level of classes. An object model is independent of the languages or tools used to access it and work within its logical framework. The same model exists whether you're working with Visual Basic, VBA, Visual LISP, Delphi, Java, C/C++, VB.NET, C#.NET or any other language that incorporates or provides an ActiveX interface. This does not mean that all features of the object model are equally supported in all languages. They often are not. Some features are only accessible or are more easily accessed within some languages than from within others.

One analogy might be that an Object Model is a house and its arrangement of rooms, doors and windows. The people that enter and use the house all deal with the same house. In this case, the house and rooms are the object model and the people are the programming languages. Hopefully, you get the point.

Class Inheritance

An Object Model always begins with a root or *base* object. In the case of AutoCAD, the base object is the AutoCAD Application object, also called the AcadApplication object. This provides the base properties, methods, events and collections from which all other objects and collections are derived. For example, the AcadApplication object has a collection of Documents (the Documents collection), which in turn has one or more Document objects within it. Each Document object has its own objects, collections, properties and methods and so on.

You can navigate an Object Model *downward* into sub-level objects and collections, as well as navigate *upward* to parent objects and collections. This *model* becomes very powerful for enabling applications to directly access and manipulate the environment to perform an almost limitless set of tasks. It also keeps things neat and organized, which always helps when developing software solutions.

Collections and Dictionaries

A *Collection* is a group of similar objects that have a common parent container. This container has a unique name and in most cases will provide its own methods for accessing the objects it contains. A *Dictionary* is a special type of collection that allows you to extend your own collections with names. Visual LISP does not provide a means for creating or doing much with collections. It does allow you to iterate them, modify members, add and delete members. A dictionary allows you to add your own dictionaries as well as populate them, iterate them, add, modify and delete their members as well as

add, modify and delete the dictionaries themselves.

Some common collections within AutoCAD are Documents, Layers, Dimension Styles, Linetypes, Blocks and so forth.

Some common dictionaries within AutoCAD are PageSetups, Layouts (yes, they are also stored as a dictionary), Layer States, and Xrecord objects. The AutoLISP dictionary functions are *dictadd*, *dictnext*, *dictremove*, *dictrename*, *dictsearch* and *namedobjdict*. In Visual LISP, you have access to the ActiveX dictionary object methods, properties and event reactors as follows:

Methods:

AddObject

AddXRecord

Delete

GetExtensionDictionary

GetName

GetObject

GetXData

Item

Remove

Rename

Replace

SetXData

Properties:

Application

Count

Document

Handle

HasExtensionDictionary

Name

ObjectID

ObjectName

OwnerID

EventReactors:

Modified

Properties, Methods and Events

Properties are simply descriptive attributes associated with an object or a collection. Examples could include Name, Height, Width, Rotation Angle, Scale, Color, Layer, Linetype and so forth. Properties will vary according to what type of object they are associated with, but some properties are common to all objects and collections. Collections and Dictionaries usually provide the Count and Name properties, as well as the Item, and Add, methods. Only dictionaries will provide a Delete method since you can't delete Collections from Visual LISP.

Methods are built-in functions that an object provides to access or modify special properties or perform special actions upon the object itself. Examples of common Methods include Rotate, Erase, Copy, Scale and Offset. You might notice that these look just like AutoCAD Modify commands. Well, in essence they are just that, but with a slight difference.

Whereas AutoCAD Modify commands are general in nature, they must validate object usage for each execution, Methods are provided by their host object and therefore, only supported Methods are provided by each object. Confused?

Stated another way, the OFFSET command can be used at any time, but if you try to OFFSET a TEXT object you'll get an error message from AutoCAD. However, the TEXT object itself provides a variety of Methods such as Copy, Rotate, Scale and Move but not Offset. So you can "invoke" a method from an object and be assured that it is valid for use with that object.

Events are actions that an object or collection can generate from various activities, which can be detected and responded to as well. This is referred to as *event-driven programming* when events are used in combination with reactions to those events. AutoCAD provides a powerful set of event-response tools called *Reactors* that enable you to post listening devices in the drawing environment that respond to various Events. For example, you could create a Reactor to respond to an Erase event when an object has been erased in the active drawing. This is only one example of Events and Reactors.

Property Relevance

It is important to understand that you should NEVER assume all properties are available to all objects or collections. There are two functions in particular that are valuable for ensuring your code performs properly when dealing with properties and methods at runtime: `(vlax-property-available-p)` and

(vlax-method-applicable-p). These two functions are just two of the Visual LISP predicate functions that provide Boolean tests for whether a condition is True or False (*non-nil* or *nil* in LISP terminology).

The syntax for these functions is as follows:

(vlax-property-available-p *object propertyname*)

```
(vlax-method-applicable-p object method)
```

Properties are related to the type of object they are related to. For example, a Circle object would have a Diameter property, but Line objects would not. As an example of how Properties vary according to object types, the following code would crash with an error when picking a CIRCLE entity:

```
(if (setq ent (entsel "\nSelect object to get property: "))
  (progn
    (setq obj (vlax-ename->vla-object (car ent)))
    (princ
      (strcat "\nLength: " (vla-get-Length obj))
    )
  )
)
```

But, if you verify that the property is valid for the relevant object first, it would perform properly as shown in the example below:

```
(if (setq ent (entsel "\nSelect object to get property: "))
  (progn
    (setq obj (vlax-ename->vla-object (car ent)))
    (if (vlax-property-available-p obj 'Length)
      (princ
        (strcat "\nLength: " (vla-get-Length obj))
      )
      (princ "\nObject has no LENGTH property...")
    )
  )
)
```

Unfortunately, there is no direct means to fetch a list of all properties for a given object in such a way as to iterate it for programmatic purposes. However, you can fetch a list for informational purposes that can help you greatly.

To inquire as to what Properties and Methods a given object has you use the `(vlax-dump-object)` function on that object. The syntax of this function is `(vlax-dump-object object show-methods)` where the *show-methods* argument is either nil or non-nil. If non-nil, it shows the supported Methods for the object; otherwise Methods are simply not shown.

```
_$ (setq acadapp (vlax-get-acad-object))
#<VLA-OBJECT IAcadApplication 00a8a730>

_$ (vlax-dump-object (vla-get-documents acadapp) T)
; IAcadDocuments: The collection of all AutoCAD drawings open in the current session
; Property values:
;   Application (RO) = #<VLA-OBJECT IAcadApplication 00a8a730>
;   Count (RO) = 1
; Methods supported:
;   Add (1)
;   Close ()
;   Item (1)
;   Open (2)
```

The output above shows the properties and methods of the Documents collection object. You'll notice that the first line of output shows the internal object reference (IAcadDocuments) along with a description of what it represents, and then it lists the available Properties and Methods.

TIP: The following command definition may come in handy for you to explore the properties and methods of selected entities. There is no error handling provided, but it is nonetheless a useful little tool.

```
(defun C:DUMP ( / ent obj)
  (while (setq ent (entsel "\nSelect entity to get object data: "))
    (setq obj (vlax-ename->vla-object (car ent)))
    (vlax-dump-object obj T)
    (vlax-release-object obj))
  )
```

```
)  
(princ)  
)
```

TIP: The enclosed (RO) beside certain Properties denotes *Read-Only*, in this case all the properties are read-only. The enclosed numbers beside the Methods indicate how many arguments are required to use each method.

To access a Property, you use the (vla-get-xxx) function, or even the more generic (vlax-get-Property) function, either will work. The syntax for the first form is (vla-get-xxx *object*) where xxx is the property name. When using the (vlax-get-property) function, the syntax is (vlax-get-property *object propertyname*), where the *propertyname* can be either a double-quoted string or a single-quoted name.

(vlax-get-property *object propertyname*) or

(vla-get-propertyname *object*) or

(vlax-get *object propertyname*)

Returns the value assigned to the named property of the object. If the property does not exist for this object, an error is generated. For example, if you request the "Diameter" property from a Line entity, this will generate an error.

Arguments:

Object – A vla-object

Propertyname – A valid property with respect to the object.

Examples:

```
(vlax-get-property objLine "Length")  
(vlax-get-property objLine 'Length)  
(vla-get-Length objLine)  
(vlax-get objLine "Length")  
(vlax-get objLine 'Length)
```

All of these expressions will do the same thing.

Property names are not case sensitive but examples throughout this book will generally capitalize the first letter for clarity. You will find that the first two options above are easiest to use in general, however, there are situations that require using the second two options. This is particularly with respect to interfacing with external applications like Microsoft Excel or Word.

Using Methods

Using the example in Figure 3-1, you can see that the Documents collection object supports four Methods: *Add*, *Close*, *Item* and *Open*. The *Item* Method requires one argument to be used (hence the (1) shown beside that method in Figure 3-1), this is the index or name of the document to be fetched from the collection.

An interesting feature of the `Item` method (in general) is that it can accept either a string or an integer value argument. When given an integer argument it simply returns the (nth) item of the collection, where 0 is the first item. When given a string value, it attempts to fetch the item by its name property. The `Item(name)` method is not case sensitive, which is very useful for fetching names without having to first convert string cases.

TIP: If you are familiar with Visual Basic or VBA and the use of *default methods* or *default properties*, you should be aware that this feature does not exist in Visual LISP. For example, in Visual Basic, accessing the `Item` method can be done using either of the two following ways:

`Object.Item(12)` or `Object(12)` or `Object("Name")`

This is because the `Item` method is the *default method* for most objects in VB or VBA. Visual LISP does not support this feature and therefore requires that you spell out all properties and methods for every use, every time. Don't feel bad though, Microsoft has dropped support for default properties and methods in all .NET languages. The following VliSP examples should demonstrate this better:

```
(vlax-invoke-method documents "Item" 12) will work...
```

```
(vla-item documents "Drawing1.dwg") will work...
```

```
(vlax-invoke-method documents 12) will not work.
```

Using the example in Figure 3-1, the `Item` method might be used in any of the following ways:

- `(vla-Item documents 1)`
- `(vla-Item documents "Drawing1.dwg")`

- (vlax-invoke-method documents "Item" 1)
- (vlax-invoke-method documents `Item "Drawing1.dwg")

(vlax-invoke-method *object method [arguments]...*) or
(vla-method *object arguments*) or
(vlax-invoke *object method [arguments] ...*)

Invokes a method associated with *object* and supplies any required *arguments* to that method. If successful, returns a result. If the requested method is not provided by the object, an ActiveX error is generated. For example, requesting the "Offset" method from a Text entity will generate an ActiveX error.

Arguments:

Object – A vla-object

Method – A method exposed by the object

Arguments – Any required arguments to supply to the method

Examples:

```
(vlax-invoke-method objLine "Move" point1 point2)
(vla-Move objLine point1 point2)
(vlax-invoke objLine "Move" point1 point2)
```

All of these of these examples do the same thing. This is generally true for most AutoCAD objects, but not for objects created from imported TypeLib interfaces or external applications or ActiveX components. You should use the first form for working with external application objects, however you can use the second form for internal objects.

TIP: While you opt to use either of the two forms of Get/Put on Properties and Methods, you may find it more flexible to use the longer form (e.g. vlax-put-property) as opposed to the shorter form (e.g. vla-put-color). The reason is that by separating the property name from the function, you can define functions and iterative statements that can accept a list of properties and their associated values. For example...

```
(defun MapPropertyList (object proplist)
  (foreach propset proplist
```

```

(if (vlax-property-available-p object (car propset))
    (vlax-put-property
     object
     (car propset)
     (cadr propset)
    )
  )
)
)
)

```

Be careful when trying to apply this approach to methods, as the arguments list for methods varies with respect to the object and method. Some methods don't take any arguments, while others will vary in length.

Data Types

Data types are a means for describing the type of values a given object or property can contain. Examples of data types include Integer, Double, Currency, Date, String, and so on. While AutoLISP has enjoyed *type independence* for years, Visual LISP does as well, but not always. Within AutoCAD, you can remain type independent as you can with AutoLISP, but when it comes to interacting with other applications, such as Microsoft Excel, you will inevitably have to come to terms with data types and use them wisely.

Being type independent is not a free lunch either. The price paid comes in the form of inefficient processing. When you declare data type in advance, you are telling the compiler to carve out only enough resources to suit that expected data type. To store data of type Integer for example is far less demanding than storing a "long" Date value.

When you work *without* data types, everything is automatically allocated for the largest possible data type to make sure whatever is used will fit in the available resources. The result is that the application is more bloated than it really needs to be, both in terms of initial load size as well as runtime resource allocation. AutoLISP never forced programmers to declare data types ahead of runtime. Therefore, it always used the maximum allocation for a given symbol as a best guess. Even when using (getint), the variable itself isn't declared until runtime, so AutoLISP was not capable of efficiently predicting allocation needs at design time.

This is essentially why applications developed in languages like C++, Java, and even Visual Basic are usually faster (when compared to similarly functional coding in type-free languages). They ensure leaner execution ahead of time in order to ensure faster performance at runtime. AutoLISP does not do this and is therefore a much slower processing language medium. Visual LISP is much better, but only if you leverage the new features to their fullest extent wherever possible. I must admit though, that even Visual LISP does not enforce design time data type declaration. It simply relies upon, and respects data types much more rigorously than AutoLISP during runtime.

For anyone familiar with VB, VBA and VBScript programming, Visual LISP is more like VBScript in terms of strictness than AutoLISP. For example, there is no equivalent in Visual LISP to the DIM statement in VB or VBA. While VBScript does not enforce data types, it at least supports OPTION EXPLICIT to force variable declarations.

Constants and Enumerations

A **Constant** is a special data type. It is just what it sounds like, a value that cannot be changed. This is sometimes referred to as being *static*. Often, Constants are provided by the programming language or by the hosting application itself, as a means of convenience. For example, the `acByLayer` constant can be substituted for a property value in place of 256. The name value is easier to understand and remember than an integer value. For example, the two expressions shown below are functionally identical:

```
(vla-put-Color object acByLayer)
(vla-put-Color object 256)
```

Enumerations are logical groups of constants that are used to identify a range of constant values. For example, you might use colors 1, 2, 3, 4, and 5 but having constants for these such as `acRed`, `acYellow`, `acGreen`, `acCyan`, `acBlue`, `acMagenta` and `acWhite` are handy for clarity as well as sensible coding. Ranges of related constant values of this type are called *enumerations*. See appendix A for a list of standard AutoCAD enumerations.

TIP: Not all ActiveX enumerations are provided within Visual LISP. For example, the standard Decimal and Short data types are not mirrored as `vlax-vbDecimal` or `vlax-vbShort`. Refer to Chapter 6 for more information on data types.

Variants and Safearrays

In the section on Data Types above, there was mention of using the largest allocation available for type-free declarations, such as (setq) expressions in AutoLISP. Actually, this entails allocating for a **Variant** data type. A Variant is simply a catch-all data type that provides enough resource space to contain any other data type, be it numeric, date, string, or whatever. A Variant data type is the product of ActiveX actually, but the concept is more generic in nature and has existed long before ActiveX was around.

Visual LISP actually holds all converted ActiveX data as Variants with a specifier that denotes what specific type is contained within it. This sounds confusing but it's really very simple. The container is a Variant which is holding a Currency data type value within it. When you assign a new value to the object, you must provide that specifier to make sure that the data is properly stored. This is especially true when you are passing values between AutoCAD and other applications such as Microsoft Excel.

In addition to posting values, you can query the nested data type from a Variant value, as well as convert the value properly into a relevant LISP data type. For example, you might query a Variant object value that contains a Double value within it. You would then read that value as a REAL data type in LISP. Visual LISP provides plenty of functions for creating, reading, and modifying Variant data values in a LISP environment.

Safearrays are something like LIST objects in AutoLISP. The main difference is that they are static, meaning that they cannot be stretched or changed in terms of how many members they can store. This prevents unwanted errors generated by attempting to assign or fetch members beyond the length of the array. This is why they are called "safe" actually. Any LIST structure passed into ActiveX must be converted into a Safearray first. Any LIST oriented data fetched from an ActiveX object should be converted to a LIST data type for use by LISP functions such as (car), (nth), (assoc), (mapcar), (member) and so on. Visual LISP provides plenty of functions for creating, manipulating and reading Safearray data values.

For more information on Variants and Safearrays, refer to chapter 6.

Namespaces

A Namespace is a virtual space of resource allocation in which a process runs and interacts with other resources in that space. But it can at times communicate with other processes in other Namespaces. Think of Namespaces as bedrooms. Your application might be a person working in one bedroom; a process in a specific namespace. Another application can be working in an adjacent bedroom

(namespace) as well. The two can remain independent and isolated or they can be made to pass data between each other for communication. This is essentially how namespaces work.

Some of the advantages to using namespaces are that the processes in a specific namespace are isolated from those of other namespaces and this prevents them from stepping on each other (trying to reserve resources in contention). It also enables direct loading and unloading of processes by their namespace. In other words, it's somewhat like being able to unplug one of the bedrooms from the house as if it were built in modular form. Removing one bedroom wouldn't affect the other rooms or processes they each have active.

Probably the one significant disadvantage to using namespaces is that they incur some overhead on the operating system as well as their host application. In order to manage a given namespace it has to be given its own range of memory addresses and pointer allocations. This consumes additional resources to track and control the namespace, which in turn provides the means to directly access it to unload it or pause it if necessary.

AutoCAD provides its own internal management of namespaces within Visual LISP, as well as within ObjectARX and VBA. This is yet another powerful improvement provided by Visual LISP over AutoLISP. Actually, each opened document is its own namespace as well (if you're not working in single-document mode). The effects of this can be seen when setting a variable in one drawing session and attempting to read it in another. There are ways to pass such variables between drawing sessions though, and we'll discuss these in Chapter 10.

Interfaces and Type Libraries

Interfaces are a means for connecting to the object models of other ActiveX processes or components. When you want to be able to tap into specific properties, constants, or methods of other applications, you first have to define an interface to load the object model of that target application. For example, maybe you want to be able to work with Microsoft Excel to store some AutoCAD information directly into a spreadsheet file using Excel's own tools from Visual LISP. This requires that you define the interface, and that in turn allows for the use of a *Type Library*, or *TypeLib*.

To use a Type Library, it must be loaded into memory and certain interface pointers have to be defined. Visual LISP provides a set of functions specifically for loading and configuring Type Library interfaces.

```
(vlax-import-type-library  
  :tlb-filename name string
```

```
:methods-prefix    string  
:properties-prefix string  
:constants-prefix string  
)
```

Imports a type library reference into the current namespace.

Arguments:

:tlb-filename string – (string) is the path and filename of the TypeLib file

:methods-prefix string – (string) is an arbitrary prefix string identifier

:properties-prefix string – (string) is an arbitrary prefix string identifier

:constants-prefix string – (string) is an arbitrary prefix string identifier

Example:

```
(vlax-import-type-library  
  :tlb-filename      "c:\\myfiles\\typelibs\\tlfile.tlb"  
  :methods-prefix    "dsxm-"  
  :properties-prefix "dsxp-"  
  :constants-prefix  "dsxc-"  
)
```

This example imports the type library interface to an external application or control defined in the file `tlfile.tlb`. The remaining arguments define the prefixes for methods, properties and constants exposed from the type library interface.

If this type library provided a method named `AddNumbers`, it would be used in our Visual LISP code as `dsxm-AddNumbers`. What's interesting is that once you've actually imported the type library and this expression has succeeded, the Visual LISP will recognize all defined properties, methods and constants from the external application and color-code them in blue as with any built-in LISP function. This is another reason that the VLIDE is helpful for coding and providing features that improve your ability to spot code errors early.

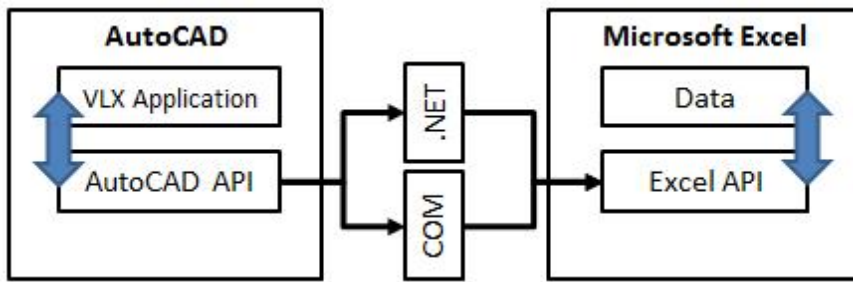


Figure 3-3 – Type Library Interfacing.

A Type Library is simply an *interface* that exposes all of the object model members of one provider to other applications that request it. When you load a type library, it immediately defines and identifies all of the publicly exposed properties, constants and methods of it's related application provider to the application consumer that is using it.

In Figure 3-3, the Excel Type Library has been loaded to interface Visual LISP with Excel's object model and use the tools it exposes. This can save a lot of time and headache by giving you direct access to tools built into Excel that will do what you need without having to attempt to reinvent the wheel in Visual LISP alone. An example of how this might be used is shown below and in Figure 3-4.

For example, when supplying a constant value as an argument to an Excel function through a call from Visual LISP, you could use the constant enumeration name instead of the actual underlying value to keep your code clear and understandable. This also saves you from having to look up all the enumerations in Excel and translating them in Visual LISP. If Excel provides a constant such as `put-cellcolor` you can use that directly from Excel.

Visual LISP requires TypeLib information to determine whether a method, property or constant for an object is available. Some objects may not have any TypeLib information available, such as the `AcadDocument` object.

(vlax-typeinfo-available-p *object*)

Returns T if TypeLib information is available for *object*. If none is available, it returns *nil*.

Arguments:

Object – A vla-object.

```
(defun Excel-Get-Cell (rng row column)
  (vlax-variant-value
```

```

    (msxl-get-item (msxl-get-cells rng)
      (vlax-make-variant row)
      (vlax-make-variant column)
    )
  )
)

(defun Excel-Put-CellColor (row col intcol / rng)
  (setq rng (Excel-Get-Cell (msxl-get-ActiveSheet xlapp) row col))
  (msxl-put-ColorIndex (msxl-get-interior rng) intcol)
)

```

Figure 3-4 – Example of using Type Library enabled code with Excel.

The second function definition in Figure 3-4 (**Excel-Put-CellColor**) provides a means for applying a color fill value to a given cell in an Excel worksheet from Visual LISP. This is possible by using the exposed interface methods from Excel that were provided by loading the Excel Type Library first. The type library items appear above with an **msxl-** prefix.

Once you invoke a TypeLib interface, the referenced functions are then recognized by the VLISP editor syntax engine. When you type them in properly, they change color to show that they are indeed recognized as a valid function from the external TypeLib interface. This is the basis of what makes this a useful coding practice: syntax awareness.

TIP: Type Libraries come in many forms, they are most often .TLB files, but can also be .OLB, .DLL and even .EXE files. It's worth noting that Microsoft Office 97 and 2000 normally use .TLB files, however Office XP uses the .EXE files themselves to provide the type library interface definitions to other applications. Consult the documentation for whatever external application or service you want to work with for information about how it exposes its ActiveX type library information.

Microsoft Office TypeLib Versions

Product	Ver	Example
Office 97	8	Excel.Application.8
Office 2000	9	Outlook.Application.9
Office XP	10	Word.Application.10

Office 2003	11	Powerpoint.Application.11
Office 2007	12	Excel.Application.12
Office 2010	14	Word.Application.14

Another handy tip is to look in the Windows registry under HKEY_CLASSES_ROOT to find all of the registered API libraries for every service and installed application. There are also many freeware and shareware tools on the Internet to find, organized, view and inspect all the type libraries registered on your computer. These are often better than looking in the registry, since they can read the property pages within type libraries to show the internal documentation. Property pages are where the documentation information is drawn from when picking on objects in the VBA Object Browser.

If you omit the version identifier, Windows will query for the "current version" by reading the CurVer sub-key under the class GUID entry in HKEY_CLASSES_ROOT. For example, you may likely see both Excel.Application and Excel.Application.10 together in this registry. But if you look under Excel.Application, it will have a CurVer subkey that most likely is set to the value "Excel.Application.14" (assuming you have Office 2010 or Excel 2010 installed). It will also have the same CLSID value. This is essentially how upgrades redirect the type library interface to all external applications: using the registry.

Chapter 4 – Debugging Code with Visual LISP

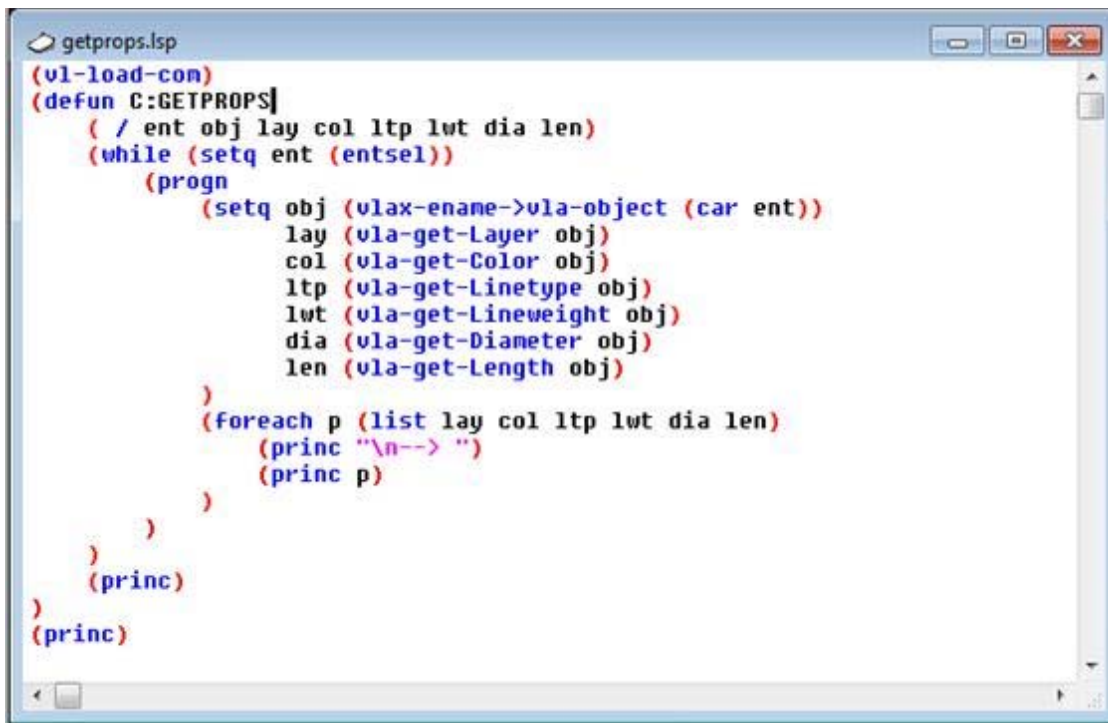
This chapter will focus on using the testing and debugging tools in Visual LISP to catch problems early and make your code more bug-proof. Debugging is as much a part of successful code development as mowing the lawn is for home ownership. It can be tedious and painful at times, but ignoring or neglecting it will certainly cause you greater pain in the long run.

The sooner you get familiar and comfortable with using the tools for debugging; the better off you'll be in a variety of respects. Not the least of which will be improved code quality and better customer satisfaction (putting smiles on the faces of those that pay your salary never hurts).

Breakpoints

Breakpoints are a tool for placing markers in your code to trigger a pause during execution automatically. If you are having a problem with your code in a particular part of the execution, place a *Breakpoint* at the beginning of that section and run the code until it hits that Breakpoint. Then you can use one or more of the following tools to dig deeper into the execution in a methodical manner to find the cause of the problem and fix it in less time.

Example: Load the code file `ERRORTTEST1.LSP` shown in Figure 4-1 and run the `GETPROPS` command in a drawing that contains a few `CIRCLE`, `ARC` and `LINE` entities.





```
getprops.lsp
(vl-load-com)
(defun C:GETPROPS
  ( / ent obj lay col ltp lwt dia len)
  (while (setq ent (entsel))
    (progn
      (setq obj (vlax-ename->vla-object (car ent)))
      lay (vla-get-Layer obj)
      col (vla-get-Color obj)
      ltp (vla-get-Linetype obj)
      lwt (vla-get-Lineweight obj)
      dia (vla-get-Diameter obj)
      len (vla-get-Length obj)
    )
    (foreach p (list lay col ltp lwt dia len)
      (princ "\n--> ")
      (princ p)
    )
  )
  (princ)
)
(princ)
```

Figure 4-1 – ERRORTTEST1.LSP example code

You'll notice that when you select a **Line** or **Ellipse** entity, the code crashes with an error message *"error: ActiveX Server returned the error: unknown name: Diameter"*.

The same happens if you pick TEXT or POINT objects. Maybe you can see the cause of this error in the example code already, but let's pretend that this is a far more complex piece of code and you can't easily find the cause of this error by looking at the code. What to do now? Place a breakpoint in the code, load it and run it again. This time, when it gets to the breakpoint location in the code, the execution pauses, and you can begin debugging the code execution using the various tools provided in the VLIDE. One of these tools is called *Stepping*.

Place your editor cursor directly in front of the line that contains (setq lay ...) and press the **F9** key, or pick the  button, to toggle the Breakpoint ON at that location. You'll see the beginning parenthesis (blocked in red. This is one of the visual aids provided by the VLIDE editor and it is very helpful indeed. Once you've toggle the Breakpoint ON, load the code into AutoCAD again using the  button, or press CTRL+ALT+E to do the same thing.

```

getprops.lsp
(vl-load-com)
(defun C:GETPROPS
  (/ ent obj lay col ltp lwt dia len)
  (while (setq ent (entsel))
    (progn
      (setq obj (vla-ename->vla-object (car ent)))
      lay (vla-get-Layer obj)
      col (vla-get-Color obj)
      ltp (vla-get-Linetype obj)
      lwt (vla-get-Lineweight obj)
      dia (vla-get-Diameter obj)
      len (vla-get-Length obj)
    )
    (foreach p (list lay col ltp lwt dia len)
      (princ "\n--> ")
      (princ p)
    )
  )
)
(princ)


```

Figure 4-2 – ERRORTTEST1.LSP with a BreakPoint set

Now when you run the GETPROPS command and pick an entity, it will stop on that breakpoint and jump back to the VLIDE editor to await your next command. You'll notice here a few things are a little different now. First, the block of code that is contained within the matching parenthesis is now highlighted. Second, you'll see that the DEBUG toolbar buttons are now enabled (no longer grayed out). This toolbar is now the main tool for continuing your debugging process.






The first three buttons at left are the Stepping control buttons (described in the next section in more detail), followed by the buttons for Continue, Quit and Reset. Then the next three buttons are Toggle Breakpoint, Add Watch, and Last Break, followed last by the Breakpoint Step status button. This last button simply shows a visual queue as to whether the current process is stopped before or after a matching subset of parenthesis. It can help to look at this to know whether an error is *thrown* before the expression or just after it was evaluated.

Go ahead and pick the **Step Into** button . Keep picking on that button and watch how the code continues to execute one expression at a time. This will continue until the execution encounters the expression that generates the error. At that point, execution is aborted and the error message is displayed.

Hopefully, you'll discover that the cause of the error is that this code assumes certain properties are available without first verifying that they indeed are available. The Diameter property is obviously not available when picking a LINE entity. Nor is the Length property available when picking a CIRCLE entity.

Stepping

As you may have surmised in the above example, stepping is simply a means of walking through code execution one line or one expression at a time. This lets you pause the execution and control the frame advance to proceed along until you get to a point in the code where you want to inspect what's going on or reveal an error or specific condition. You can **Step Into** , **Step Over** , or **Step Out Of** , which are common stepping methods in all programming languages, not just Visual LISP.

Step Into – Continues advancing execution by evaluating the next expression from the innermost nested statement to the outermost statement before advancing to the next expression or statement.

Step Over – Skips the currently highlighted statement block and advances execution to the next expression or statement.

Step Out Of – Skips out of the breakpoint block and advances to the next expression or statement. If there are no more breakpoints beyond this point, execution continues uninterrupted.

Animation

Another method of Stepping is to use Animated Execution. This feature executes the code normally but pauses after each expression is evaluated to highlight the block of code in the editor window. After each pause, the code advances automatically to the next expression. The pauses are processed using a timed delay value that you can adjust to suit your needs or preferences.

Watches


A Watch, in the context of debugging, is a marker placed on a particular object or symbol to continually display its properties during program execution. Adding a watch to a particular variable (symbol) enables you to see its value assignment during the course of a step-execution following a breakpoint encounter in the process. To Add a Watch, select a symbol by highlighting the code in the editor window, and then pick the Add Watch button  or press **CTRL+W**. This opens the Watch window and adds a watch reference into the watch list. You can watch as many symbols at a time as you desire, but keep in mind that the more you add, the more cumbersome it can be to clearly see what's going on.

Figure 4-3 shows a Watch being placed on the symbol 'p' in the (foreach) section of the code. By moving the breakpoint to the beginning of the (foreach) section, this will enable the Watch to display each value of the symbol 'p' as it is processed through the (foreach) iteration.

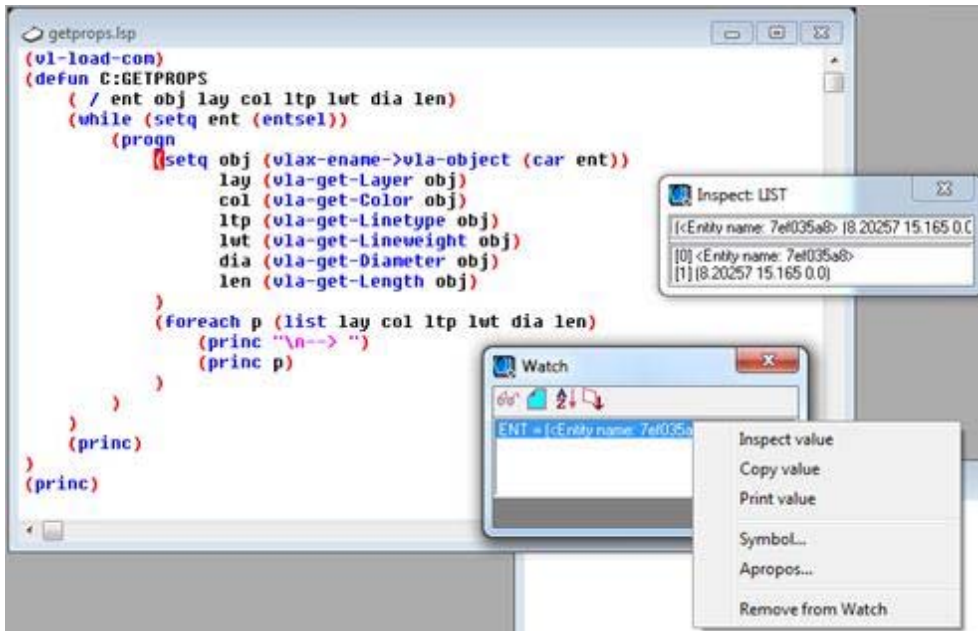


Figure 4-3 – Adding a Watch to the 'p' symbol.


Note that initially, P=nil, since the code is not executing and there is no value assigned to 'p' as of yet. When the (foreach) loop is entered, P will display the values for each of the symbols in the list (lay col ltp lwt dia len) respectively, even if they are set to nil.

Tracing

There are several Trace features provided by VLISP. One is a Command Trace, which places a marker on a given command (or all commands) and displays a notification in the Trace Log Window whenever the command (or any command) is called from your active code execution. If the VLIDE is open, the Trace log window is displayed and any calls are posted there during execution.

If the VLIDE is not active, the trace dump is posted to the AutoCAD command prompt window. However, once the VLIDE activated, it remains active even when you return to the AutoCAD editor session. Therefore, once VLISP is activated, all Trace output is sent to the Trace window in the VLIDE and you must return to the VLIDE session to continue viewing trace output until you close and reopen AutoCAD to terminate the trace output to VLISP.

Another type of Trace is a Stack Trace.

The Trace button  is not on the DEBUG toolbar, but instead on the VIEW toolbar. This is because the Trace feature is actually a window display as opposed to a debugging command related to a specific piece of code (as is the Add Watch and Breakpoint features).

To display the Trace Log window, you must first turn ON the command trace by picking the Debug pulldown menu and checking the option titled "Trace Command". Once this is done, any calls to AutoCAD commands from your code execution in the VLIDE are reported to the Trace Log window as shown below.

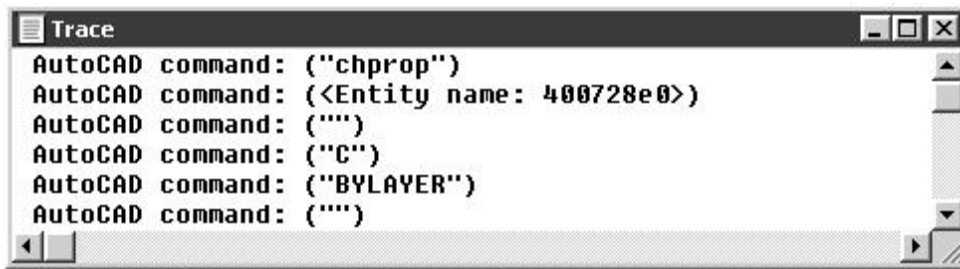



Figure 4-4 – Trace Log window after CHPROP command called.

Figure 4-4 shows how a command such as CHPROP is reported to the Trace Log window along with any arguments it uses such as entity name, command-line options and values supplied to it. You may notice that each component is represented as a single-member list. This is because VLISP represents command stacks in list form internally.

Inspection

Inspection involves drilling down into a symbol to see what properties it contains and what form it is defined as. For example, inspecting the function (vla-get-activespace) will show that it is defined as a SUBR, an intrinsic function which is provided by VLISP. The number/letter string to the right of the declaration denotes its memory address in the current namespace. 

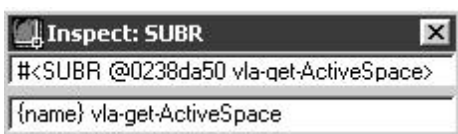


Figure 4-5 - The Inspection Window

Symbol Service

The Symbol Service utility provides a way to inspect symbols as to their properties. This includes protection status, tracing, debug on entry status and whether it has been exported to the AutoCAD



namespace. From this pop-up form you can also perform online help look-ups by picking the help button  at the top of the form. The example below shows the result of highlighting the code (vla-get-activespace) and picking the Symbol Service button. You can also right-click on the highlighted code and pick Symbol Service from the pop-up menu.



Figure 4-6 - The Symbol Service Window

Apropos

The APROPOS feature allows you to search for functions, properties and methods based upon a wildcard match, and return a list of them within a listbox in the IDE. From this list you can copy/paste into your code window or perform online help lookups to learn what the item can do or how it's used. There are various ways to invoke this feature. One of them is to right-click on some code and pick Apropos from the pop-up menu (shown in the example below). Or you can pick the Apropos button  on the View toolbar.

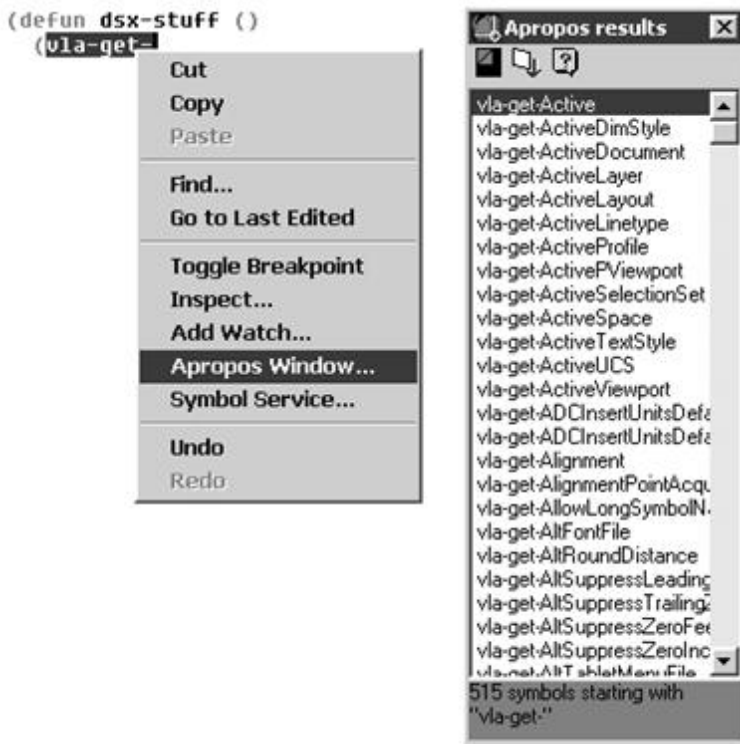


Figure 4-7 - The Apropos Results Window

As you can see by the example above, an APROPOS search on "vl-get-" turns up quite a few matching items in the Results window. You can narrow down the search by typing in a few more characters in your code window, such as "vla-get-Active" to only find those items that begin with the same string value.

You can also modify the Apropos search within the Results window by picking on the top-left button (tool tip says "Apropos Options") and entering your changes to the search criteria in the edit box. Other options on this form allow you to specify case-matching, prefix only, and lowercase conversion. The Filter Value button displays even more options on the Filter Value form.

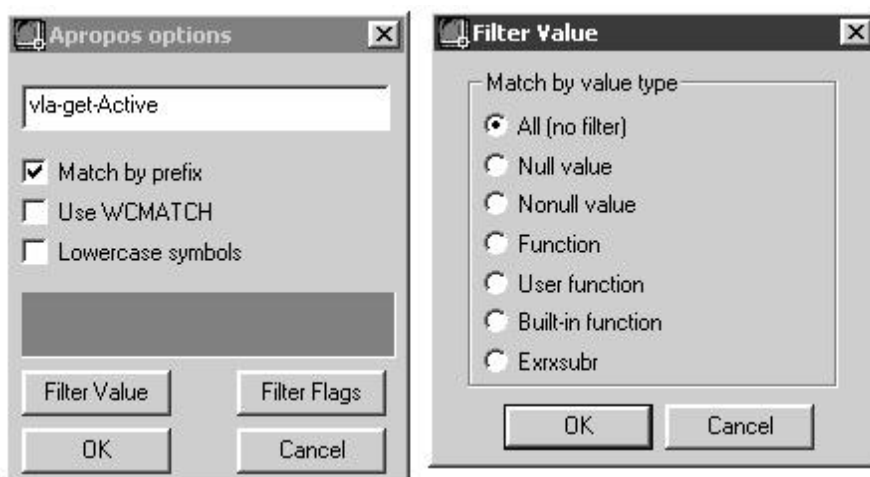


Figure 4-8 – Apropos Filter Value options

You can, for example, limit your search to items such as built-in functions, externally-defined functions (ExrSubrs such as those defined by ObjectARX applications), and Null or Non-Null values. The Filter Flags button displays a search filtering form for limiting the search to symbols that have certain characteristics themselves, such as being protected or those that have been exported to the AutoCAD namespace.

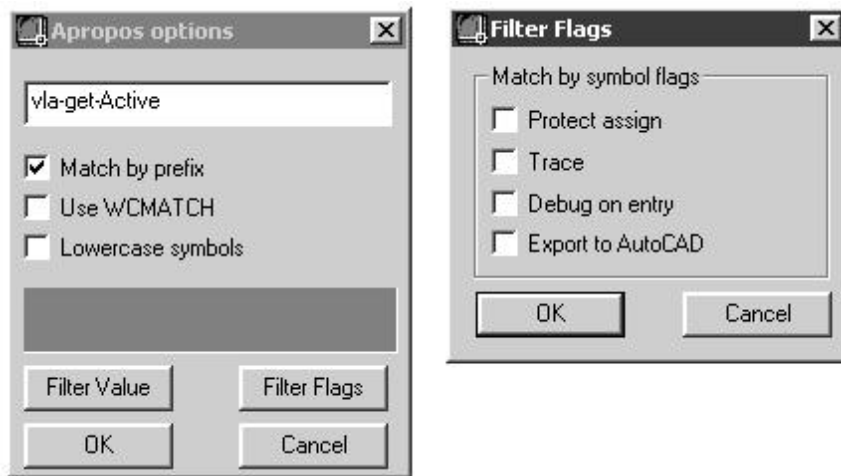


Figure 4-9 – Apropos Filter Flags options

Bookmarks

Bookmarks are not necessarily a *debugging* tool, but they are useful for locating a particular section of code quickly. This is especially true in cases where you are working with very large amounts of code in a single file and it becomes difficult to jump around in the file to specific points in the code. Bookmarks appear as a rounded square solid green symbol in front of the line where you insert them.

To insert a Bookmark, place the cursor on the desired line of code and press `ALT+. .` (a period) or pick Search/Bookmarks/Toggle Bookmark. To remove a bookmark, place the cursor on the bookmarked line and press `ALT+. .` again or pick Search/Bookmarks/Toggle Bookmark. To clear all bookmarks in a given file, pick Search/Bookmarks/Clear All Bookmarks.

TIP: While Visual LISP does not allow you to jump to bookmarks by name, you can move between them in a Next/Previous manner. To jump from one bookmark to the next, press `CTRL+. .` (a period). To move to the previous bookmark, press `CTRL+,` (a comma) or continue pressing `CTRL+. .` Until you cycle through all the bookmarks again.

Goto Line Position

When Bookmarks are not practical, you can also jump directly to a line in your code by number. Simply press **CTRL+G** to display the Goto Line box, enter the line number and press **Enter** to go to that line.



Figure 4-10 – The Go To Line Box.

Error Trapping

Ultimately, no method of debugging will get you to the goal line without proper *error trapping*. What is Error Trapping? It is simply a process of capturing an error in order to diagnose the nature of the error and performing some corrective action as a result. This is more efficient and produces better quality results than simply allowing the error to crash your code and display an ugly, cryptic message that confuses the user.

ActiveX in particular, is not known for being very friendly when it comes to the content of its error messages. For example, a common error message thrown by ActiveX operations in Visual LISP is the following:

`Error: ActiveX error: No description provided.`

What does this mean to the user? For that matter, what does it mean to anyone? Not much. However, within the context of your code, you might be trying to initiate a connection to an Access database using ADO or JET. At the point where you would try to make the connection, you should place an Error Trap around that code and test whether it succeeded or failed, and if it failed, determine why it failed. Then you can check the error conditions and display a meaningful message that may help the user figure out the cause themselves, saving you even more work.

How do you place an Error Trap around your code? You use the functions provided by Visual LISP for trapping, checking and handling errors generated by an ActiveX object.

Visual LISP Error Trapping Functions

Visual LISP provides some additional error trapping and error handling functions over the age-old AutoLISP **error** function. Each of these functions give you a collective set of tools to catch, verify and

handle errors thrown from code execution in Visual LISP, especially for code that runs in it's own namespace or that is interfacing with external application objects or procedures. For example, it can be very difficult at times to intercept and react to errors generated from things like ADO failures unless you use these special functions.

(vl-catch-all-apply '*function list*)

Places an error trap over the result of a function execution. Works similarly to the Try-Catch exception handling provided in C++, C#.NET and VB.NET programming languages. This function returns either the successful object or an Error object. The (vl-catch-all-error-p) function determines if the return object is an Error object.

Arguments:

Function – Either a defun or lambda function definition or symbol pointer

List – A list of required arguments for the function being evaluated

The (vl-catch-all-apply) function is used to place an error "catch" (trap) around a set of code expressions. Once executed, any result is passed directly to the output of this function where it can be checked to see if it generated an error, and if so, what kind of error was generated.

The syntax for this function is (vl-catch-all-apply *function list*) where *function* is the expression being executed, and *list* is the items on which the function is being executed upon or by way of.

TIP: Be aware of every ActiveX object you intend to use or interface with. You should be careful to determine whether or not the object will "throw" an ActiveX or OLE error when it fails. If it is capable of throwing such an error (as opposed to returning nil) as the result of a failure, you should ALWAYS wrap the expressions used to interface with it inside of an error handler to keep your code from "blowing up" on the user.

For example, to place an error trap around an attempt to open Microsoft Excel, you could use something like this...

```
(cond
  ( (vl-catch-all-error-p
      (setq XL
        (vl-catch-all-apply 'vlax-create-object
          '("Excel.Application.14")
        )
      )
    )
```



```

    )
  )
  (vl-exit-with-error
    (strcat "\nError: " (vl-catch-all-error-message XL))
  )
)
( T (princ "\nSuccessfully opened Microsoft Excel session object.") )
)

```

Figure 4-11 – Error trapping example using an Excel application object

This small example does the following (working from the inside out in order of processing):

- Attempt to create an object of Excel.Application.14
- If the attempt fails it returns appsession as an Error object.
- (vl-catch-all-error-p) returns T when it inspects appsession
- Evaluation is aborted by the (vl-exit-with-error) function which displays the error message passed through the Error object app session.
- This error causes the code to abort execution immediately and displays the message to the user at the same time. Otherwise, if (vl-catch-all-error-p) returns nil, the returned appsession object is not an Error object, and the program can continue on to do more things with it.

A more simple and direct test is to force a "Divide by Zero" failure to create an error and see how Visual LISP handles it. From within the LISP Console window, enter the following two lines of code in the order shown. After the first line, you should see the error object returned as `<%catch-all-apply-error%>`. After the second line, you should see the string value message returned from the Error object as "divide by zero".

```
_$ (setq catchit (vl-catch-all-apply '/ '(50 0)))
```

```
#<%catch-all-apply-error%>
```

```
_$ (vl-catch-all-error-message catchit)
```

```
"divide by zero"
```

A good place to use (vl-catch-all-apply) is when attempting to fetch an object from a collection using the (vla-item) method. For example, you might expect the following code fragment to return nil

if no matching object is found. However, this fragment would throw an ActiveX error instead.

```
(setq layers
  (vla-get-layers
    (vla-get-activedocument
      (vlax-get-acad-object))))
(setq mylayer (vla-item layers "Doors"))
```

The proper way to do this would be to use `(vl-catch-all-apply)` to trap the error when a request fails. This might look something like the following:

```
(if
  (not
    (vl-catch-all-error-p
      (setq mylayer
        (vl-catch-all-apply
          'vla-item (list layers "Doors"))
        )
      )
  )
  (princ "\nLayer was found in layers collection!")
  (princ "\nLayer does not exist."))
)
```

TIP: Here is an example function that I will use throughout this book in place of `(vla-item)`. It returns an object or nil if no item is found in the provided collection. I highly recommend using a function like this in place of `(vla-item)` to avoid errors in your code.

```
(defun get-item (collection item / result)
  (if
    (not
      (vl-catch-all-error-p
        (setq result
          (vl-catch-all-apply
            'vla-item (list collection item))
          )
        )
    )
```

```

    )
  )
  result
)
)

```

(vl-catch-all-error-p *object*)

Returns T or nil depending upon whether *object* is an Error object or not.

Arguments:

Object – Any vla-object

Example:

```
(vl-catch-all-error-p (vl-catch-all-apply '/ '(50 0)))
```

This will returns **T** (true) because (/ 50 0) is a classic "divide by zero" failure.

(vl-catch-all-error-message *object*)

Returns the message description from an Error object. If *object* is not an Error object, this function returns *nil*.

Arguments:

Object – Any vla-object

Example:

```
(vl-catch-all-error-message (vl-catch-all-apply '/ '(50 0)))
```

This will display an error message "divide by zero".

(vl-exit-with-error *message*)

Aborts the VLX execution and returns a string message result.

Arguments:

Message – A string containing an error message result

The `(vl-exit-with-error)` function aborts execution immediately and returns a string value as the result. This is useful for passing up a custom error message that may provide added clarity to users. This works very much like the AutoLISP `(exit)` function except that you can pass a return value back as a result of the error. Figure 4-8 shows how you can pass `(vl-catch-all-error-message)` as the return message value.

(vl-exit-with-value *value*)

Aborts the VLX execution and returns a numeric or symbolic result value.

Arguments:

Value – Any value or symbol

Example:

```
(defun fubar (somevalue / *error*)
  (defun *error* (s)
    (vl-exit-with-value s)
  )
  (/ somevalue 0); force divide by zero error
)

(defun errortest ( / try)
  (cond
    ( (vl-catch-all-error-p
      (setq try (vl-catch-all-apply 'fubar (list 12)))
    )
    (princ
      (strcat "\nError: "
        (vl-catch-all-error-message try))
    )
  )
)
```

If you load the above example and type in (errortest), the result will be "Error: divide by zero". The (vl-exit-with-value) function works the same way as (vl-exit-with-error) except that it returns a numeric value as the result. This can be helpful if you want to handle errors using a numeric value parameter, such as passing up the return value of an ActiveX Error number.

As you can see from these functions and the figures shown, you can perform very detailed error trapping and handling using Visual LISP to help you produce better quality code and software products. This practice is not unique to Visual LISP by any means. It is the same in general as what is done with other languages such as C/C++, Visual Basic, VBA, Java and so forth. However, the error trapping and handling features provided by Visual LISP are by no means as flexible and robust as those provided by .NET and C++ (e.g. Try/Catch/Fail or Finally). Error trapping makes sense but you have to make the effort to put it to efficient use to get the benefits it offers.

Chapter 5 – Working with Projects and Multiple Files

Projects are collections of related LSP files that you associate together for a common purpose. Examples can be multiple files that comprise a single feature or group of features that you want to always be working together in some respect. This is also called a *Work Space* in other products, but the overall intent is the same: Collect related code files together with a name to make it easier to open and work on them together.

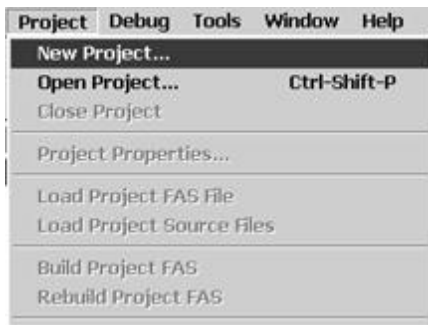


Figure 5-1 - The Project pulldown menu and the Project Window

While Projects are great, VLISP has certain limitations that make them less than ideal compared to other code development tools on the market such as Microsoft Visual Studio. Among these limitations are that you cannot include DCL or other types of code files, and you can only compile the project to FAS output, not to VLX. Ideally, a VLISP project should allow for all file types that can be included in a VLX application (DVB, txt, LSP, DCL).

Nonetheless, Projects are very useful for nothing less than to keep related LSP files together and be able to quickly open any or all of them in the editor. See Figures 5-2 and 5-3 for an example of how a project configuration is managed.

Once you create and open a project, it will display a dockable listbox in the VLIDE window that displays all the member .LSP files. To open a particular file, simply double-click on it.

You can also open multiple files at once by right-clicking on the list and picking Multiple Selection from the pop-up menu (refer to the image at right).

You can add and remove files from a project at any time by using the Add File or Remove File options from the pop-up menu. You can also add or remove files from the Project Properties form (see Figure 5-2).

TIP: The order in which you add files or sort them in the project files list is the order they will be compiled in when using a project files list as the input for the Make Application Wizard (discussed in Chapter 13). You can go back and modify the order of files after they have been added into a given project.

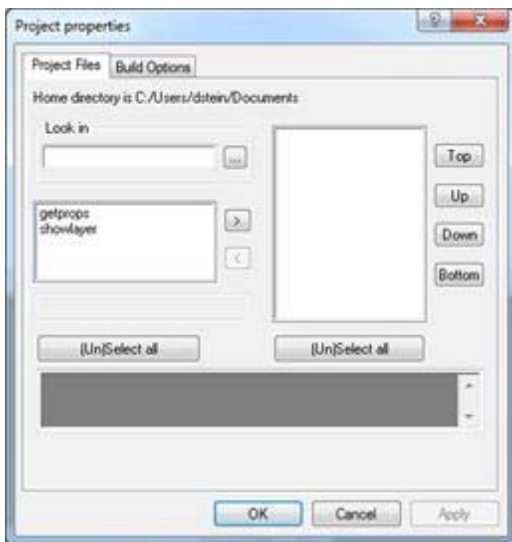


Figure 5-2 – The Project Properties form, Files tab

Figure 5-2 shows the main properties form for making and modifying a Visual LISP project. Note that there are two tabs "Project Files" and "Build Options". Figure 5-3 shows the "Build Options" tab panel. The Project Files panel is where you select the .LSP files to be part of your project.

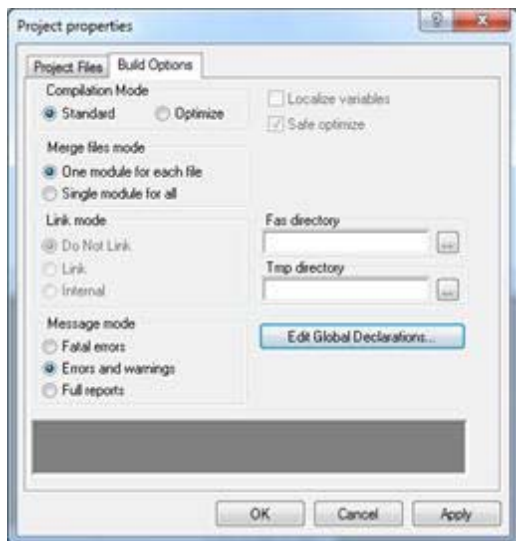


Figure 5-3 – Project Properties / Build Options

The options shown in Figure 5-3 will be explained in more detail in Chapter 13 ("Making Applications"). All of these options pertain to the making of FAS output files, .FAS files are compiled LISP code that can be created from one or more LSP files as a single .FAS file, which can be compiled into a VLX application file with other FAS files.

Chapter 6 – Working with Variants and Safearrays

While the topic of Variant and Safearray data types was discussed earlier in this book, they are significant enough within the ActiveX world of Visual LISP to warrant an entire chapter devoted solely to them. We will begin by briefly reviewing what they are and then begin exploring how to work with them using Visual LISP functions.

As we mentioned before, a Variant is a data type that is designed to be a generic catch-all container for any other type of data. They consume the most memory and processing resources of all the data types because they are the largest in terms of resource requirements.

Languages such as C/C++, Visual Basic and Delphi provide declaration statements to notify the compiler in advance as to what data types each variable will contain. This not only guarantees leaner resource requirements but also allows for error checking during compilation that heads off runtime problems.

Visual LISP Variant Functions

(vlax-make-variant *[value]* *[type]*)

Creates a variant object using the given value or symbol evaluation

Arguments:

Value – The value to be assigned to the variant. If value is omitted, an empty variant of type vlax-vbEmpty is created.

Type – The data type of the variant. If type is omitted, the LISP data type is cast to the closest ActiveX data type (see table below).

Examples:

```
(vlax-make-variant) or (vlax-make-variant nil)
```

Creates an *uninitialized* variant of type (vlax-vbEmpty).

```
(vlax-make-variant 10 :vlax-vbInteger)
```

Creates a variant of type Integer (vlax-vbInteger) with value of 10.

```
(vlax-make-variant "vlisp example")
```

Creates a variant of type String (vlax-vbString) with value of "vlisp example".

```
(setq dblarray (vlax-make-safearray vlax-vbDouble '(0 . 3)))
```

```
(vlax-make-variant dblarray :vlax-vbArray)
```

Creates a variant containing a safearray of double values.

TIP: The Decimal and Short ActiveX data types are not supported in Visual LISP. You can however, specify their types using the (vlax-variant-type) when reading in values from external sources. To send data to external sources in these types, you may have to use the numeric representation of (vlax-vbDecimal) and (vlax-vbShort) as they are not provided as enumerations within Visual LISP. For example, a Decimal data type is enumeration value 14.

Variant Data Types

What if you don't specify the data type for the Variant constructor? Visual LISP will attempt to convert it to an appropriate variant data type using a default mapping. Table 6-1 below shows the default mapping of data types from LISP to Variant.

LISP Data Type	Variant Default Data Type Assignment
nil	vlax-vbEmpty
:vlax-null	vlax-vbNull
INT (integer)	vlax-vbLong
REAL (float)	vlax-vbDouble
STR (string)	vlax-vbString
VLA-OBJECT	vlax-vbObject
:vlax-true or :vlax-false	vlax-vbBoolean
VARIANT	Same as the type of initial value
SafeArray	vlax-vbArray
N/A	vlax-vbShort
N/A	vlax-vbDecimal
N/A	vlax-vbDate

Table 6-1 – Visual LISP Default LISP->Variant Data Mappings

(vlax-variant-type variant)

Returns the data type of a variant. If the *symbol* is not a variant, an error is generated. The return value is an enumeration of the data type (see Appendix A for Data Type enumerations).

Arguments:

Symbol – A symbol containing a variant value.

Examples:

```
(setq vartest (vlax-make-Variant 6 vlax-vbInteger))  
(vlax-variant-type vartest) returns 2 (integer type)  
(setq vartest (vlax-make-Variant "dog" vlax-vbString))  
(vlax-variant-type vartest) returns 8 (string type)  
(setq vartest 123)  
(vlax-variant-type vartest) returns...  
; *** ERROR: bad argument type: variantp 123
```

A variant type value greater than 8192 indicates that the variant contains some form of safearray. To determine the data type of the safearray, subtract 8192 from the return value. For example, if the return value is 8197, the safearray data type is 5 (8197 – 8192), which is a vlax-vbDouble data type.

(vlax-variant-value *symbol*)

Returns the value contained in a variant symbol. If *symbol* does not contain a variant data type, an error is generated. Otherwise, the data type is returned as an enumeration (integer) value (see Appendix A for Data Type enumerations).

Arguments:

Symbol – A symbol containing a variant value.

Examples:

```
(setq vartest (vlax-make-Variant "testvalue" vlax-vbString))  
(vlax-variant-value vartest)
```

Returns value "testvalue" as a string result.

```
(setq sa (vlax-make-Safearray vlax-vbDouble '(0 . 2)))  
(setq vartest (vlax-make-Variant sa vlax-vbDouble))  
(vlax-variant-value vartest)
```

Returns a value of #<safearray...> which is a vla-object type.

```
(vlax-safearray->list (vlax-variant-value vartest))
```

Returns value (0.0 0.0 0.0) a list result.

(vlax-variant-change-type *symbol type*)

Changes the data type assignment of a variant.

Arguments:

Symbol – A variant value

Type – Data type number or enumeration to convert to

Examples:

```
(setq vartest (vlax-make-variant 5 vlax-vbInteger))  
(setq vartest (vlax-variant-change-type vartest vlax-vbString))
```

Converts vartest to variant of type String (vlax-vbString) which would result in a value being returned from (vlax-variant-value) as "5".

Visual LISP SafeArray Functions

(vlax-make-safearray *type dim1 [dim2] ...*)

Creates a safearray of data type *type* of dimension bounds *dim1*, etc. where additional dimensions can be specified. If the operation fails for any reason, expression returns *nil*.

Arguments:

Type – Data type (integer or enumeration)

Dim1 – Dimension of array (one dimension array)

Dim2 – (optional) Dimension of second array (two dimension array) etc.

Examples:

```
(setq sa (vlax-make-Safearray vlax-vbDouble '(0 . 2)))
```

Creates a single-dimension array of doubles, capable of storing three distinct elements (0, 1, 2).

```
(setq sa (vlax-make-Safearray vlax-vbString '(0 . 1) '(1 . 3)))
```

Creates a two-dimensional array of strings, the first dimension contains two elements beginning at index 0. The second dimension contains three elements and begins at index 1.

TIP: To populate a SafeArray you can either use `(vlax-safearray-fill)` or `(vlax-safearray-put-element)` depending upon whether you need to assign elements one at a time or all at once.

(vlax-safearray->list *symbol*)

If *symbol* contains a safearray, the elements are returned in a LISP LIST data type. If *symbol* does not contain a safearray, an error is generated. You should wrap calls to this function inside of an error catch to ensure proper error handling.

Arguments:

Symbol – A symbol containing a safearray

(vlax-safearray-type *symbol*)

If *symbol* contains a safearray, the data type of the elements is returned as an enumerated result (integer value). This can be matched either by the integer or enumeration result (see Appendix A for Data Type enumerations). If *symbol* does not contain a safearray, an error is generated.

Arguments:

Symbol – A symbol containing a safearray

Examples:

```
(setq sa (vlax-make-Safearray vlax-vbDouble '(0 . 3)))
```

```
(vlax-safearray-type sa)
```

Returns 5 (a double) which equates to vlax-vbDouble

(vlax-safearray-fill *safearray* 'element-values)

Assigns values to multiple elements in a safearray. If the supplied argument is not an array, an ActiveX

error is returned. You should wrap calls to this function inside of an error catch to ensure proper error handling.

Arguments:

Safearray - An object of type safearray.

Element-values - A list of values to be stored in the array. You can specify as many values as there are elements in the array. If you specify fewer values than there are elements, the remaining elements retain their current value or are left empty. For multi-dimension arrays, *element-values* must be a list of lists, with each list corresponding to a dimension of the array.

Create a single-dimension array of *double* values:

```
_$ (setq myarray (vlax-make-Safearray vlax-vbDouble '(0 . 2)))  
#<safearray...>
```

Use vlax-safearray-fill to populate the array elements with values:

```
_$ (vlax-safearray-fill myarray '(1 2 3))  
#<safearray...>
```

List the contents of the array to verify element values:

```
_$ (vlax-safearray->list myarray)  
(1.0 2.0 3.0)
```

(vlax-safearray-get-element *safearray element [element...]*)

Returns the value of specified elements within a safearray, where element values are integers denoting the index locations to fetch within the array. If the safearray argument is not a safearray object, an ActiveX error is returned. You should wrap calls to this function inside of an error catch to ensure proper error handling.

Arguments:

Safearray - An object of type Safearray

Element - Integer of index location to fetch

```
_$_ (setq sa (vlax-make-Safearray vlax-vbString '(1 . 2) '(1 . 2) ))
```

```
#<safearray...>
```

Use `vlax-safearray-put-element` to populate the array:

```
_$_ (vlax-safearray-put-element sa 1 1 "A")
```

```
"a"
```

```
_$_ (vlax-safearray-put-element sa 1 2 "B")
```

```
"b"
```

```
_$_ (vlax-safearray-put-element sa 2 1 "C")
```

```
"c"
```

```
_$_ (vlax-safearray-put-element sa 2 2 "D")
```

```
"d"
```

Use `vlax-safearray-get-element` to retrieve the second element in the first dimension of the array:

```
_$_ (vlax-safearray-get-element sa 1 1)
```

```
"A"
```

```
_$_ (vlax-safearray-get-element a 2 2)
```

```
"D"
```

(vlax-safearray-put-element *safearray element [element...] value*)

Assigns a new value to a single element in a safearray. If the safearray argument is not a Safearray object, an ActiveX error is returned. If the element-value supplied is not capable of casting into the expected array data type, an ActiveX error is returned. You should wrap calls to this function inside of an error catch to ensure proper error handling.

Arguments:

Safearray - An object of type Safearray

Element - A set of index values pointing to the element you are assigning a value to. For a single-dimension array, specify one index value; for a two-dimension array, specify two index values, and so on.

Value - A value to assign to each element. To assign different values to individual elements in the array, make separate calls with unique values to correspond to the appropriate element locations.

```
_$_ (setq sa (vlax-make-Safearray vlax-vbString '(1 . 2) '(1 . 2) ))  
#<safearray...>
```

Use `vlax-safearray-put-element` to populate the array:

```
_$_ (vlax-safearray-put-element sa 1 1 "A")  
"A"  
_$_ (vlax-safearray-put-element sa 1 2 "B")  
"B"  
_$_ (vlax-safearray-put-element sa 2 1 "C")  
"C"  
_$_ (vlax-safearray-put-element sa 2 2 "D")  
"D"
```

You can also populate array values using the `vlax-safearray-fill` function. The following function call accomplishes the same task as three `vlax-safearray-put-element` calls:

```
(vlax-safearray-fill sa '(("A" "B") ("C" "D")))
```

(vlax-safearray-get-dim *safearray*)

Returns the dimension (number of array dimensions) in a given `safearray`. If the supplied argument is not an array, an ActiveX error is returned. You should wrap calls to this function inside of an error catch to ensure proper error handling.

Arguments:

Safearray - An object of type `Safearray`

```
_$_ (setq myarray (vlax-make-Safearray vlax-vbInteger '(2 . 5)))  
#<safearray...>
```

```
_$_ (vlax-safearray-get-dim myarray)  
2
```

(vlax-safearray-get-l-bound *safearray dim*)

Returns the lower boundary of the specified array dimension (an integer value). If the supplied

argument is not an array, an ActiveX error is returned. You should wrap calls to this function inside of an error catch to ensure proper error handling.

Arguments:

Safearray - An object of type Safearray

Dim - The integer location of the dimension within the array, where the first dimension is 1.

The following examples evaluate a safearray defined as follows:

```
(vlax-make-Safearray vlax-vbString '(1 . 2) '(0 . 1) )
```

Get the starting index value of the array's first dimension:

```
_$ (vlax-safearray-get-l-bound tmatrix 1)
```

```
1
```

(vlax-safearray-get-u-bound *safearray dim*)

Returns the upper boundary of the specified array dimension (an integer value). If the supplied argument is not an array, an ActiveX error is returned. You should wrap calls to this function inside of an error catch to ensure proper error handling.

Arguments:

Safearray - An object of type Safearray

Dim - The integer location of the dimension within the array, where the first dimension is 1.

```
(setq sa (vlax-make-Safearray vlax-vbString '(1 . 2) '(0 . 1) ))
```

```
_$ (vlax-safearray-get-u-bound sa 1)
```

```
2
```

The first dimension ends with index 2. Get the end index value of the second dimension of the array, which starts at 1:

```
_$ (vlax-safearray-get-u-bound sa 2)
```

```
1
```

You might also want to define your own shorthand functions such as Lbound and Ubound, which are commonly used in VB and VBA.

Chapter 7 –Object Manipulation Functions

Visual LISP provides a set of functions that allow you to create, manipulate and close ActiveX objects. This is normally with respect to external application session objects, but it can also apply to any external process object, such as DLL or OCX interfaces.

(vlax-get-object *program-id*)

Attempts to connect to an existing object (process). Same as the Visual Basic/VBA/VBscript GetObject (*program-id*) function.

Arguments:

Program-ID - A string that names the application object class identifier. For example "Word.Application.14" or "Excel.Application.14".

Example:

```
(setq xlappp (vlax-get-object "Excel.Application.14"))
```

Returns a vla-object to the external Excel application session if successful, otherwise it returns *nil*.

(vlax-create-object *program-id*)

Attempts to create a new object session (process). Same as the Visual Basic function CreateObject (*program-id*).

Arguments:

Program-ID - A string that names the application object class identifier. For example "Word.Application.14" or "Excel.Application.14".

Example:

```
(setq xlappp (vlax-create-object "Excel.Application.14"))
```

Returns a vla-object to the new external Excel application session if successful, otherwise it returns *nil*.

(vlax-get-or-create-object *program-id*)

Attempts to first connect to an existing object session, and then, if none are found, it attempts to create a new object session. This function has no equivalent in Visual Basic; it is unique to Visual LISP.

Arguments:

Program-ID - A string that names the application object class identifier. For example "Word.Application.11" or "Excel.Application.11".

Example:

```
(setq xlapp (vlax-get-or-create-object "Excel.Application.11"))
```

Returns a vla-object to the external Excel application session if successful, otherwise it returns nil. To mimick this functionality in VBScript it might look something like the following:

```
Dim xlapp
On Error Resume Next
Set xlapp = GetObject("Excel.Application.14")
If err.Number <> 0 Then
    err.Clear
    Set xlapp = CreateObject("Excel.Application.14")
    If err.Number <> 0 Then
        wscript.echo "error: unable to instantiate Excel interface"
    End If
End If
```

(vlax-write-enabled-p *object*)

Returns T if *object* can be modified, otherwise it returns *nil*.

Note: Be careful about this function. It may often return False when the object is in fact open for modification.

Arguments:

Object - Any vla-object

(vlax-object-erased-p *object*)

Returns T if *object* was erased from the drawing, otherwise returns *nil*.

Arguments:

Object - Any vla-object representing an Entity object type.

(vlax-release-object *object*)

Releases object from memory, but does not deallocate memory. When releasing an object that points to an external application session it is strongly suggested that (gc) be forced to release the external process from operating system resources.

Arguments:

Object - Any vla-object.

WARNING: While object symbols may be localized, completion of a function does not necessarily release the objects' resources. It is advised that you still use this function to ensure the object is released properly when it is no longer needed. However, be aware that even releasing an object derived from an external application may not fully release it from memory or from the process stack of the operating system. It is best to follow the completion of your code with releasing of all unused objects, and then you should call the (gc) function in order to "force" a garbage collection of the memory heap.

Chapter 8 –File and Directory Functions

Some of the most useful functions provided by Visual LISP are the file and directory functions. These are a collection of functions that enable you to access, and modify file properties as well as list files and folders within specified folders. One example of putting these to use, is within the context of a dialog box listbox.

Maybe you'd like to show a list of drawing files in a listbox but not show their extensions (possibly to keep the names shorter). This can be done by combining a directory listing and the `vl-filename-base` function in unison as follows:

```
(mapcar 'vl-filename-base (vl-directory-files pathname "*.dwg"))
```

This will return a list of names such as ("drawing1" "drawing2" ...). Be careful with this example in that it provides no error checking. If the `(vl-directory-files)` function returns `nil`, the rest of the expression would crash with an error. This example is only shown to demonstrate how these functions can be combined and used to facilitate file and directory information usage.

(vl-file-size *filename*)

Returns the byte size of *filename* in integer form. If *filename* is not found, returns *nil*.

Arguments:

Filename - String name of file to query.

Example:

```
(vl-file-size "c:\\myfile1.txt"); returns 125523 (roughly 124 Kb)
```

(vl-file-copy *source-filename target-filename [append]*)

Copies file from source location *source-filename* to destination *target-filename*. If *append* is non-`nil` and destination file exists, the source file is appended to the existing destination file. If destination file exists and *append* is `nil`, the file will not be copied and the return value is `nil`. If successful, an integer value is returned.

Arguments:

Source-filename - Name of file to be copied. If file is not in the default search path, then the filename must include the full path location.

Target-filename - Name of destination to copy source file to. If destination path is not specified, the default working directory location is used.

Append - (Optional) if non-nil, indicates source file is to be appended onto destination file if destination file exists.

Examples:

```
(vl-file-copy "c:\\myfile1.txt" "c:\\mycopy.txt")
```

```
(vl-file-copy "c:\\myfile2.txt" "c:\\mycopy.txt" T); appends target file
```

(vl-file-delete *filename*)

Deletes filename. Returns T if successful, otherwise returns *nil*.

Arguments:

Filename - String name of file to delete.

(vl-file-rename *old-name new-name*)

Renames existing file from *old-name* to *new-name*. Returns T if successful, otherwise returns *nil*.

Arguments:

Old-Name - String name of existing file.

New-Name - String name to rename file when completed.

(vl-file-directory-p *filename*)

Returns T if *filename* represents a directory folder name. Returns *nil* if *filename* is actually a file or does not exist at all.

(vl-file-systime *filename*)

Returns list of date and time values for last modification of filename. Return list is in the form of (year month day-of-week day-of-month hours minutes seconds)

(vl-filename-base *filename*)

Returns the base filename without its path or extension.

Arguments:

Filename - String naming the file, with or without the path or extension.

Examples:

```
(vl-filename-base "c:\\myfiles\\drawing1.dwg")
```

Returns "drawing1"

```
(vl-filename-base "drawing1.dwg")
```

Returns "drawing1"

(vl-filename-directory *filename*)

Returns the directory or path prefix value from the specified *filename* string.

Arguments:

Filename - String naming the file including the pathname.

Examples:

```
(vl-filename-directory "c:\\dwgfiles\\working\\drawing1.dwg")
```

Returns: "c:\\dwgfiles\\working"

(vl-filename-extension *filename*)

Returns the extension of a given filename string.

Arguments:

Filename - Name of file (string)

Examples:


```
(vl-filename-extension "c:\\myfiles\\drawing1.dwg")
```

Returns "dwg"

(vl-filename-mktemp [*pattern directory extension*])

Creates a unique file name to be used for a temporary file. Returns a string file name, in the format: *directory\\base<XXX><.extension>* where *base* is up to 5 characters, taken from *pattern*, and *XXX* is a 3 character unique combination.

All file names generated by vl-filename-mktemp during a VLISP session are deleted when you exit VLISP.

Arguments:

Pattern - A string containing a file name pattern; if nil or absent, vl-filename-mktemp uses "\$VL~~".

Directory - A string naming the directory for temporary files; if nil or absent, vl-filename-mktemp chooses a directory in the following order:

- The directory specified in *pattern*, if any.
- The directory specified in the TMP environment variable.
- The directory specified in the TEMP environment variable.
- The current directory.

Extension - A string naming the extension to be assigned to the file; if nil or absent, vl-filename-mktemp uses the extension part of *pattern* (which may be an empty string).

Examples:

```
(vl-filename-mktemp)
```

```
"C:\\TMP\\$VL~~004"
```

```
(vl-filename-mktemp "myapp.del")
```

```
"C:\\TMP\\MYAPP005.DEL"
```

```
(vl-filename-mktemp "c:\\acad2010\\myapp.del")
```

```
"C:\\\\ACAD2010\\\\MYAPP006.DEL"
```

```
(vl-filename-mktemp "c:\\\\acad2010\\\\myapp.del")
```

```
"C:\\\\ACAD2010\\\\MYAPP007.DEL"
```

```
(vl-filename-mktemp "myapp" "c:\\\\acad2010")
```

```
"C:\\\\ACAD2010\\\\MYAPP008"
```

```
(vl-filename-mktemp "myapp" "c:\\\\acad2010" ".del")
```

```
"C:\\\\ACAD2010\\\\MYAPP00A.DEL"
```

(vl-directory-files *path pattern [mode]*)

Returns a list of files or sub-folders depending upon mode.

Arguments:

Path - String name of path to query.

Pattern - String denoting files to query, may contain wildcards. If not specified or nil, assumes "*.*".

Mode - (Optional) Integer. One of the following...

-1 = List directory names only

0 = List files and directories (default if not specified)

1 = List files only.

Examples:

```
Command: (vl-directory-files "c:\\\\dwgfiles\\\\Working" "*.dwg")  
("drawing1.dwg" "drawing2.dwg" . . .)
```

```
Command: (vl-directory-files "c:\\\\dwgfiles" nil -1)  
(". " ".." "Finished" "Working")
```

```
Command: (vl-directory-files "c:\\\\dwgfiles" nil 1)  
nil
```

Chapter 9 –Iteration and String Functions

AutoLISP provides many powerful mapping and iteration functions such as `(while)` `(foreach)` `(mapcar)` and `(apply)`. Visual LISP adds a few more that are more suited to working with ActiveX collection objects. These include `(vlax-for)`, `(vl-every)` and `(vlax-map-collection)` to name a few.

(vlax-map-collection *object function*)

Applies function over collection object members (objects). If object is not a collection, an error is generated.

Arguments:

Object - A vla-object representing a collection

Function - A symbol or lambda expression to be applied to object

Examples:

```
(setq docs (vla-get-Documents (vlax-get-Acad-object)))  
(vlax-map-collection docs 'vlax-dump-object)
```

This will repeat the full property listing for each document currently opened...

```
; IAcadDocument: An AutoCAD drawing  
; Property values:  
;   Active (RO) = -1  
;   ActiveDimStyle = #<VLA-OBJECT IAcadDimStyle 046bb644>  
;   ActiveLayer = #<VLA-OBJECT IAcadLayer 046bbd84>  
;   ActiveLayout = #<VLA-OBJECT IAcadLayout 046b8a64>  
;   ActiveLinetype = #<VLA-OBJECT IAcadLineType 046b89b4>  
... cont'd...
```

(vlax-for *symbol collection [expression1 [expression2]]...*)

Iterates member objects of collection and performs expressions on each member object. If second argument is not a collection object, an error is generated. Reference to *symbol* is localized and

temporary, just as with (foreach).

Arguments:

Symbol - a symbol to be assigned to each vla-object in a collection.

Collection - a vla-object representing a collection

Expressions - one or more expressions to be evaluated (optional)

Examples:

```
(setq acadapp (vlax-get-Acad-object))  
(setq layers (vla-get-Layers (vla-get-ActiveDocument acadapp)))  
(vlax-for eachLayer layers  
  (princ (vla-get-Name eachLayer))  
  (terpri)  
)
```

This will list the names of all layers in the active drawing at the command prompt. Tip: Avoid defining a symbol named "acad" since it can often generate a runtime error.

(vl-position *item list*)

Returns the nth position of *item* within *list* if found. If *item* is not found in *list*, returns *nil*. The position index of the first member is zero (0).

Arguments:

Item - Any symbol or value.

List - A list of values or symbols.

Example:

```
(setq mylist `("A" "B" "C"))  
(vl-position "B" mylist) returns 1  
(vl-position "b" mylist) returns nil.
```

(vl-every *predicate-function list [list]...*)

The `vl-every` function passes the first element of each supplied list as an argument to the test function, followed by the next element from each list, and so on. Evaluation stops as soon as one of the lists runs out.

Arguments:

Predicate-function - The test function. This can be any function that accepts as many arguments as there are lists provided with `vl-every`, and returns T on any user-specified condition. Returns T, if *predicate-function* returns a *non-nil* value for every element combination, otherwise it returns *nil*.

The *predicate-function* value can take one of the following forms:

- A symbol (function name)
- (function (lambda (*A1 A2*) ...))

List(s) - The list to be tested.

Examples:

Check for files larger than 1024 bytes in given folder:

```
(vl-every
  (function
    (lambda (filename)
      (> (vl-file-size filename) 1024)
    )
  )
  (vl-directory-files nil nil 1)
)
```

T

Comparing two lists...

```
(vl-every '= '(1 2) '(1 3))
```

Returns nil

```
(vl-every '= '(1 2) '(1 2 3))
```

Returns T

The first expression returned *nil* because `vl-every` compared the second element in each list and they

were not numerically equal. The second expression returned T because `vl-every` stopped comparing elements after it had processed all the elements in the shorter list (1 2), at which point the lists were numerically equal. If the end of a list is reached, `vl-every` returns a non-*nil* value.

```
_$ (setq list1 (list 1 2 3 4))  
(1 2 3 4)  
_$ (setq list2 nil)  
nil  
_$ (vl-every '= list2 list1)  
T
```

The return value is T because `vl-every` responds to the *nil* list as if it has reached the end of the list (even though the predicate hasn't yet been applied to any elements). And since the end of a list has been reached, `vl-every` returns a non-*nil* value.

(vl-remove element list)

Returns a new list where every instance of [element] is removed from [list]

Arguments:

Element - Symbol or value to be removed from [list]

List - The list upon which to apply the removal operation

Examples:

```
(vl-remove 3 (list 1 23 45 62 3 2 3 4 2 3))
```

Returns: (1 23 45 62 2 4 2)

(vl-string-search pattern string [*start-position*])

Searches a string for a matching pattern and returns the integer value for the starting position where it resides.

Arguments:

Pattern - The string pattern to use for searching within the String argument

String - The string which is to be searched to find instances of [Pattern]

Start-Position - (optional) Location in [String] where search is to begin. The default is the beginning of the string.

Examples:

```
(setq acadapp (vlax-get-Acad-object))  
(setq layers (vla-get-Layers (vla-get-ActiveDocument acadapp)))  
  
(vlax-for eachLayer layers  
  (princ (vla-get-Name eachLayer))  
  (terpri)  
)
```

(vl-string->list *string*)

Parses or tokenizes a string into a LIST of ASCII character codes for each character in the string.

Arguments:

String - The string to parse or tokenize

Examples:

```
(vl-string->list "ABCDEF")
```

Returns: (65 66 67 68 69 70)

(vl-string-elt *string position*)

Returns the ASCII code for the character at a specific position within a string value

Arguments:

String - The string to search

Position - The integer value for the position to evaluate

Example:

```
(vl-string-elt "ABCDEF" 3)
```

Returns: 68

(vl-get-resource *filename*)

Returns the text content within a .TXT file which has been packaged inside of a .VLX project. It is intended to be called from within the VLX context, which is why you don't name the VLX itself, but rather the text file within it.

Arguments:

Filename - Name of embedded TXT file without the extension

Example:

```
(princ (vl-get-resource "license"))
```

(vl-string-trim *chars string*)

Returns a string after removing beginning (left) and trailing (right) chars.

Argument:

Chars - The characters to be removed

String - The string to be trimmed

Example:

```
(vl-string-trim " " "   ABC   ")
```

Returns: "ABC"

```
(vl-string-trim "A3" "ABACAB3")
```

Returns: "BACAB"

(vl-string-left-trim *chars string*)

Returns a string after removing only the beginning (left) chars

Arguments:

Chars - The characters to be removed

String - The string to be trimmed

Examples:

```
(vl-string-left-trim " " " ABC ")
```

Returns: "ABC "

```
(vl-string-left-trim "A3" "ABACAB3")
```

Returns: "BACAB3"

(vl-string-right-trim *chars string*)

Returns a string after removing only the trailing (right) chars

Arguments:

Chars - The characters to be removed

String - The string to be trimmed

Examples:

```
(vl-string-right-trim " " " ABC ")
```

Returns: " ABC"

```
(vl-string-right-trim "A3" "ABACAB3")
```

Returns: "ABACAB"

(vl-string-mismatch *string1 string2 [position1 position2 ignore-case]*)

Returns the length of the longest common prefix between two specified strings, starting at specified positions

Arguments:

String1 - The first comparison string

String2 - The second comparison string

Position1 - (optional) Location in [String1] where comparison is to begin. The default is the beginning of [String1]

Position2 - (optional) Location in [String2] where comparison is to begin. The default is the beginning of [String2]

Ignore-case - (optional) Whether to ignore case. By default, case is considered.

Examples:

```
(vl-string-mismatch "The dog" "The cat" 1 1 T)
```

Returns: 3

```
(vl-string-mismatch "He said that was good" "She said that was bad" 4 5)
```

Returns: 13

(vl-string-position *character-code string start-position [from-end]*)

Returns index location of matching string using a specified character ASCII code.

Arguments:

Character-Code - An ASCII code number

String - The String to search

Start-Position - (optional) Location in [String] where search is to begin. The default is the beginning of [String].

From-End - (optional) T = Start in reverse from end of string, nil (default) is start from beginning (left-most) end

Examples:

```
(vl-position (ascii "A") "HEY MAN")
```

Returns: 5

```
(vl-position 65 "HEY MAN")
```

Returns: 5

```
(vl-string-position (ascii "Y") "HEY MAN" nil)
```

Returns: 2

(vl-string-subst *new-pattern old-pattern string [start]*)

Substitutes one pattern for another pattern within a string. Much like the (subst) AutoLISP command.

Arguments:

New-Pattern - The new string value to replace the [old-pattern] string value

Old-Pattern - The existing pattern to be replaced in [string]

String - The string in which to perform the substitution

Start - (optional) starting index in [string] to search for [old-pattern]

Examples:

```
(vl-string-subst "Help" "Love" "Visual LISP gets no Love")
```

Returns: "Visual LISP gets no Help"

(vl-string-translate *source-set destination-set string*)

Substitutes characters in a string with a specified set of characters and returns the new string value

Arguments:

Source-Set - The pattern of characters to be matched

Destination-Set - The pattern of characters to be used to replace those in the [source-set]

String - The string to be manipulated

Examples:

```
(vl-string-translate "5" "6" "123456 123456")
```

Returns: "123466 123466"

(ACET-STR-TO-LIST delimiter string)

Parses a string into a list by breaking it at each occurrence of delimiter. While this is technically not a Visual LISP function, it is nonetheless useful and since Express Tools are usually installed it is often available for use.

Arguments:

Delimiter - Character or string value on which to break the string

String - The string to be parsed into a list

Examples:

```
(acet-str-to-list " " "the dog ate")
```

Returns: ("the" "dog" "ate")

Chapter 10 –Working with Namespaces

Developing Visual LISP VLX applications can include the use of Separate Namespaces in order to provide added performance controls and better security. However, there are some added costs in terms of coding changes that must be used to avoid problems and provide proper results. This includes importing and exporting functions and symbols, as well as passing values in and out of the local namespace.

Because a separate namespace VLX application can be isolated, it can also be queried and unloaded if desired, unlike normal LISP functions which are loaded into the document namespace and are not identifiable or capable of being unloaded by name. This very much like ObjectARX applications, and it provides added capabilities to the developer that were not available to LISP until Visual LISP came along.

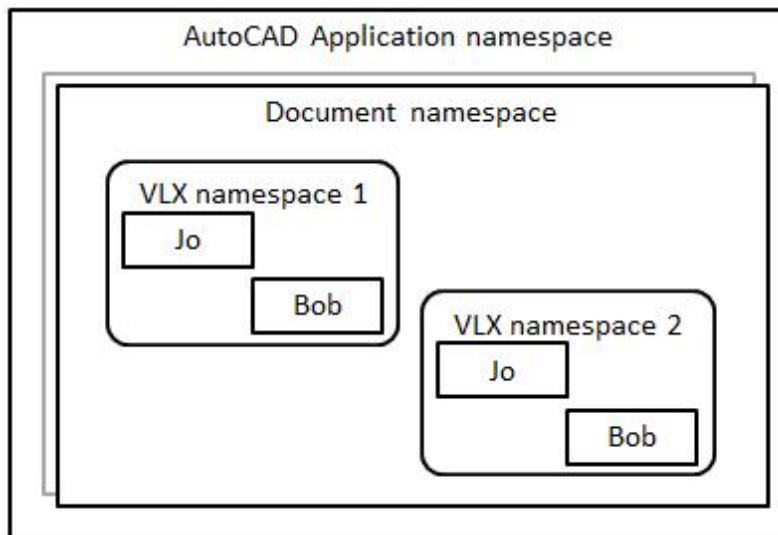


Figure 10-1 – Namespace relationships

In the world of ActiveX or COM (Component Object Model) development, every application is normally run in its own namespace within Windows. This is a common part of how multitasking is enabled. Other processes that are started by a given application may or may not run within the application's namespace. They may in fact run in their own isolated namespaces. The advantages are many, but there are tradeoffs as well.

Referring to Figure 10-1 we can use some people examples to describe how namespaces work and how processes within them behave. The two VLX applications running inside of the *Document* namespace

are each running in their own separate namespaces. This is a little misleading, as they are not really running within the *Document* namespace, but are actually running within the *AcadApplication* namespace. Because they were loaded into the *Document* namespace however, they are referenced only within that *Document* namespace. The third VLX is not a separate-namespace application and is running entirely within the *Document* namespace as would any traditional AutoLISP application.

Namespace Scoping

Note in this example, that there are three objects (function definitions) named Bob. While each is loaded into the same Document namespace, they cannot see or affect each other. This results in something like having three distinct Bob objects, sort of like Bob Smith, Bob Jones and Bob Doe. Unless you incorporate some specific Visual LISP functions, they cannot communicate with each other or affect each other at all. So any objects that refer to a Bob object in this Document will only get access to the one that is in their same namespace.

The same is true for global symbols, if any are used. If we set a symbol G\$BOB to a value of "A" from the command line in the Document session, any G\$BOB symbols running within VLX1 or VLX2 will not be affected. From a function within VLX1, we could assign G\$BOB to a value of "B". If a function within VLX1 displays (princ G\$BOB) it will return "B", but from the command prompt a request for (princ G\$BOB) will still return "A".

This type of protection results in what are commonly called private functions or private symbols, since they are private to that VLX namespace. Functions and symbols defined in the Document namespace however are not private since they are accessible by all other applications running in that namespace. To put it more accurately, private and public are relative to where the calling process is located (inside or outside of the respective namespace). In other words, object Sue is public to any functions defined and running within the VLX2 namespace, but Sue is considered private in the sense that VLX1 and other namespaces cannot access it by default.

Namespace Functions

When you intend to compile your LSP code into separate namespace VLX modules you need to make use of some special functions to get your code to communicate with other VLX modules that run outside the namespace of your new VLX module. This is true of whether the other VLX modules are within the document namespace or are compiled into their own namespaces respectively. However, it bears noting that for each VLX that is compiled into its own separate namespace, that you need to rely upon

these functions in every file, not just some, at least if you need them to communicate with each other or with the document session namespace.

(vl-list-loaded-vlx)

Returns a list of all loaded separate-namespace VLX applications. If none are loaded this returns *nil*.

(vl-unload-vlx *appname*)

Unloads a separate-namespace VLX application by name (*appname* is a string value). This works like the `(arxunload)` function does with ObjectARX applications.

Arguments:

AppName - A symbol or string representing the string name of the VLX application to be unloaded, for example "myapp.vlx".

(vl-vlx-loaded-p *appname*)

Returns T if the specified separate-namespace VLX application is loaded in the current drawing session. Otherwise, it returns *nil*.

Arguments:

AppName - A symbol or string representing the string name of the VLX application to be unloaded, for example "myapp.vlx"

(vl-doc-export '*function*)

Exposes a function from within a separate namespace VLX application for use by applications or functions outside of its namespace. This must be declared at the top of a given LSP file, above any function definitions, prior to compiling into a separate namespace VLX application. Functions that are not exported from a given VLX are private to that VLX and cannot be accessed from outside of its namespace.

Arguments:

Function - A quoted symbol representing a function name.

(vl-doc-import *filename* ['*function*])

Imports a function from another VLX application for use within the current separate-namespace VLX application. If you don't import such functions that are exposed from other VLX applications, they are not accessible within a VLX application acting as a consumer of that function. If *filename* is specified, but 'function is omitted, all functions from the VLX module (*filename*) are imported.

Arguments:

Filename - A symbol or string representing a VLX filename.

Function - (Optional) A quoted symbol representing a function name.

If you want to limit the functions being imported, you must use the function argument to name those functions, one at a time. The filename argument does not use a file extension, only the base filename of the external VLX application file, and that file must reside in the default search path, or the full path and filename must be specified.

(vl-arx-import [*'function* / "*appname*"])

Imports a function or group of functions from a specified loaded ARX file. If function and appname are omitted, all ARX-defined functions from the current document namespace are imported. This function should be used within a (defun) function definition. The ARX application must be loaded into the current document session in order for this function to work.

Arguments:

Function - (Optional) A quoted symbol representing a function name.

AppName - (Optional, but must be included when Function is used) A symbol or string that represents the ARX file to be imported from.

For example, if you wanted to use the DOSlib ARX function (dos_getstring) for use within your separate-namespace VLX application, you would have to import it as follows:

```
(vl-arx-import 'dos_getstring "doslib2k.arx")
```

If you wanted to import all functions from doslib2k.arx, you would simply leave off the function name as follows:

```
(vl-arx-import "doslib2k.arx")
```


(vl-doc-set '*symbol value*)

Sets a symbol in the document namespace from within a separate-namespace VLX application. If used outside of a separate-namespace VLX application, this behaves like the (set) function. This function can be used to copy a symbol defined within a separate-namespace VLX application to the document namespace for public access. The symbol is copied by value, not by reference, meaning that the symbol within the VLX application cannot be modified from the document namespace. To import a document namespace symbol, you must use the (vl-doc-ref) function from within your separate-namespace VLX application.

Arguments:

Symbol - A quoted symbol name.

Value - Any value to assign to the symbol.

Examples:

Defined example function, compile into separate-namespace VLX and load into AutoCAD:

```
(defun DOCSET ()  
  (vl-doc-set 'G$NAME1 "Joe")  
)
```

From the document namespace, via the command prompt:

Command: (DOCSET)

Command: !G\$NAME1

"Joe"

(vl-doc-ref '*symbol*)

Imports a symbol from the document namespace into a separate-namespace VLX application namespace. The symbol is copied by value, not by reference, meaning that the document namespace symbol cannot be directly modified from within the VLX namespace. To export or set a document namespace symbol from within the VLX namespace, you must use the (vl-doc-set) function.

Arguments:

Symbol - A quoted symbol name.

(vl-load-all *filename*)

Loads a named VLX file into all opened documents at the same time. It also loads into any documents opened thereafter within the same AutoCAD application session.

Arguments:

Filename - A symbol or string representing a valid filename.

(vl-propagate '*symbol*)

Copies a symbol and its associated value to all opened documents within the AutoCAD application namespace, and to all documents opened afterwards during the same AutoCAD session.

Arguments:

Symbol A quoted symbol name.

(vl-bb-set '*symbol*)

Posts a symbol and its associated value to the blackboard namespace. The blackboard namespace is part of the AcadApplication namespace and is accessible by all opened documents in the Documents collection. This provides similar functionality to the Windows Clipboard, except that it is used for posting and retrieving LISP symbols only.

Arguments:

Symbol A quoted symbol name.

(vl-bb-ref '*symbol*)

Retrieves a symbol and its associated value from the blackboard namespace.

Arguments:

Symbol A quoted symbol name.

(vl-list-exported-functions)

Returns a list of all functions that have been exposed to the document namespace from any loaded VLX applications.

(vlax-add-cmd "globalname" 'function ["localname" | flags])

Defines a command-line function from a (defun) that is not defined as a C: function within a VLX application. You must specify at least the globalname and function options. The localname and flags options are optional. You cannot use (vlax-add-cmd) to expose functions as commands that create reactor objects or serve as reactor callbacks. Returns the *globalname* value if successful, otherwise returns *nil* if not successful.

It is suggested that (vlax-add-cmd) be used within a separate-namespace VLX and that you load the VLX using the APPLOAD command instead of from within a LISP startup routine.

Arguments:

GlobalName - A string that specifies the command name for use at the command prompt.

Function - A quoted symbol representing a function name.

LocalName - (Optional) Command name internal to the VLX application namespace. If omitted, defaults to GlobalName.

Flags - (Optional) Modify the behavior of the command with respect to transparency, pickset and pickfirst options and so forth.

Primary Flag Options:

ACRX_CMD_MODAL (0) - Command cannot be invoked while another command is active.

ACRX_CMD_TRANSPARENT (1) - Command can be invoked while another command is active.

Secondary Flag Options:

ACRX_CMD_USEPICKSET (2) - When the Pickfirst set is retrieved, it is cleared within AutoCAD. Command will be able to retrieve the Pickfirst set. Command cannot retrieve or set Grips.

ACRX_CMD_REDRAW (4) - When the Pickfirst set or grip set is retrieved, neither will be cleared within AutoCAD. Command can retrieve the Pickfirst set and the Grip set.

If both `ACRX_CMD_USEPICKSET` and `ACRX_CMD_REDRAW` are set, the effect is the same as if just `ACRX_CMD_REDRAW` is set. For more information on these flag options, refer to the *Command Stack* topic in the *ObjectARX Reference* manual.

Examples:

Function defined in `Transparent.VLX` and loaded into AutoCAD:

```
(vl-load-com)

(vl-doc-export 'example1)

(defun example1 ()
  (princ "\nThis is an example transparent function.")
  (princ)
)

(vlax-add-cmd "example1" 'example1 "example1" ACRX_CMD_TRANSPARENT)

(princ)
```

```
Command: LINE
Specify first point: 'EXAMPLE1
This is an example transparent function.
Resuming LINE command.
Specify first point:
```

(vlax-remove-cmd "*globalname*")

Removes a command definition that was previously defined using `(vlax-add-cmd)`. The function is not affected, but the command-prompt interface is removed from the commands group.

Arguments:

GlobalName - A string naming a command to be removed.

Examples:

```
(vlax-remove-cmd "example1")

T

(vlax-remove-cmd "example2")

nil
```

(vl-acad-defun '*function*)

Enables a (defun) LISP function to be used as a c: function from an ObjectARX application. This makes the function accessible to ObjectARX applications.

Arguments:

Function - A quoted symbol representing a function name.

Examples:

```
(vl-acad-defun 'example1)
```

(vl-acad-undefun '*function*)

Undefines a command that was previously exposed using the (vl-acad-defun) function. Returns T if successful, otherwise returns *nil*.

Arguments:

Function - A quoted symbol representing a function name.

Examples:

```
(vl-acad-undefun 'example1)
```

T

Chapter 11 –Registry Functions

Visual LISP provides special functions for accessing and modifying the Windows registry. You can query and modify keys within the HKEY_LOCAL_MACHINE, and HKEY_CURRENT_USER hives of the local registry using these functions. You cannot obtain remote registry access using Visual LISP registry functions. Nor can you access the HKEY_USERS, HKEY_CLASSES_ROOT or HKEY_CURRENT_CONFIG registry hives from Visual LISP.

Note that even in registry hives that Visual LISP can access, you are still bound by the access controls imposed by the security context of the process owner. In other words, if the Visual LISP application is being executed by a user that has limited permissions on that machine, some registry keys may not be accessible or may not be modifiable by Visual LISP. This issue is particularly important to consider in networked environments where *group policies* are used to modify registry access permissions.

(vl-registry-read *regkey* [*value-name*])

Returns the value assigned to either an explicit registry key or a registry value-name (symbol) if defined in the registry. If no such registry key or value-name is found, the result is *nil*.

Arguments:

RegKey - Name of a registry key in HKEY_LOCAL_MACHINE or HKEY_CURRENT_USER hives.

Value-Name - Name of a subordinate value symbol beneath the specified registry key. (Optional)

Examples:

```
(vl-registry-write "HKEY_CURRENT_USER\\Example1" "FOO" "123")
```

```
"123"
```

```
(vl-registry-read "HKEY_CURRENT_USER\\Example1" "FOO")
```

```
"123"
```

```
(vl-registry-read "HKEY_CURRENT_USER\\Example1")
```

```
nil
```

```
(vl-registry-write "HKEY_CURRENT_USER\\Example2" "" "ABCDEF")
```

```
"ABCDEF"
```

```
(vl-registry-read "HKEY_CURRENT_USER\\Example2")
```

```
"ABCDEF"
```

(vl-registry-write regkey [value-name] value)

Writes value to registry key or registry key value-name and returns value if successful. Returns *nil* if not successful.

Arguments:

RegKey - Name of registry key

Value-Name - Name of a subordinate value symbol beneath the specified registry key. (Optional)

Value - Value to write to the named registry key or value-name.

Examples:

```
(vl-registry-write "HKEY_CURRENT_USER\\Example1" "TEST1" "123")
```

```
"123"
```

```
(vl-registry-write "HKEY_CURRENT_USER\\Example1" "" "456")
```

```
"456"
```

(vl-registry-delete regkey [value-name])

Deletes a registry key and its associated values from the specified location in the registry. Returns T if successful, *nil* if it fails. If *value-name* is supplied and is not nil, the specified value will be purged from the registry. If *value-name* is absent or nil, the function deletes the specified key and all of its values. If any sub-keys exist, regkey cannot be deleted. To remove keys that have sub-keys, you must use (vl-registry-descendents) to collect the sub-keys and delete them first.

Arguments:

RegKey - Name of registry key

Value-Name - Name of a subordinate value-name (symbol) beneath the specified registry key.

(Optional)

Examples:

```
(vl-registry-write "HKEY_CURRENT_USER\\Example1" "TEST1" "123")
```

```
"123"
```

```
(vl-registry-delete "HKEY_CURRENT_USER\\Example1")
```

T

(vl-registry-descendents *regkey* [*value-names*])

Returns a list of subkeys or value-names beneath the specified registry key. If *value-names* is supplied and is not nil, the specified value names will be listed from the registry. If *value-name* is absent or nil, the function displays all subkeys of *regkey*. Note also that the return value is often in reverse sorted order.

Arguments:

RegKey Name of registry key

Value-Names A string containing the values for the *regkey* entry.

Examples:

```
(vl-registry-descendents "HKEY_LOCAL_MACHINE\\SOFTWARE")
```

```
("WexTech Systems" "Voice" "Synaptics" "Symantec" "Secure" "Program Groups" "Policies"  
"ODBC" "Microsoft" "MetaStream" "McNeel" "Intel Corporation" "INTEL" "InstalledOptions"  
"Helios" "DOSLib" "Dell Computers" "Dell Computer Corporation" "Dell Computer" "Clients"  
"Classes" "BVRP Software" "Autodesk" "ATI Technologies" "Apple Computer, Inc." "Adobe")
```

You can see more examples of registry functions by opening the RegDump.LSP file located in the Visual LISP Samples directory of your AutoCAD 2002 installation. In this file, you will find a useful function named (registry-tree-dump) that performs a recursive search of all subkeys and value-names beneath a specified registry key.

TIP: You can create a pair of Get and Set functions to store and retrieve registry values with some control over standardized locations and error trapping. You might find the following two functions

helpful:

```
(setq G$REGROOT "HKEY_CURRENT_USER\\Software\\MyApplication\\")

(defun RegGet (key default / val)
  (if (= nil (setq val (vl-registry-read (strcat G$REGROOT key))))
      (progn
        (regset key default)
        (setq val (vl-registry-read (strcat G$REGROOT key)))
      )
    )
  (if val val default)
)

(defun RegSet (key val)
  (vl-registry-write (strcat G$REGROOT key) "" val)
)
```

Chapter 12 – Reactors and Call-Backs

Note: Parts of this section were derived from the AutoCAD 2004 online Help documentation with some modifications to provide additional examples or clarity.

WARNING: While reactors are indeed extremely powerful and useful to developers, they should be used with careful moderation. Depending upon the types and volume of reactors you define in a given situation, you can easily and quickly deplete system resources and cause AutoCAD to become unresponsive and even unstable or crash. Be careful in choosing how you will apply reactors to your applications development.

Reactors are simply links between AutoCAD and your applications that allow you to make functions that respond to *events* that occur within AutoCAD. For example, you can create a reactor to notify your applications that an entity was erased. The application could then perform some action in response to this event. A button on a form is a simple example of event-driven programming that uses an Event and a Response to perform an action. When you pick the button, it fires an event, much like a signal or broadcast. This event is detected by a Reactor of sorts that performs some action as a result by using what is known as a *call-back* process.

In AutoCAD terms, you might consider a scenario such as using the `CommandWillStart` event to fire a Command Reactor call-back to perform some action based on what command was executed. Maybe the user initiated the HATCH command, and you want to react to that by firing a call-back function that sets a special layer active before the Hatch is placed in the drawing, and then restore the previous layer state when the command finishes. Maybe you'd like it to also restore the previous layer state if the command fails due to an error? Or what if the user simply cancels the command in midstream? This is possible using Reactors and Visual LISP programming.

What you need to do first is define the function that will be used in the call-back. Be careful not to use `(command)` or `(vl-cmdf)` anywhere in that function if it will be called upon as the result of a Command Reactor as this may start an endless cycle and crash AutoCAD. Sounds like common sense, huh? Sometimes things like this are not so obvious and can cause big problems. This is but one reason for developers to be VERY careful when considering Reactors.

The next thing you need to do is define the Reactor and construct it to call your call-back function if the

proper condition is met by the event detected (the command is HATCH or BHATCH, ignoring all others).

Figure 12-1 demonstrates how you might use a Command Reactor to respond to the HATCH or BHATCH command by defining and setting layer "HATCHING" active until the command has either finished (via the `CommandEnded` event), or aborted due to error (via the `CommandFailed` event), or user cancellation (via the `CommandCancelled` event).

Visual LISP Reactor Functions

(vl-load-com)	Loads AutoLISP reactor support functions and other AutoLISP extensions
(vlr-acdb-reactor <i>data callbacks</i>)	Constructs a global "database" reactor object
(vlr-add <i>obj</i>)	Enables a disabled reactor object
(vlr-added-p <i>obj</i>)	Tests to determine whether a reactor object is enabled
(vlr-beep-reaction [<i>args</i>])	Produces a beep sound
(vlr-current-reaction-name)	Returns the name (symbol) of the current event, if called from within a reactor's callback
(vlr-data <i>obj</i>)	Returns application-specific data associated with a reactor
(vlr-data-set <i>obj data</i>)	Overwrites application-specific data associated with a reactor
(vlr-deepclone-reactor <i>obj data</i>)	Constructs an editor reactor object that notifies of deep clone events
(vlr-docmanager-reactor <i>obj data</i>)	Constructs a reactor object that notifies of MDI-related events
(vlr-dwg-reactor <i>obj data</i>)	Constructs an editor reactor object that notifies of a drawing event (for example, opening or closing a drawing file)
(vlr-dxf-reactor <i>obj data</i>)	Constructs an editor reactor object that notifies of an event related to reading or writing of a DXF file
(vlr-editor-reactor <i>data callbacks</i>)	Constructs a global "editor" reactor object
(vlr-linker-reactor <i>data callbacks</i>)	Constructs a global "linker" reactor object
(vlr-miscellaneous-reactor <i>data callbacks</i>)	Constructs an editor reactor object that does not fall under any of the other editor reactor types
(vlr-mouse-reactor <i>data callbacks</i>)	Constructs an editor reactor object that notifies of a mouse event (for example, a double-click)
(vlr-notification <i>reactor</i>)	Determines whether or not a reactor's callback function will execute if its associated namespace is not active
(vlr-object-reactor <i>owners data callbacks</i>)	Constructs an object reactor object
(vlr-owner-add <i>reactor owner</i>)	Adds an object to the list of owners of an object reactor
(vlr-owner-remove <i>reactor owner</i>)	Removes an object from the list of owners of an object reactor
(vlr-owners <i>reactor</i>)	Returns the list of owners of an object reactor

(vlr-pers reactor)	Makes a reactor persistent between sessions (<i>not</i> transient)
(vlr-pers-list [reactor])	Returns a list of persistent reactors in the current drawing
(vlr-pers-p reactor)	Determines whether or not a reactor is persistent
(vlr-pers-release reactor)	Makes a reactor transient (<i>not</i> persistent)
(vlr-reaction-name reactor-type)	Returns a list of all callback conditions for this reactor type
(vlr-reaction-set reactor event function)	Adds or replaces a callback function in a reactor
(vlr-reactions reactor)	Returns a list of pairs (<i>event-name . callback_function</i>) for the reactor
(vlr-reactors [reactor-type...])	Returns a list of reactors of the specified types
(vlr-remove reactor)	Disables a reactor object
(vlr-remove-all reactor-type)	Disables all reactors of the specified type
(vlr-set-notification reactor 'range)	Defines whether or not a reactor's callback function will execute if its associated namespace is not active
(vlr-sysvar-reactor data callbacks)	Constructs an editor reactor object that notifies of a change to a system variable
(vlr-toolbar-reactor data callbacks)	Constructs an editor reactor object that notifies of a change to the bitmaps in a toolbar
(vlr-trace-reaction)	A pre-defined callback function that prints one or more callback arguments in the Trace window
(vlr-type reactor)	Returns a symbol representing the reactor type
(vlr-types)	Returns a list of all reactor types (see next section)
(vlr-undo-reactor data callbacks)	Constructs an editor reactor object that notifies of an undo event
(vlr-wblock-reactor data callbacks)	Constructs an editor reactor object that notifies of an event related to writing a block
(vlr-window-reactor data callbacks)	Constructs an editor reactor object that notifies of an event related to moving or sizing an AutoCAD window
(vlr-xref-reactor data callbacks)	Constructs an editor reactor object that notifies of an event related to attaching or modifying XREF

Reactor Types

There are many types of AutoCAD reactors. Each reactor type responds to one or more AutoCAD events. The different types of reactors are grouped into one of the following five categories:

Database Reactors

Database reactors notify your application when specific events occur to the drawing database, such as when an object has been added to the drawing database.

Document Reactors

Document reactors notify your application of a change to the current drawing document, such as

opening a new drawing document, activating a different document window, and changing a document's lock status. This does not include of all the events covered by Editor reactors.

Editor Reactors

Editor reactors notify you each time an AutoCAD command is invoked; a drawing is opened, closed, or is saved; a DXF file is imported or exported; or a system variable setting is modified.

Linker Reactors

Linker reactors notify your application every time an ARX application is loaded or unloaded.

Object Reactors

Object reactors notify you each time a specific object is changed, copied, or deleted.

With the exception of Editor reactors, there is one type of reactor for each reactor category. The following table lists the name by which each reactor type is identified in the Visual LISP environment:

General reactor types	
Reactor type identifier	Description
:VLR-AcDb-Reactor	A Database reactor
:VLR-DocManager-Reactor	A Document management reactor
:VLR-Editor-Reactor	A General Editor reactor-maintained for backward-compatibility
:VLR-Linker-Reactor	A Linker reactor
:VLR-Object-Reactor	An Object reactor

The Editor reactor class is broken down into more specific reactor types. The :VLR-Editor-Reactor type is retained for backward-compatibility, but any new Editor reactors introduced after AutoCAD 2000 cannot be referenced through :VLR-Editor-Reactor. The following table lists the types of Editor Reactors.

Editor reactor types	
Reactor type	Description
:VLR-Command-Reactor	Notifies of a command event
:VLR-DeepClone-Reactor	Notifies of a deep clone event
:VLR-DWG-Reactor	Notifies of a drawing event (for example, opening or closing a drawing file)
:VLR-DXF-Reactor	Notifies of an event related to reading or writing of a DXF file
:VLR-Insert-Reactor	Notifies of an event related to block insertion
:VLR-Lisp-Reactor	Notifies of a LISP event
:VLR-Miscellaneous-Reactor	Does not fall under any of the other editor reactor types

:VLR-Mouse-Reactor	Notifies of a mouse event (for example, a double-click)
:VLR-SysVar-Reactor	Notifies of a change to a system variable
:VLR-Toolbar-Reactor	Notifies of a change to the bitmaps in a toolbar
:VLR-Undo-Reactor	Notifies of an UNDO event
:VLR-Wblock-Reactor	Notifies of an event related to writing a block
:VLR-Window-Reactor	Notifies of an event related to moving or sizing an AutoCAD window
:VLR-XREF-Reactor	Notifies of an event related to attaching or modifying XREFs

Note: Use the `vlr-types` function to return the complete list of reactor types.

For each reactor type there are a number of events that can cause the reactor to notify your application. These events are known as callback events, because they cause the reactor to call a function you associate with the event. For example, when you issue the SAVE or QSAVE commands to save a drawing, a `:vlr-beginSave` event occurs. When you complete the save process, a `:vlr-saveComplete` event occurs. In designing a reactor-based application, it is up to you to determine the events you are interested in, and to write the callback functions to be triggered when these events occur.

The `vlr-reaction-names` function returns a list of all available events for a given reactor type:

```
(vlr-reaction-names reactor type)
```

For example, the following command returns a list of all events related to Object reactors:

```
$ (vlr-reaction-names :VLR-Object-Reactor)
```

```
(:VLR-cancelled :VLR-copied :VLR-erased :VLR-unerased :VLR-goodbye :VLR-openedForModify
:VLR-modified :VLR-subObjModified :VLR-modifyUndone :VLR-modifiedXData :VLR-unappended
:VLR-reappended :VLR-objectClosed)
```

NOTE: If this or any other `vlr-*` command fails with a "no function definition" message, you may have forgotten to call `vl-load-com`, the function that loads AutoLISP reactor support functions.

To print out a list of all available reactor events, sorted by reactor type, load and execute the following example function:

```
(defun print-reactors-and-events ()
  (foreach rtype (vlr-types)
    (princ (strcat "\n" (vl-princ-to-string rtype)))
    (foreach rname (vlr-reaction-names rtype)
      (princ (strcat "\n\t" (vl-princ-to-string rname)))))
```

```

    )
  )
  (princ)
)

```

Verifying Reactor Types

The *AutoLISP Reference* lists each event available for a reactor type. For each reactor type, you can find this information by looking up the description of the function you use to define a reactor of that type. These functions have the same name as the reactor type, minus the leading colon. For example, `vlr-acdb-reactor` creates a database reactor, `vlr-toolbar-reactor` creates a toolbar reactor, and so on.

(vlr-type reactor)

Iterates member objects of collection and performs expressions on each member object. If second argument is not a collection object, an error is generated. Reference to *symbol* is localized and temporary, just as with (foreach).

Arguments:

reactor A reactor object.

Return Values

A symbol identifying the reactor type. The following table lists the types that may be returned by the vlr-type function:

Reactor types	
Reactor type	Description
:VLR-AcDb-Reactor	A drawing database reactor.
:VLR-Command-Reactor	An editor reactor notifying of a command event. This does not include C: commands defined by LISP expressions, only native AutoCAD commands.
:VLR-DeepClone-Reactor	An editor reactor notifying of a deep clone event.
:VLR-DocManager-Reactor	A document management reactor.
:VLR-DWG-Reactor	An editor reactor notifying of a drawing event (for example, opening or closing a drawing file).
:VLR-DXF-Reactor	An editor reactor notifying of an event related to reading or writing of a DXF file.
:VLR-Editor-Reactor	A general editor reactor; maintained for backward-compatibility.
:VLR-Insert-Reactor	An editor reactor notifying of an event related to block insertion.
:VLR-Linker-Reactor	A linker reactor.

:VLR-Lisp-Reactor	An editor reactor notifying of a LISP event.
:VLR-Miscellaneous-Reactor	An editor reactor that does not fall under any of the other editor reactor types.
:VLR-Mouse-Reactor	An editor reactor notifying of a mouse event (for example, a double-click).
:VLR-Object-Reactor	An object reactor. (any object, e.g. vla-object type)
:VLR-SysVar-Reactor	An editor reactor notifying of a change to a system variable.
:VLR-Toolbar-Reactor	An editor reactor notifying of a change to the bitmaps in a toolbar.
:VLR-Undo-Reactor	An editor reactor notifying of an undo event.
:VLR-Wblock-Reactor	An editor reactor notifying of an event related to writing a block.
:VLR-Window-Reactor	An editor reactor notifying of an event related to moving or sizing an AutoCAD window.
:VLR-XREF-Reactor	An editor reactor notifying of an event related to attaching or modifying XREFs.

Examples

```
_$ (vlr-type circleReactor)
```

```
:VLR-Object-Reactor
```

There are various ways to obtain information about reactors. Visual LISP supplies AutoLISP functions to query reactors, and you can use standard Visual LISP data inspection tools to view information on them.

To use AutoLISP to list all reactors in a drawing, call the `vlr-reactors` function. The function returns a list of reactor lists. Each reactor list begins with a symbol identifying the reactor type, followed by pointers to each reactor of that type. For example:

```
_$ (vlr-reactors)
```

```
((:VLR-Object-Reactor #<VLR-Object-Reactor>) (:VLR-Editor-Reactor #<VLR-Editor-Reactor>))
```

In this example, `vlr-reactors` returned a list containing two lists, one identifying a single object reactor and one identifying a single Editor reactor.

To list all reactors of a given type, supply `vlr-reactors` with an argument identifying the reactor type. Specify one of the values returned by the `vlr-types` function; these are listed in the section on Reactor Types. For example, the following lists all DWG reactors:

```
_$ (vlr-reactors :vlr-dwg-reactor)
```

```
((:VLR-DWG-Reactor #<VLR-DWG-Reactor> #<VLR-DWG-Reactor>))
```

In this case, the return value is a list containing one list. The one list identifies pointers to two DWG reactors.

Using Object Reactors

Unlike other AutoCAD reactors, object reactors are attached to specific AutoCAD entities (objects). When you define an object reactor, you must identify the entity the reactor is to be attached to. The `vlr-object-reactor` function, which creates object reactors, requires the following arguments:

- A list of VLA-objects identifying the drawing objects that are to fire notifications to the reactor. These objects are referred to as the *reactor owners*.
- AutoLISP data to be associated with the Reactor object.
- A list of pairs naming the event and the callback function to be associated with that event (*event-name . callback_function*).

WARNING: You cannot modify an object in a callback function if it is included in the object reactor's owner list. Attempts to do so will generate an error message and can crash AutoCAD. This is a very esoteric concern with using reactors: To carefully plan your implementation strategy so that you avoid the possibility of circular references where a reactor callback affects one of the sources of the reactor itself.

For example, the following statement defines an object reactor with a single owner (the object identified by `myCircle`), then attaches the string "Circle Reactor" to the reactor and tells AutoCAD to invoke the `print-radius` function when a user modifies `myCircle`:

```
(setq circleReactor (vlr-object-reactor (list myCircle)
```

```
"Circle Reactor" '(:vlr-modified . print-radius))))
```

The Reactor object is stored in variable `circleReactor`; you can refer to the reactor using this variable. When defining a list of owners, you must specify VLA-objects only; `ENAME` objects are not allowed. VLA-objects are required because callback functions can only use ActiveX methods to modify AutoCAD objects, and ActiveX methods require a VLA-object to work on.

Note that, although you cannot use objects obtained through functions such as `entlast` and `entget` with callback reactors, you can convert these `ENAME` objects into VLA-objects using the `vla-x-ename->vla-object` function. See the *AutoLISP Reference* for more information on `vla-x-ename->vla-object`.

The following code example draws a circle and applies a reactor to the circle to notify of any change made to the entity thereafter. Load the code, draw the circle and then go back and either move or

resize the circle using SCALE or grip editing to see how it works.

```
(vl-load-com)

(setq oAcad (vlax-get-acad-object)
      oDoc  (vla-get-activedocument oAcad)
)

(cond
  ( (and
      (setq ctrPt (getpoint "\nCenter point: "))
      (setq rad (distance ctrPt (getpoint ctrPt "\nRadius: ")))
    )
    (setq CircleObject
      (vla-addCircle
        (vla-get-ModelSpace oDoc)
        (vlax-3d-point ctrPt)
        radius
      )
    )
  )

)

(if CircleObject
  (setq circleReactor
    (vlr-object-reactor (list CircleObject) "Circle Reactor"
      '(:vlr-modified . rShowRadius))
  )
)

(defun rShowRadius
  (notifier-object reactor parameter-list)
  (cond
    ( (vlax-property-available-p notifier-object "Radius")
      (princ "*** The radius is ")
    )
  )
)
```

```

    (princ (vla-get-radius notifier-object))
  )
)
)

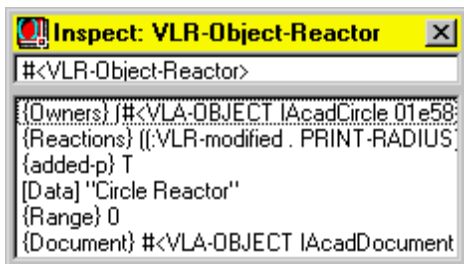
```

Attaching Data to Reactor Objects

The object reactor creation example in [Using Object Reactors](#) included a string, "Circle Reactor," in the call to `vlr-object-reactor`. You do not have to specify any data to be included with the reactor; you can specify `nil` instead. However, an object may have several reactors attached to it. Include an identifying text string, or other data your application can use, to allow you to distinguish among the different reactors attached to an object.

Inspecting Reactors Within the VLIDE

You can examine reactors using the VLIDE **Inspect** tool. For example, the object reactor defined in [Using Object Reactors](#) was returned to the variable `circleReactor`. If you open an Inspect window for this variable, VLISP displays the following information:



The following information is revealed in the Inspect list:

Objects owning the reactor

- Event and associated callback function
- Whether or not the reactor is active:
 - Yes if `added-p` is `T`
 - No if `added-p` is `nil`
- User data attached to the reactor
- Document range in which the reactor will fire:
 - 0 - Reactor responds only in the context of the drawing document it was created in.
 - 1 - Reactor responds in the context of any document
- See the section "Reactors and Multiple Namespaces"

- The AutoCAD document attached to the object reactor

Double-click on the item that begins with {Owners} to view a list of the owner objects:



You can drill down to find the owner by double-clicking on a list item in the Inspect list box.

Querying Reactors

VLISP also provides functions to inspect a reactor definition from within an application program, or at the Console prompt:

- `vlr-type` returns the type of the specified reactor. For example:

```
$ (vlr-type circleReactor)
:VLR-Object-Reactor
```

- `vlr-current-reaction-name` returns the name of the event that caused the callback function to be called.

- `vlr-data` returns the application-specific data value attached to the reactor, as shown in the following example:

```
$ (vlr-data circleReactor)
"Circle Reactor"
```

You can use this data to distinguish among multiple reactors that can fire the same callback function.

- `vlr-owners` returns a list of the objects in an AutoCAD drawing that fire notifications to an object reactor. The following function call lists the objects that fire notifications to circleReactor:

```
_$ (vlr-owners circleReactor)
(#<VLA-OBJECT IAcadCircle 03ad077c>)
```

- `vlr-reactions` returns the callback list of condition-function pairs of the specified reactor. The following example returns information about circleReactor:

```
$ (vlr-reactions circleReactor)
```

```
((:vlr-modified . PRINT-RADIUS))
```

Transient and Persistent Reactors

Reactors may be transient or persistent. Transient reactors are lost when a drawing closes; this is the default reactor mode. Persistent reactors are saved with the drawing and exist when the drawing is next opened. If you use persistent reactors that invoke custom applications via a callback, the custom applications must be loaded for the callback to work properly. See the next section for more on persistent reactors.

Use the `vlr-pers` function to make a reactor persistent. To remove persistence from a reactor and make it transient, use `vlr-pers-release`. Each function takes a Reactor object as its only argument. For example, the following command makes a reactor persistent:

```
_$ (vlr-pers circleReactor)
```

```
#<VLR-Object-Reactor>
```

If successful, `vlr-pers` returns the specified Reactor object.

To determine whether a Reactor object is persistent or transient, issue `vlr-pers-p`. For example:

```
_$ (vlr-pers-p circleReactor)
```

```
#<VLR-Object-Reactor>
```

The `vlr-pers-p` function returns the Reactor object if it is persistent, `nil` if it is not.

Opening Drawings with Persistent Reactors

Since a reactor is only a link between an event and a callback function. While this link remains, the callback function itself is not part of the reactor, and is normally not part of the drawing. The reactors saved in the drawing are only usable if their associated callback functions are loaded in AutoCAD. You can cause this to occur automatically when a drawing is opened if you define the reactor and callback functions in a separate-namespace VLX.

If you open a drawing containing VLISP reactor information and the associated callback functions are not loaded, AutoCAD displays an error message. You can use the `vlr-pers-list` function to return a list of all Persistent reactors in a drawing document.

Reactors and Multiple Namespaces

The current implementation of AutoLISP supports working in one drawing document at a time. Some AutoCAD APIs, such as ObjectARX and VBA, do support the ability of an application to work simultaneously in multiple documents. As a result, an application may modify an open drawing that is not currently active. This is not supported in AutoLISP.

Guidelines for Using Reactors

As I mentioned at the start of this chapter, Reactors demand *careful* attention to planning and consideration for performance and stability. The following guidelines are provided in the AutoCAD online Help documentation and are very good points to consider.

When using reactors, try to adhere to the following guidelines. Reactors that violate these guidelines can result in unpredictable results for your application if the internal implementation of reactors changes.

- Do not rely on the sequence of reactor notifications.

It is recommended that, with a few exceptions, you do not rely on the sequence of reactor notifications. For example, an OPEN command triggers BeginCommand, BeginOpen, EndOpen, and EndCommand events. However, they may not occur in that order. The only event sequence you can safely rely on is that a Begin event will occur before the corresponding End event. For example, `commandWillStart()` always occurs before `commandEnded()`, and `beginInsert()` always occurs before `endInsert()`. Relying on more complex sequences may result in problems for your application if the sequence is changed as a result of new notifications being introduced in the future and existing ones being rearranged.

- Do not rely on the sequence of function calls between notifications.

It is not guaranteed that certain functions will be called between certain notifications. For example, when you receive `:vlr-erased` notification on object A, all it means is that object A is erased. If you receive `:vlr-erased` notification on A followed by a `:vlr-erased` notification on B, all it means is that both objects A and B are erased; it does not ensure that B was erased after A. If you tie your application to this level of detail, there is a very high probability of your application breaking in future releases. Instead of relying on sequences, rely on reactors to indicate the state of the system.

- Do not use any *interactive* functions in your reactor callback function (for example, do not use

`getPoint, entsel`).

Attempting to execute interactive functions from within a reactor callback function can cause serious problems, as AutoCAD may still be processing a command at the time the event is triggered. Therefore, avoid the use of input-acquisition methods such as `getPoint`, `entsel`, and `getkeyword`, as well as selection set operations and the `command` function.

- Do not launch a dialog box from within an event handler.

Dialog boxes are considered interactive functions and can interfere with the current operation of AutoCAD. However, message boxes and alert boxes are not considered interactive and can be issued safely.

- Do not update the object that issued the event notification.

The event causing an object to trigger a callback function may still be in progress and the object still in use by AutoCAD when the callback function is invoked. Therefore, do not attempt to update an object from a callback function for the same object. You can, however, safely read information from the object triggering an event. For example, suppose you have a floor filled with tiles and you attach a reactor to the border of the floor. If you change the size of the floor, the reactor callback function will automatically add or subtract tiles to fill the new area. The function will be able to read the new area of the border, but it cannot attempt any changes on the border itself.

- Do not perform any action from a callback function that will trigger the same event.

If you perform an action in your reactor callback function that triggers the same event, you will create an infinite loop. For example, if you attempt to open a drawing from within a `BeginOpen` event, AutoCAD will simply continue to open more drawings until the maximum number of open drawings is reached.

- Verify that a reactor is not already set before setting it, or you may end up with multiple callbacks on the same event.
- Remember that no events will be fired while AutoCAD is displaying a modal dialog.

WARNING: A VLX may run in a separate-namespace from the document it is loaded from, but it is still associated with that originating document and cannot manipulate objects in other documents.

Visual LISP provides limited support for reactor callback functions executing in a document that is not

active. By default, a reactor callback function will execute only if a notification event occurs when the document it was defined in is the active document. You can alter this behavior using the `vlr-set-notification` function.

To specify that a reactor should execute its callback function even if the document it was defined in is not active (for example, if an application in another namespace triggers an event), issue the following function call:

```
(vlr-set-notification reactor-object 'all-documents)
```

This can be useful to notify all instances of your application (that is, if not a separate namespace VLX application propagated to all sessions) that an event occurred in one of the sessions.

To modify a reactor so it only executes its callback function if an event occurs when the document it was defined in is active, issue the following:

```
(vlr-set-notification reactor-object 'active-document-only)
```

The `vlr-set-notification` function returns the specified reactor object. For example, the following sequence of commands defines a reactor and sets it to respond to events whether or not its associated document is active:

```
_$ (setq circleReactor (vlr-object-reactor (list myCircle)
"Circle Reactor" '(:vlr-modified . print-radius))))
#<VLR-Object-Reactor>
_$ (vlr-set-notification circleReactor 'all-documents)
#<VLR-Object-Reactor>
```

To determine the notification setting of a reactor, use the `vlr-notification` function. For example:

```
_$ (vlr-notification circleReactor)
all-documents
```

The `vlr-set-notification` function affects only the specified reactor. All reactors are created with the default notification set to active-document-only.

WARNING: If you choose to set a reactor to execute its callback function even if triggered when its document is not active, the callback function should do nothing other than set and read AutoLISP system variables. Performing other types of actions may cause AutoCAD to become unstable or crash!

Note that VBA provides no equivalent to `vlr-CommandCancelled`, which means that only through Visp can you handle a user pressing ESC during a command being managed by a command reactor.

Chapter 13 – Making Visual LISP Applications

Probably the most significant feature provided by Visual LISP is the capability to build and manage applications. In this context, we are really talking about VLX applications, but you could consider FAS output to be applications as well. The building of Visual LISP applications is closely tied to the use of Projects, but they are not inseparable.

Why Make VLX Applications?

The main reasons for making VLX applications are improved security and performance. Security is improved because the Visual LISP compiler encrypts and compiles the source LSP code into binary output that is unreadable to the human eye. It also can combine multiple LSP files into a single VLX output further improving security and providing a single output for delivery to users. Performance is improved because the compiled code is actually more efficient to execute at runtime.

Unlike many other programming languages, Visual LISP does not truly "compile" its output, but more accurately performs an encryption and partial compilation. This is somewhat like what a Java compiler does to produce "p-code" output, which is then compiled at runtime by the JVM (Java Virtual Machine) compiler on the client. Visual LISP VLX code is compiled to binary output but not to machine level language, meaning it must be interpreted at runtime by the client. It still provides some measure of performance improvement over raw LSP source code though.

FAS files are an intermediate output during the VLX compilation that is the product of the LSP file compilation. The VLX module combines FAS files and any other file types to wrap it all up as a single loadable module on the client. VLX applications can include other file types such as LISP, Dialog Control Language files (.DCL), Compiled LISP code (.FAS), VBA compiled files (.DVB), ASCII TEXT (.TXT) and even other VLISP Projects (.PRV).

One of the most useful features of making VLX applications is that you can combine multiple files into the single VLX output. This makes for easy loading and management as well as keeping your deliverable product clean and compact. Let's try an example.

Building a Simple Application

Open the FirstApplication.LSP file in Visual LISP from the book samples CD. Then open the

FirstApplication.DCL file in Visual LISP as well. Now, pick File/Make Application/New Application Wizard from the pulldown menu. There are two modes for compiling VLX applications: Simple and Expert. Simple used when you are only going to compile LSP files and do not intend to compile a separate namespace VLX. Expert mode allows you to include additional Resource files such as DCL, DVB, VLX and others within the VLX as well as make it a separate namespace application.

Since in this exercise we will be compiling a LSP file with a DCL file into a single, separate namespace VLX application, you have to select the Expert mode from the Wizard Mode panel (Figure 13-1). Pick the Next button.

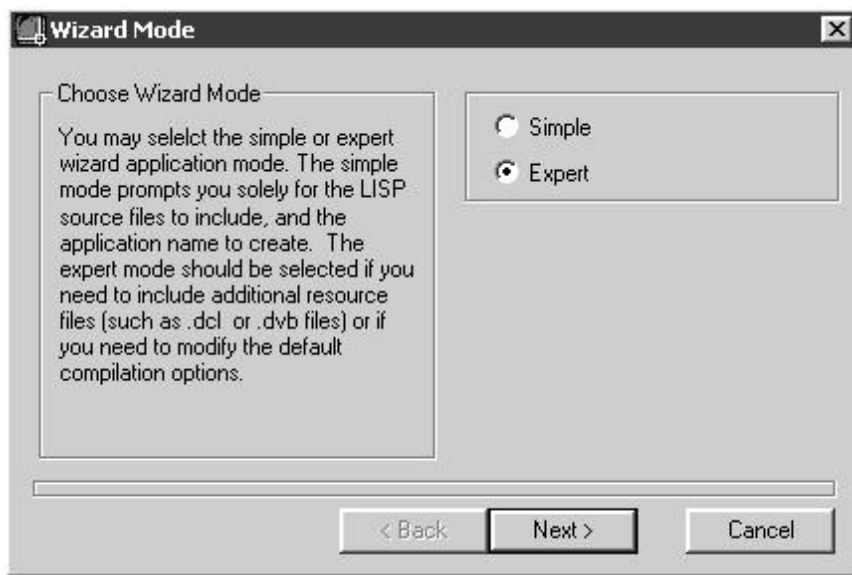


Figure 13-1 – Make Application Wizard

The Application Directory panel (Figure 13-2) is where you specify the VLX filename and target output location. The Application Location is where you want the VLX file to be created at the end of the process. The Application Name is the name you want to call the VLX file (don't include the extension, only the base filename). You will see that while you type in the Application Name box, the Target File window shows the actual VLX filename result. Once you've specified the Application Location, and entered the Application Name "FirstApplication", pick the Next button to continue on.

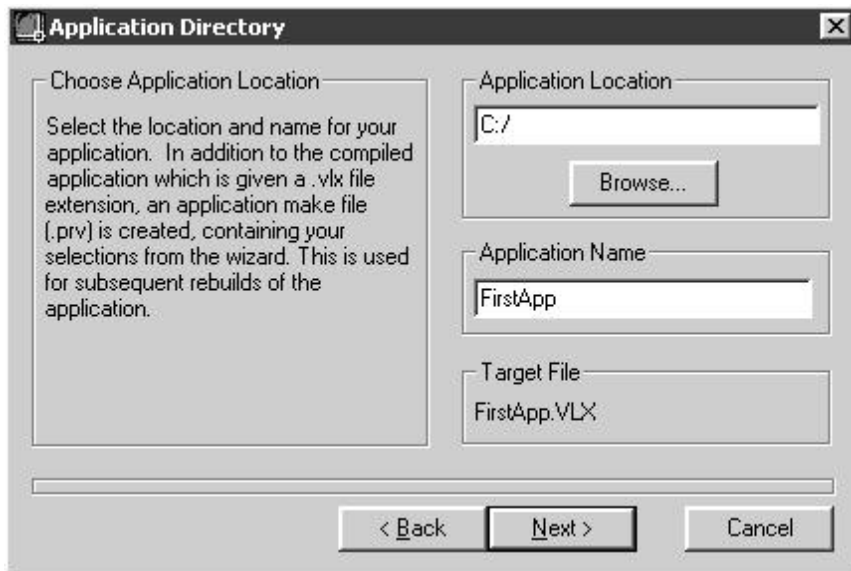


Figure 13-2 – Specifying the output location and VLX filename

The Application Options panel (Figure 13-3) prompts you to make this a Separate Namespace application, as well as use ActiveX Support. For this example, check both options, and pick Next to continue.

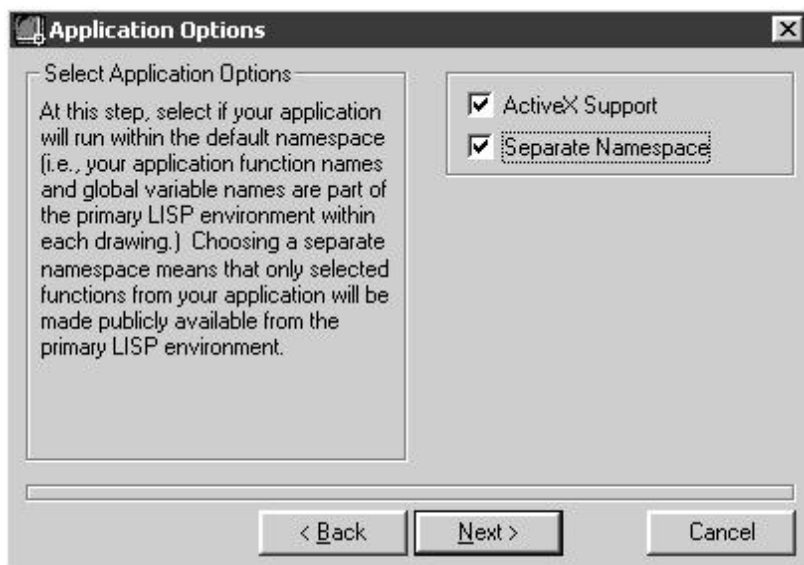


Figure 13-3 – Application Options form (Separate Namespace checked)

The LISP Files to Include panel (Figure 13-4) is where you select the LISP code files (*.LSP) to include in your VLX application. Pick the Add button to browse for, and select the FirstApplication.LSP file. Then pick the Next button to continue.

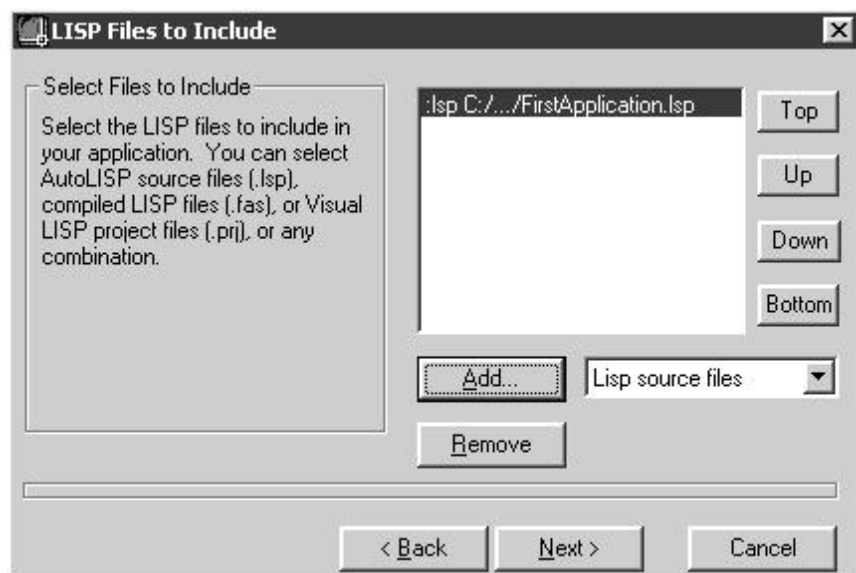


Figure 13-4 – LISP Files to Include form

The Resource Files to Include panel (Figure 13-5) is where you select additional resource files, such as DCL dialog form files, DVB (VBA) files, and other types of files. Change the file type selection to DCL Files and pick the Add button to locate and select the FirstApplication.DCL file. Then pick the Next button to continue on.

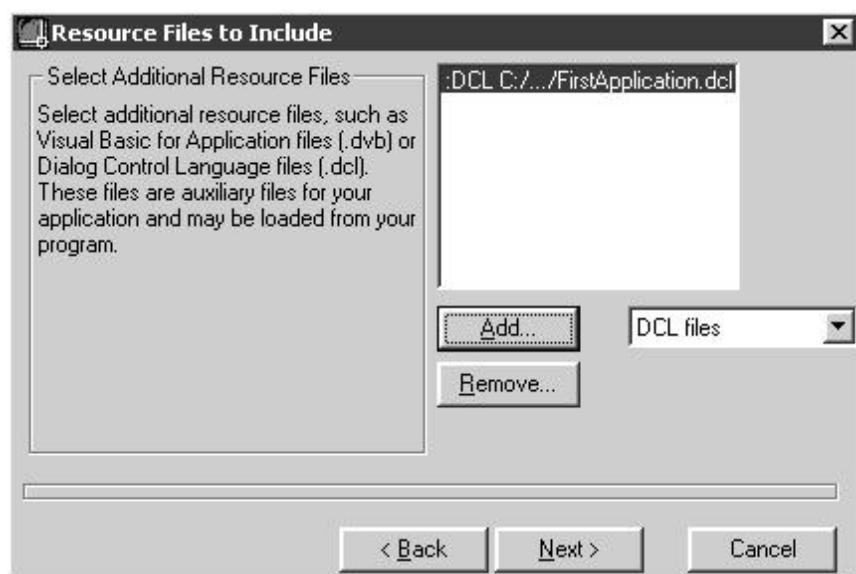


Figure 13-5 – Resource Files Include form

The next panel prompts you to choose either Standard or Optimized compilation. For this example, use the Standard option and pick the Next button to continue.

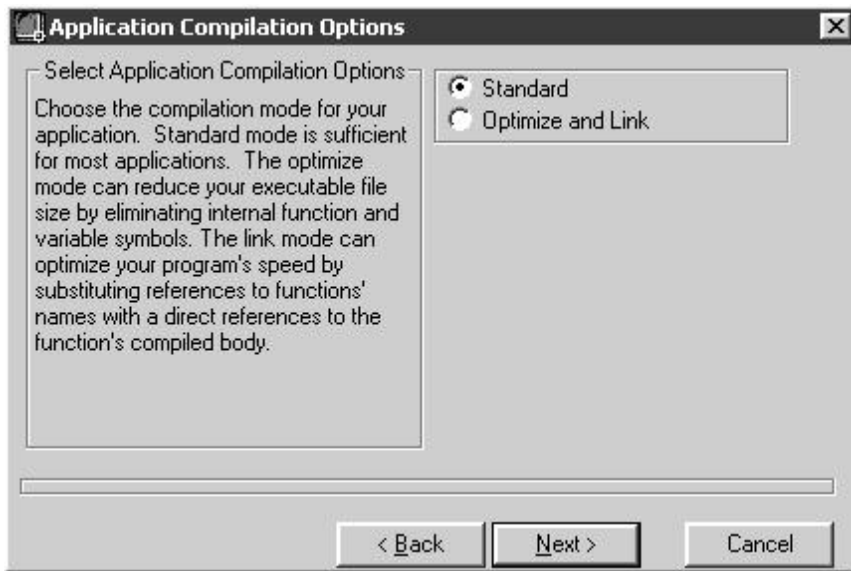


Figure 13-6 – Application Compilation Options form

The final form asks if you want to save the Make Application settings and go ahead and compile the VLX application. If you choose not to compile, the settings you just configured are saved to a make file that uses a .PRV file extension. You can reuse make files at any time to recompile using the stored settings and save a lot of time. For this example, go ahead and compile your VLX application by picking the Finish button.

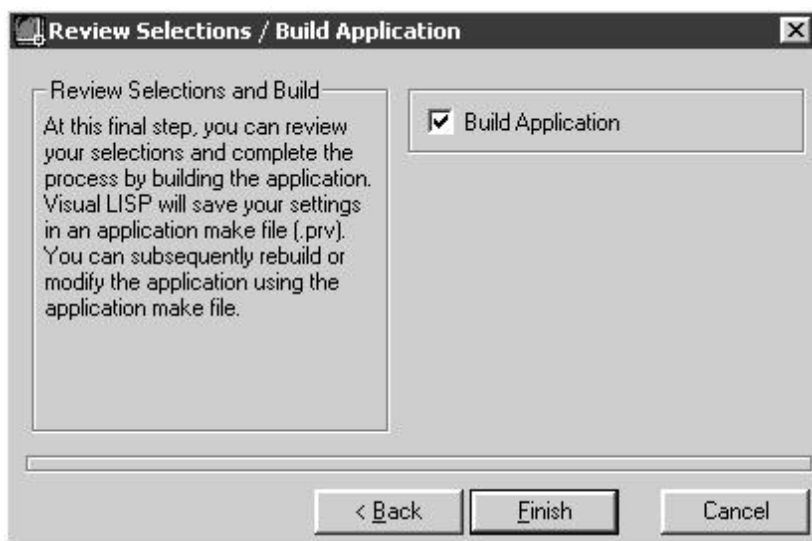


Figure 13-7 – Review selections and build application form.

Now that you've compiled FirstApp.VLX you can load it into AutoCAD and try the FIRSTAPP command to see how it works. You should see a dialog form with one OK button and a message displayed saying "Congratulations!" in the middle.

If this doesn't happen, review this chapter to make sure you followed all steps correctly and compile and load it again. To reload a separate namespace VLX you first have to unload the existing definition by using the (vl-unload-vlx) function. To unload FIRSTAPP, you would use (vl-unload-vlx "firstapp.vlx") at the command prompt.

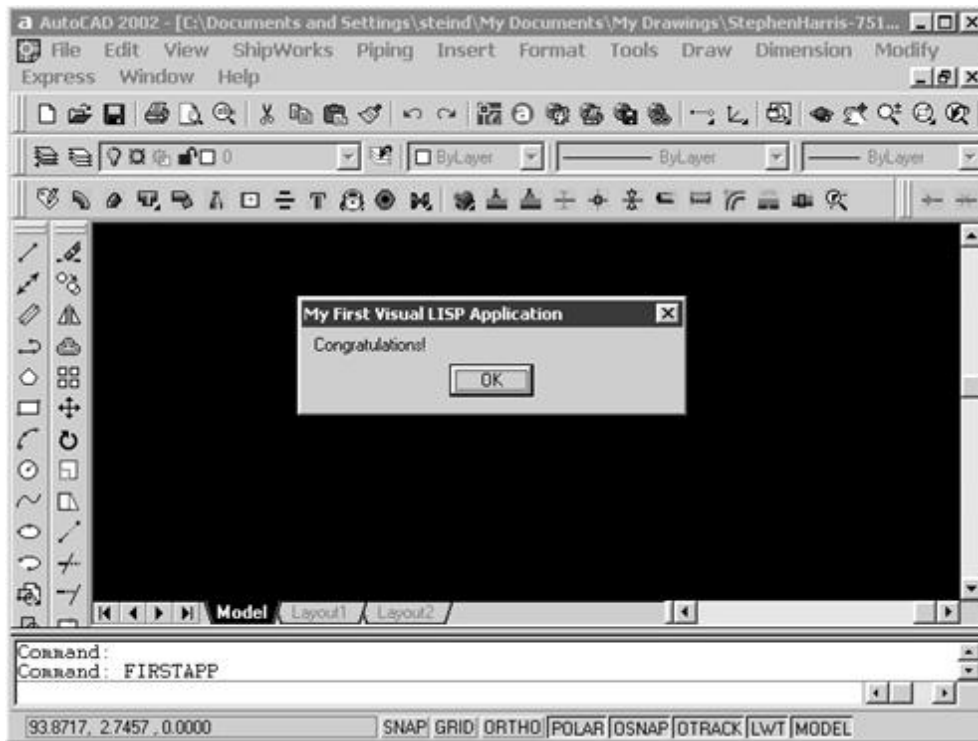


Figure 13-8 – Results of running the FIRSTAPP command.

PRV Files

The Make Application Wizard creates a PRV file to store the settings for your application. If you open a PRV file in notepad, you will see that it is actually a LISP formatted file in which the properties are stored as dotted-pair lists. The example below shows a PRV that compiles a LSP and a DCL file into the ASW_PM.VLX output.

```
;;; Visual LISP make file [V1.0] asw_pm saved to:[C:/] at:[3/05/10]
(PRV-DEF (:target . "FirstApp.VLX")
  (:active-x . T)
  (:separate-namespace)
  (:protected . T)
  (:load-file-list (:lsp "source/FirstApp.lsp"))
  (:require-file-list (:DCL "source/FirstApplication.DCL")))
```

```

(:ob-directory)

(:tmp-directory)

(:optimization . st)

)

;; EOF

```

WARNING: Although you might be tempted to "tweak" PRV files in a text editor, you should instead use the "Existing Application Properties" feature to modify the PRV configuration settings. Editing the PRV file manually may corrupt the file and cause errors when you attempt to recompile.

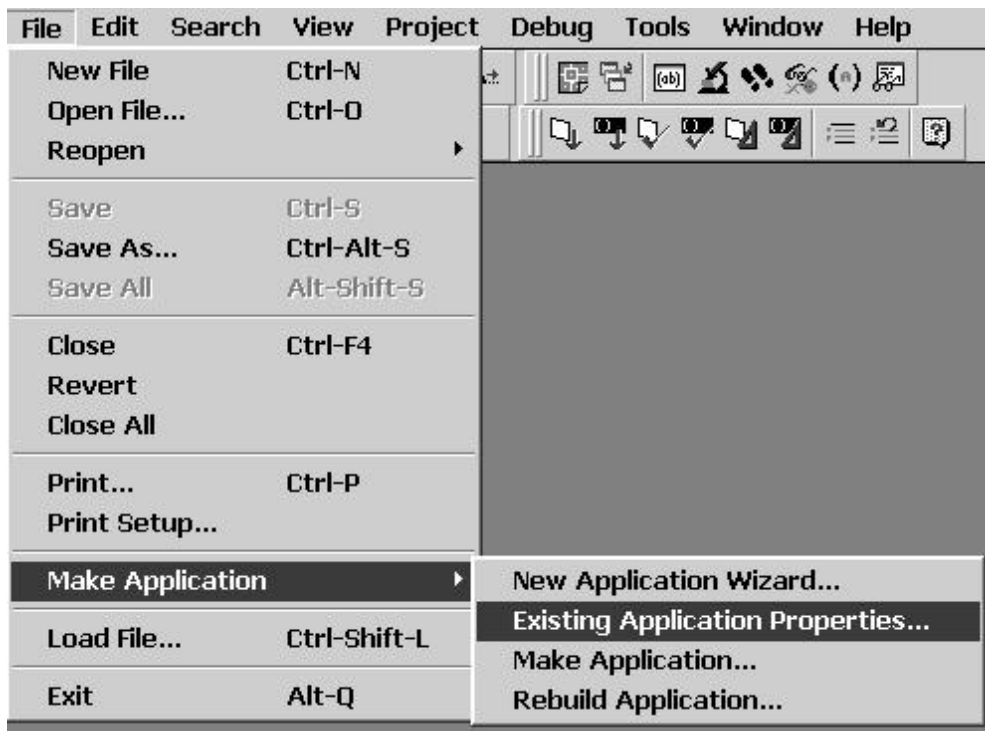


Figure 13-9 - Launching the Existing Application Properties dialog

Chapter 14 – Using ObjectDBX with Visual LISP

Visual LISP can interface with any ActiveX-enabled resources available to the user. ObjectDBX is yet another resource provided within AutoCAD that can be tapped by Visual LISP to perform special tasks that are not possible with any other technologies. First, we need to start off by explaining what ObjectDBX really is.

What is ObjectDBX?

ObjectDBX is a subset of ObjectARX, well, sort of. It's a C++ object-oriented API for manipulating AutoCAD and its related objects, collections, properties, methods and events. While ObjectDBX is capable of many powerful feats of daring, it does have some limitations compared to ObjectARX and Visual LISP. Aside from the limitation, it also provides some nice advantages over them as well. Confused? I know I was at first. But, one place where ObjectDBX really shines is in the world of remote document access, in particular, mining drawings other than those that are open.

Recently, Autodesk released the ObjectDBX SDK for developers to use for mining and manipulating drawing data without having AutoCAD installed. Free? Of course not. In fact, there's a steep price tag and licensing royalty to contend with if you want to pursue this baby. You could opt for OpenDWG alternatives, but since ObjectDBX is built by Autodesk, you can be fairly certain it's going to be reliable when it comes to recognizing all the subtle things in a DWG file.

For the sake of this chapter however, I am going to focus on ObjectDBX as an integral service within AutoCAD, and how it can be used from Visual LISP to perform certain tasks that VLISP alone cannot do. Sound interesting? Let's see how this works.

ObjectDBX within Visual LISP

In order to use ObjectDBX within Visual LISP, you must first load the ObjectDBX TypeLib interface as shown in Figure 14-1. Then you must invoke the interface using a special function (`vla-getInterfaceObject`) as shown in Figure 14-2. Figure 14-1 shows a few example functions for loading the ObjectDBX TypeLib interface within Visual LISP.

Let's suppose for example, that you would like to be able to search a directory of drawing files to find those that contain a specific block insertion. While you could open each drawing and fetch the Blocks

table or do a (`ssget`) search, there is another way to do this without ever opening the drawings in the AutoCAD editor: ObjectDBX.

```
;; Calls REGSVR32 to register a DLL silently via the /S option
(defun DLLRegister (dll)
  (startapp "regsvr32.exe" (strcat "/s \" dll \"\")))

;; Calls REGSVR32 to un-register a DLL silently via the /U /S options
(defun DLLUnRegister (dll)
  (startapp "regsvr32.exe" (strcat "/u /s \" dll \"\")))

;; Returns the ProgID for a given ClassID if found in registry
(defun ProgID->ClassID (ProgID)
  (vl-registry-read (strcat "HKEY_CLASSES_ROOT\\" progid "\\CLSID")))
)

;; Registers ObjectDBX (if not already), Returns ProgID if successful
(defun DBX-Register ( / classname)
  (setq classname "ObjectDBX.AxDbDocument.18")
  (cond
    ( (ProgID->ClassID classname) )
    ( (and
        (setq server (findfile "AxDb.dll"))
        (DLLRegister server)
        (ProgID->ClassID classname)
      )
      (ProgID->ClassID classname)
    )
    ( (not (setq server (findfile "AxDb.dll")))
      (alert "Error: Cannot locate AxDb.dll...")
    )
    ( T
      (DLLRegister "ObjectDBX.AxDbDocument.18")
      (or
        (ProgID->ClassID "ObjectDBX.AxDbDocument.18")
        (alert "Error: Failed to register ObjectDBX...")
      )
    )
  )
)
)
```

Figure 14-1 – Visual LISP functions to load the ObjectDBX interface.

The (`dllregister`) function is a general-purpose tool you can use to perform a Windows DLL registration on a client using the REGSVR32 command through a shell operation. The /S parameter denotes a silent registration which suppresses any notifications during the registration process.

The `(dllunregister)` function performs the opposite of `(dllregister)`, whereby it removes a DLL's registration from a local machine. This is often useful for removing a DLL when you need to register an updated version of the same DLL.

The `(progid->classid)` function performs a look-up of a given class registration in the Windows Registry and returns the GUID, which is a lengthy encoded unique identifier for a given ActiveX component. No two GUID values are the same as they are generated by a complex hashing algorithm during compilation. This particular function verifies that a given DLL has been registered by checking for its GUID in the registry. If no GUID is found, the DLL has not been registered yet, and this returns *nil*. Then you can use `(dllregister)` to register the DLL on the client machine.

The following function in Figure 14.1A opens a remote drawing document and returns the DBX document object if successful, otherwise it returns *nil*. You can use this function to take care of the messy stuff and simply use the returned document object to perform any operations you desire.

```
(defun DBX-doc-open (filename / dbxdoc)
  (cond
    ( (findfile filename)
      (if (not (DBX-Register))
        (exit)
      )
      (setq dbxdoc
        (vla-getinterfaceobject
          (vlax-get-acad-object) "ObjectDBX.AxDbDocument.18"))
      (cond
        ( (vl-catch-all-error-p
          (vl-catch-all-apply
            'vla-Open (list dbxdoc (findfile filename))
          )
        )
          (princ "\nUnable to open drawing.")
          (exit)
        )
        ( T dbxdoc )
      )
    )
  )
)
```

Figure 14-1A – ObjectDBX Document Opening Function

Now you have a nice little black-box function to open drawings remotely, so you can move on to wrapping inside bigger and better things, like returning table lists and so forth. You can also modify certain properties of remote drawings through DBX.

```

(defun DBX-GetTableList
  (filename tblname / dbxdoc out name)
  (cond
    ( (setq dbxdoc (DBX-doc-open filename))
      (vlax-For tblItem (DBX-TableGet tblName dbxdoc)
        (setq name (vla-get-Name tblItem))
        (if (/= (substr name 1 1) "")
          (setq out (cons name out))
        )
      )
    )
    (vlax-release-object dbxdoc)
  )
  ( T
    (strcat (princ "\nUnable to open file: " filename))
  )
  )
  (if out (reverse out))
)

(defun DBX-TableGet (tName object)
  (cond
    ( (= (strcase tName) "BLOCKS")      (vla-get-Blocks      object) )
    ( (= (strcase tName) "LAYERS")      (vla-get-Layers      object) )
    ( (= (strcase tName) "TEXTSTYLES") (vla-get-textstyles object) )
    ( (= (strcase tName) "DIMSTYLES")   (vla-get-dimstyles  object) )
    ( (= (strcase tName) "LINETYPES")   (vla-get-linetypes  object) )
    ( (or
      (= (strcase tName) "PLOTCONFIGURATIONS")
      (= (strcase tName) "PAGESETUPS")
    )
      (vla-get-plotconfigurations object)
    )
    ( (= (strcase tName) "LAYOUTS") (vla-get-Layouts object) )
    ( (= (strcase tName) "GROUPS") (vla-get-Groups object) )
    ( T
      (vl-exit-with-error
        "\n(dbx-dwgscan error): Invalid table name specified.")
      )
    )
  )
)

```

Figure 14-2 – Visual LISP functions for using ObjectDBX to inspect drawing tables.

An example of using the code in Figure 14-2 is to query the LAYERS table in another drawing. The syntax for doing this would be as follows:

```

(dbx-gettablelist "c:\\\\users\\dstein\\drawings\\sample1.dwg" "LAYERS")

```

Returns: ("0" "Alpha" "Beta" "Gamma" "Delta" "Epsilon")

The functions shown in Figure 14-2 use the ObjectDBX "Open" method to access a given drawing file and access a given table collection within it. Among the limitations of using ObjectDBX is that you cannot access tables within any drawings you have opened in your AutoCAD Documents collection, as this will generate an error. ObjectDBX enables access even if a drawing is opened by another user, as long as it is not opened by the user that is requesting to open the drawing through an ObjectDBX interface.

```
(defun DWGSCAN
  ($table $name $dwgfiles / $files $dwgs $path $collection n out)
  (cond
    ( (and $table $name $dwgfiles)
      (princ
        (strcat
          "\nScanning "
          (itoa (length $dwgfiles))
          " drawings for "
          (strcase (substr $table 1 (1- (strlen $table))) t)
          " [" $name "]"...)
        )
      )
    (foreach n $dwgfiles
      (cond
        ( (setq $collection (DBX-GetTableList n $table))
          (cond
            ( (member (strcase $name) (mapcar 'strcase $collection))
              (setq out (cons n out))
            )
          )
          (setq $collection nil)
        )
        ( T
          (princ
            "\nUnable to query table collection in drawing.")
          )
        )
      )
    )
    ( T (princ "\nUsage: (DWGSCAN tablename itemname drawingfiles)"))
  )
  (if out (reverse out))
)
```

Figure 14-3

Figure 14-3 shows a function that uses the functions in Figures 14-1 and 14-2 to perform a search of a list of drawings for a specified table item. If you load the example file `dbx-dwgscan.lsp` into your AutoCAD session, you can use the `(dwgscan)` function to search for items in other drawings. The example below demonstrates using `(dwgscan)` to search a list of drawings for a block named "Chair123".

```
Command: (dwgscan "Blocks" "Chair123" dwgfiles)
```

Scanning 51 drawings for block [Chair123]...

```
("c:\\drawings\\plan003.DWG" "c:\\drawings\\plan004.DWG" "c:\\drawings\\plan005.DWG")
```

Some things to note about using ObjectDBX services from Visual LISP:

- You cannot perform selection set operations on drawings through DBX. Only table operations can be used.
- You cannot open any documents that are opened in the Documents collection of the AutoCAD session performing the DBX operation.
- ObjectDBX does not support using any "command" operations on documents.
- Be sure to release a DBX object when finished using it, and use `(gc)` following any object release of an external process (external to the AutoCAD namespace).

The document interface exposed through ObjectDBX is quite a bit more restrictive than that of a document object internal to a given AutoCAD editing session. Below is a table of the exposed properties and methods of an ObjectDBX Document object. You can see this yourself by performing `(vlax-dump-object)` on an active DBX document object, such as that returned by the `(DBX-Doc-Open)` function shown above.

Some interesting notes: Document-centric system variables are not exposed. The Application object is also not present as the document is not actually opened in the Application namespace in a manner like a drawing opened for editing. The Name property is NOT read-only. Notice the methods that are available.

```
; IAxDbDocument: IAxDbDocument Interface  
; Property values:  
; Application (RO) = Exception occurred
```

```

; Blocks (RO) = #<VLA-OBJECT IAcadBlocks 037aad64>
; Database (RO) = #<VLA-OBJECT IAcadDatabase 037ac634>
; Dictionaries (RO) = #<VLA-OBJECT IAcadDictionaries 037a8a34>
; DimStyles (RO) = #<VLA-OBJECT IAcadDimStyles 037a8954>
; ElevationModelSpace = 0.0
; ElevationPaperSpace = 0.0
; Groups (RO) = #<VLA-OBJECT IAcadGroups 037acd24>
; Layers (RO) = #<VLA-OBJECT IAcadLayers 037acc44>
; Layouts (RO) = #<VLA-OBJECT IAcadLayouts 037acba4>
; Limits = (0.0 0.0 12.0 9.0)
; Linetypes (RO) = #<VLA-OBJECT IAcadLineTypes 037a8e84>
; ModelSpace (RO) = #<VLA-OBJECT IAcadModelSpace 037a8dd4>
; Name = "C:\\Documents and Settings\\dave\\My Documents\\DRAWING3.dwg"
; PaperSpace (RO) = #<VLA-OBJECT IAcadPaperSpace 037a8d24>
; PlotConfigurations (RO) = #<VLA-OBJECT IAcadPlotConfigurations 037a8bf4>
; Preferences (RO) = #<VLA-OBJECT IAcadDatabasePreferences 037ac694>
; RegisteredApplications (RO) = #<VLA-OBJECT IAcadRegisteredApplications 037a8b34>
; TextStyles (RO) = #<VLA-OBJECT IAcadTextStyles 037a93a4>
; UserCoordinateSystems (RO) = #<VLA-OBJECT IAcadUCSs 037a92f4>
; Viewports (RO) = #<VLA-OBJECT IAcadViewports 037a91e4>
; Views (RO) = #<VLA-OBJECT IAcadViews 037a9124>
; Methods supported:
; CopyObjects (3)
; DxfIn (2)
; DxfOut (3)
; HandleToObject (1)
; ObjectIdToObject (1)
; Open (1)
; RegisterLicenseObject (2)
; RevokeLicenseObject (1)
; Save ()
; SaveAs (1)

```

ObjectDBX is indeed a cool puppy to play with. When most programmers discover it and learn what it

can do, they immediately ask if it's available for use outside of AutoCAD. Well, yes, it is, but it's *very* expensive to license from Autodesk for an individual developer.

Chapter 15 – XDATA and XRECORDs

AutoCAD provides a few ways to store information in drawings that is non-graphical. This can include a variety of data types such as numbers, text and so forth. Of these, the two most common are Extended Entity Data (EED) and Dictionaries. The most common form of EED is XDATA, which is an extension of all graphical entities as well as many table objects such as Layers and Linetypes. This allows you to store hidden (non-graphical) information within these entities or table objects and retrieve the information when required.

Another form of storing non-graphical information is through the use of XRECORD objects. XRECORD objects are part of the Document object and allow you to store string information within a Dictionary collection.

The advantages of using XDATA are that the information is attached to a specific entity or table member. The advantages to using XRECORD objects is that they are attached to the Document itself, and not to any particular entity or table object. In addition, XDATA has certain limits on the size of the data that can be stored on a given entity or table member. XRECORD objects do not impose any size limitation on data storage, but it does affect the DWG file size, and memory requirements when the drawing is opened.

Working with XDATA

Xdata can be attached to and retrieved from any graphical entity in a drawing, as well as many table objects, such as layers, layouts and linetypes. Xdata divides information storage by the data type, so you have to be aware of the type of information you intend to store whenever you attach it to anything, as well as when you attempt to retrieve it. For example, if you attach an integer value to an entity and attempt to retrieve it as though it were a string value, you will not get the desired results.

Working with XRECORD Objects

XRECORD objects are maintained as a Dictionary, meaning they have a unique name and are accessed by that name. They are attached to the document object itself, not to any graphic objects or tables as is the case with Xdata. Xrecords are stripped from a drawing if it is saved back to R12 or often when converted to another CAD format that does not support them.

Because XRECORD objects are attached to the document, they are safe from casual deletion by users. For example, if you attach XDATA to a layer, and that layer is purged, the XDATA is then released as well. You can attach XDATA to layer "0" to prevent this, however, XDATA still imposes limits on data type and data size that can be stored.

Xrecords can only be created, renamed or deleted. There are no direct methods for modifying them. The only way to modify an Xrecord is to retrieve its contents, delete the Xrecord from the dictionary object, and recreate a new Xrecord with new data. The following functions demonstrate how to do this using standard AutoLISP.

```
(defun Xrecord-Rebuild (name dat)
  (Xrecord-Delete name)
  (Xrecord-Add name dat)
)

(defun Xrecord-Get (name / xlist)
  (if (setq xlist (dictsearch (namedobjdict) name))
      (cdr (assoc 1 xlist))
  )
)

(defun Xrecord-Delete (name)
  (dictremove (namedobjdict) name); remove from dictionary
)

(defun Xrecord-Add
  (name sdata / xrec xname)
  (setq xrec
    (list
      (cons 0 "XRECORD")
      (cons 100 "AcDbXrecord")
      (cons 1 sdata)
      (cons 62 1)
    )
  )
)
```

```

(setq xname (entmakex xrec)); rebuild xrecord
(dictadd (namedobjdict) name xname); return to dictionary
(princ)
)

```

The problem with the above form is that it uses (entmake) and can sometimes cause problems in AutoCAD when mixed with certain other ActiveX functions. A more appropriate form would be the ActiveX approach as shown in the examples below.

```

(vl-load-com)

```

```

(defun Xrecord-Rebuild (dict name data)
  (Xrecord-Delete dict name)
  (Xrecord-Add dict name data)
)

```

```

(defun Xrecord-Get
  (dict name / acadapp doc dcs odc xrec #typ #dat out)
  (setq acadapp (vlax-get-acad-object))
  doc (vla-get-ActiveDocument acadapp)
  dcs (vla-get-Dictionaries doc)
)
(cond
  ( (setq odc (dsx-item dcs dict))
    (cond
      ( (setq xrec (dsx-item odc name))
        (vla-getXrecordData xrec '#typ '#dat)
        (setq #typ (vlax-Safearray->list #typ)
              #dat (vlax-Safearray->list #dat))
        )
      (setq out (mapcar 'vlax-variant-value #dat))
      (vlax-release-object odc)
    )
  )
  (vlax-release-object dcs)
)

```

```

    )
  )
  out
)

```

```

(defun Xrecord-Delete (dict name / dcs odc xr)
  (setq dcs (vla-get-dictionaries active-doc))
  (cond
    ( (setq odc (dsx-item dcs dict))
      (cond
        ( (setq xr (dsx-item odc name))
          (vla-delete xr)
          (vlax-release-object xr)
        )
      )
      (vlax-release-object odc)
    )
  )
  (vlax-release-object dcs)
)

```

```

(defun Xrecord-Add
  (dict name data / acadapp doc dicts dict xrec #typ #dat)
  (setq acadapp (vlax-get-acad-object)
        doc (vla-get-ActiveDocument acadapp)
        dicts (vla-get-Dictionaries doc)
        dict (vlax-invoke-method dicts "Add" dict)
        xrec (vla-AddXrecord dict name)
  )
  (if (not (listp data)) (setq data (list data))); ensure list!
  (vla-setXrecordData xrec
    (List->VariantArray
      (List->IntList data)
      'vlax-vbInteger
    )
  )
)

```

```

)

(List->VariantArray data 'vlax-vbVariant)

)

(vla-getXrecordData xrec '#typ '#dat)

(setq #typ (vlax-Safearray->list #typ)
      #dat (vlax-Safearray->list #dat)

)

(mapcar 'vlax-variant-value #dat)

)

```

The two functions `(List->VariantArray)` and `(List->IntList)` are used to define the safearray contents and dimension respectively. They can be used for much more than this obviously. The second argument to `(List->VariantArray)` must be a single-quoted ActiveX data type declaration such as `'vlax-vbString`.

```

(defun List->VariantArray (lst datatype / arraySpace sArray)

  (setq arraySpace
        (vlax-make-safearray
          (eval datatype)
          (cons 0 (1- (length lst))))
  )

)

(setq sArray (vlax-Safearray-fill arraySpace lst))

(vlax-make-variant sArray)

)

(defun List->IntList (lst / n)

  (setq n 0)

  (mapcar (function (lambda (x) (setq n (1+ n)))) lst)

)

```

The other function `(dsx-item)` is used to fetch (or attempt to fetch) an item using the `Item` method of a collection. This function includes error catching in case the fetch fails, which returns an ActiveX error instead of something like *nil*. In this case, we trap an error and return *nil* if the fetch fails. Otherwise,

we return the object from the collection.

```
(defun DSX-Item (collection item / out)
  (if
    (not
      (vl-catch-all-error-p
        (setq out
          (vl-catch-all-apply 'vla-item (list collection item))
        )
      )
    )
    out ; return object or nil
  )
)
```

To demonstrate how to use this stuff we'll save an Xrecord in our current drawing with some information such as the current username (assuming we're on Windows NT, 2000 or XP) and some other information.

```
(setq username (getenv "username")); logged on user ID
machine (getenv "computername"); NETBIOS computer name
)

(Xrecord-Rebuild "PERSONAL" "UserData" (list username machine))
_$_ Returns ("DSTEIN1234" "W2K-1234")

(Xrecord-Get "PERSONAL" "UserData")
_$_ Returns ("DSTEIN1234" "W2K-1234")

(Xrecord-Rebuild "PERSONAL" "UserData" "1234")
_$_ Returns ("1234")
```

So, what can you do with Xrecords? Anything you want. They are very useful for storing information in a drawing that is not tied directly to any particular entity or table. If you are used to storing information in Xdata, you are probably aware that if the entity or table item is deleted the Xdata is lost. Of course, you can attach Xdata to things like Layer "0" or the like, so it never gets deleted. However, Xdata imposes limitations on contents that might be alleviated by switching to Xrecords instead.

Chapter 16– The AutoCAD Application Object

The AcadApplication object is the root of everything Visual LISP can address relating to ActiveX. This includes collections, properties, methods, events and derived objects that inherit from this base object. Remember, the ActiveX object model is a hierarchy of classes that allow for lower level classes to be derived that contain properties and methods of their parent classes. In order to gain access to anything within AutoCAD, you must first start by gaining access to AutoCAD itself, and then work your way down into whatever you need.

For example, if you want to access the Layers collection and fetch a particular layer, you must first get the AcadApplication object, then the ActiveDocument object, and then get the Layers collection from that object. One way to begin understanding the AcadApplication object is by dumping the object using the (vlax-dump-object) function. This function takes one required argument (the object) to request a list of its properties, and an optional flag, which if provided (and non-nil) requests a list of methods as well.

```
Command: (vlax-dump-object (vlax-get-acad-object) T)

; IAcadApplication: An instance of the AutoCAD application
; Property values:
;   ActiveDocument = #<VLA-OBJECT IAcadDocument 0f1e89b0>
;   Application (RO) = #<VLA-OBJECT IAcadApplication 01877c20>
;   Caption (RO) = "AutoCAD 2011 - UNREGISTERED VERSION - [Drawing1.dwg]"
;   Documents (RO) = #<VLA-OBJECT IAcadDocuments 11120b08>
;   FullName (RO) = "C:\\Program Files\\Autodesk\\AutoCAD 2011\\acad.exe"
;   Height = 726
;   HWND (RO) = 983660
;   LocaleId (RO) = 1033
;   MenuBar (RO) = #<VLA-OBJECT IAcadMenuBar 111172b4>
;   MenuGroups (RO) = #<VLA-OBJECT IAcadMenuGroups 0736a890>
;   Name (RO) = "AutoCAD"
;   Path (RO) = "C:\\Program Files\\Autodesk\\AutoCAD 2011"
;   Preferences (RO) = #<VLA-OBJECT IAcadPreferences 110ef5bc>
;   StatusId (RO) = ...Indexed contents not shown...
```

```

;   VBE (RO) = AutoCAD: Problem in loading VBA
;   Version (RO) = "18.1s (LMS Tech)"
;   Visible = -1
;   Width = 1020
;   WindowLeft = 2
;   WindowState = 1
;   WindowTop = 2
; Methods supported:
;   Eval (1)
;   GetAcadState ()
;   GetInterfaceObject (1)
;   ListArx ()
;   LoadArx (1)
;   LoadDVB (1)
;   Quit ()
;   RunMacro (1)
;   UnloadArx (1)
;   UnloadDVB (1)
;   Update ()
;   ZoomAll ()
;   ZoomCenter (2)
;   ZoomExtents ()
;   ZoomPickWindow ()
;   ZoomPrevious ()
;   ZoomScaled (2)
;   ZoomWindow (2)

```

Figure 16-1 – (vlax-dump-object) results on the AcadApplication object.

While you might expect the list of Properties, Collections and Methods to be much larger for the AcadApplication object, remember that the Object Model is a tree structure. This means that much of the complexity is delegated at multiple levels, such as down into the Documents collection, the Preferences collection and so forth. The items shown in Figure 16-1 apply *only* to the AcadApplication object and nothing else.

To demonstrate a tiny bit of what you can do with the AcadApplication object, load and run the following sample of code. This will minimize the AutoCAD session window and then maximize it after a short pause.

```
(defun MinMax ( / acadapp)
  (vl-load-com)
  (setq acadapp (vlax-get-acad-object))
  (vla-put-windowstate acadapp acMin)
  (vl-cmdf "DELAY" 1000)
  (vla-put-windowstate acadapp acMax)
  (vlax-release-object acadapp)
)
```

Minimizing AutoCAD can come in handy when you intend to write a program that launches another application. Quite often, AutoCAD will jump back to the front and hide the other application window because it attempts to regain "focus" from the Windows application stack. This doesn't always happen, but it happens frequently. One way to avoid this is to hide AutoCAD after you launch the other application. This will prevent it from popping back in front of the other application window.

```
(defun ShowNotepad (filename / acad fn)
  (vl-load-com)
  (cond
    ( (setq fn (findfile filename)); make sure file exists first
      (setq acadapp (vlax-get-acad-object))
      (vla-put-windowstate acadapp acMin)
      (vlax-release-object acadapp)
      (startapp "notepad.exe" fn)
    )
    ( T (princ (strcat "\nFile not found: " filename)) )
  )
)
```

Another solution is to use a third-party function such as the DOSlib function (`dos_exewait`) which launches another application and suspends AutoCAD until the other application session is terminated (closed).

TIP: The Path property of the AcadApplication object shows the path to where ACAD.EXE resides on the local machine. This can be used to get the actual installation path when performing modifications to the support files path list within the AcadPreferences *Files* collection.

Since Autodesk decided to follow Microsoft's lead and drop VBA support, the interesting behavior is that the VBE object is still visible from within the AcadApplication object, but it's broken. For example:

```
(vlax-dump-object (vla-get-vbe (vlax-get-acad-object)) t)
; error: Automation Error. Problem in loading VBA
```

Chapter 17 – AutoCAD Entities

AutoCAD Entities are graphical objects such as ARC, CIRCLE and LINE objects. The term entity is synonymous with graphical object in the context of ActiveX programming within AutoCAD. All entities are derived from the base class named `AcDbEntity`, which provides certain default properties and methods to all entities. Some default properties are Layer and Color, while some default methods are Copy and Delete.

Some properties are common to all objects. Some properties are common to groups of objects, but not all objects. Some properties are specific to a given object type. To access or modify object properties using Visual LISP, use the following examples:

(vla-get-propertyname object) where *propertyname* might be color or linetype. You can also use the alternate form **(vlax-get-property object propertyname)** if desired. These are interchangeable when it comes to working with AutoCAD objects.

(vla-put-propertyname object value) where *propertyname* might be color or linetype and *value* might be acRed or "dashed". You can also use the alternate form **(vlax-put-property object propertyname value)** if desired. Again, these are interchangeable when working with AutoCAD objects.

All Entities: Common Properties

Property	Description	Data Type	DXF
Application (RO)	AutoCAD session	Object (pointer)	
Color	Entity color	Integer/Enum	62 (transient)
Document (RO)	Parent document	Object (pointer)	
EntityTransparency	Opacity setting	String	
Handle	Entity Handle ID	String	5
HasExtensionDictionary (RO)	Has XDATA attached	Boolean	
Hyperlinks (RO)	Web links	Object (collection)	
Layer	Entity layer	String	8
Linetype	Entity linetype	String	6 (transient)
LinetypeScale	Entity linetype scale	Real/Double	48
Lineweight	Entity lineweight	Integer/Enum	370
Material	Material assignment	String	
ObjectID (RO)	Object ID value	Integer	
ObjectName (RO)	Name of Entity type	String	100 (multi)
OwnerID (RO)	Parent object	Integer	

Normal	Extrusion Vector	Array	210
PlotStyleName	Name of PlotStyle	String	
Thickness	Entity thickness	Real/Double	39 (transient)
TrueColor	RGB/Pantone Color Value	acCmColor/Object	
Visible	Toggles display	Boolean	60
Layout-Name		(N/A)	410
(N/A)	DXF Entity Name	Integer	0
(N/A)	DXF Space	Integer	67
(N/A)	DXF Xrecord Group	String	102 (paired)
(N/A)	DXF Material object Hard Pointer	String	347

** Depends upon use of Color-Based or Named plotstyles in active drawing.

Common Methods

Method	Description	Parameters
ArrayPolar	Polar Array	3
ArrayRectangular	Rectangular Array	6
Copy	Create a Copy	0
Delete	Delete entity	2
GetBoundingBox	Get Diagonal Bounding Point Coordinates	0
GetExtensionDictionary	Query if object has an Xrecord attached	3
GetXData	Query Xdata from object	1
Highlight	Highlight object display	1
IntersectWith	Intersect with another object/entity	2
Mirror	Mirror about 2 dimensional axis points	2
Mirror3D	Mirror about 3 dimensional axis points	3
Move	Relocate	2
Offset	Create offset duplicate	1
Rotate	Rotate about 2 dimensional point	2
Rotate3D	Rotate about 3 dimensional axis points	3
ScaleEntity	Scale geometry	2
SetXData	Attach Xdata to object	2
TransformBy		1
Update	Update entity properties list	0

ARC

Property	Description	Data Type
ArcLength (R0)	Perimeter length	Double
Area	Enclosed area	Double
Center	Center Point	Array
EndAngle	Ending Angle	Double
EndPoint	End Point	Array
Radius	Radius value	Double
StartAngle	Starting Angle	Double

StartPoint	Start point	Array
TotalAngle (RO)	Total angle in radians	Double

Special notes about ARC objects:

You cannot change the start point of an arc or ellipse. To edit an arc, use the EndAngle and Radius properties. To edit an ellipse, use the EndAngle, MajorAxis, and RadiusRatio properties.

The Area property is calculated in square drawing units as though it were closed by a vector from the startpoint to the endpoint. This is not the same as the area of a circular segment, which would include the area from the centerpoint out to the perimeter as a portion of the total circular area.

BlockReference (Insert)

Property	Description	Data Type
EffectiveName	Short name	String
InsertionPoint	Basepoint	Array/Doubles
InsUnits (RO)	Units name	String
InsUnitsFactor (RO)	Units factor / multiple	Double
IsDynamicBlock (RO)	Dynamic Block	Boolean
Name	Base name	String
Rotation	Rotation angle	Double
XEffectiveScaleFactor	Scale factor X result	Double
XScaleFactor	Scale factor X	Double
YEffectiveScaleFactor	Scale factor Y result	Double
YScaleFactor	Scale factor Y	Double
ZEffectiveScaleFactor	Scale factor Z result	Double
ZScaleFactor	Scale factor Z	Double

Methods

ConvertToAnonymousBlock
 ConvertToStaticBlock (1)
 Explode
 GetAttributes
 GetConstantAttributes
 GetDynamicBlockProperties
 ResetBlock

CIRCLE

Property	Description	Data Type
Area	Enclosed area	Double
Center	Center Point	Array
Circumference	Distance around circle	Double
Diameter	Diameter value	Double
Radius	Radius value	Double

DIMENSION: ANGULAR

Property	Description	Data Type
AngleFormat	Angle format	Integer
Arrowhead1Block	Arrowhead 1 block name	String
Arrowhead1Type	Arrowhead 1 type	Integer
Arrowhead2Block	Arrowhead 2 block name	String
Arrowhead2Type	Arrowhead 2 type	Integer
ArrowheadSize	Arrowhead size (length)	Double
DecimalSeparator	Decimal separator character	String
DimConstrDesc		String
DimConstrExpression		
DimConstrForm		Integer
DimConstrName		String
DimConstrReference		Integer
DimConstrValue		
DimensionLineColor	Dimension line color	Integer
DimensionLinetype	Dimension linetype	String
DimensionLineWeight	Dimension lineweight	Integer
DimLine1Suppress	Suppress dimension line 1	Integer
DimLine2Suppress	Suppress dimension line 2	Integer
DimLineInside	Dimension line inside	Integer
DimTxtDirection	Text direction	Integer
ExtensionLineColor	Extension line color	Integer
ExtensionLineExtend	Extension line extend distance	Double
ExtensionLineOffset	Extension line offset	Double
ExtensionLineWeight	Extension line lineweight	Integer
ExtLine1EndPoint	Extension line 1 endpoint	Array/Doubles
ExtLine1Linetype	Extension line 1 linetype	String
ExtLine1StartPoint	Extension line 1 startpoint	Array/Doubles
ExtLine1Suppress	Extension line 1 suppress	Integer
ExtLine2EndPoint	Extension line 2 endpoint	Array/Doubles
ExtLine2Linetype	Extension line 2 linetype	String
ExtLine2StartPoint	Extension line 2 startpoint	Array/Doubles
ExtLine2Suppress	Extension line 2 suppress	Integer
ExtLineFixedLen	Extension line fixed length	Double
ExtLineFixedLenSuppress	Extension line fixed length suppress	Integer
Fit	Dimension fit mode	Integer
ForceLineInside	Force inside dimension line	Integer
HorizontalTextPosition	Horizontal text position	Integer
Measurement (RO)	Measurement value	Double
StyleName	Dim stylename	String
SuppressLeadingZeros	Suppress leading zero values	Integer
SuppressTrailingZeros	Suppress trailing zero values	Integer
TextColor	Text color	Integer
TextFill	Text fill	Integer
TextFillColor	Text fill color	Integer
TextGap	Text gap	Double

TextHeight	Text height	Double
TextInside	Text inside mode	Integer
TextInsideAlign	Text inside alignment	Boolean
TextMovement	Text movement type	Integer
TextOutsideAlign	Text outside alignment	Boolean
TextOverride	Text override value	String
TextPosition	Text position location	Array/Doubles
TextPrecision	Text precision scope	Integer
TextPrefix	Text prefix value	String
TextRotation	Text rotation angle	Double
TextStyle	Text style name	String
TextSuffix	Text suffix value	String
ToleranceDisplay	Tolerance display mode	Integer
ToleranceHeightScale	Tolerance height scaling	Double
ToleranceJustification	Tolerance justification type	Integer
ToleranceLowerLimit	Tolerance lower limit value	Double
TolerancePrecision	Tolerance precision scope	Integer
ToleranceSuppressLeadingZeros	Suppress tolerance leading zero values	Integer
ToleranceSuppressTrailingZeros	Suppress tolerance trailing zero values	Integer
ToleranceUpperLimit	Tolerance upper limit value	Double
VerticalTextPosition	Vertical text position mode	Integer

DIMENSION: DIAMETER

Property	Description	Data Type
AltRoundDistance		Double
AltSuppressLeadingZeros		Integer
AltSuppressTrailingZeros		Integer
AltSuppressZeroFeet		Boolean
AltSuppressZeroInches		Boolean
AltTextPrefix		String
AltTextSuffix		String
AltTolerancePrecision		Integer
AltToleranceSuppressLeadingZeros		Integer
AltToleranceSuppressTrailingZeros		Integer
AltToleranceSuppressZeroFeet		Boolean
AltToleranceSuppressZeroInches		Boolean
AltUnits		Integer
AltUnitsFormat		Integer
AltUnitsPrecision		Integer
AltUnitsScale		Double
Arrowhead1Block		String
Arrowhead1Type		Integer
Arrowhead2Block		String
Arrowhead2Type		String
ArrowheadSize		Double
CenterMarkSize		Double
CenterType		Integer

DecimalSeparator	String
DimConstrDesc	
DimConstrExpression	
DimConstrForm	Integer
DimConstrName	
DimConstrReference	Integer
DimConstrValue	
DimensionLineColor	Integer
DimensionLinetype	String
DimensionLineWeight	Integer
DimLine1Suppress	Integer
DimLine2Suppress	Integer
DimTxtDirection	Integer
Fit	Integer
ForceLineInside	Integer
FractionFormat	Integer
LeaderLength (R0)	
LinearScaleFactor	Double
Measurement (R0)	Double
Normal = (0.0 0.0 1.0)	Array/Doubles
PrimaryUnitsPrecision	Integer
RoundDistance	Double
StyleName	String
SuppressLeadingZeros	Integer
SuppressTrailingZeros	Integer
SuppressZeroFeet	Boolean
SuppressZeroInches	Boolean
TextColor	Integer
TextFill	Integer
TextFillColor	Integer
TextGap	Double
TextHeight	Double
TextInside	Integer
TextInsideAlign	Boolean
TextMovement	Integer
TextOutsideAlign	Boolean
TextOverride	String
TextPosition	Array/Doubles
TextPrefix	String
TextRotation	Double
TextStyle	String
TextSuffix	String
ToleranceDisplay	Integer
ToleranceHeightScale	Double
ToleranceJustification	Integer
ToleranceLowerLimit	Double
TolerancePrecision	Integer
ToleranceSuppressLeadingZeros	Integer
ToleranceSuppressTrailingZeros	Integer

ToleranceSuppressZeroFeet	Boolean
ToleranceSuppressZeroInches	Boolean
ToleranceUpperLimit	Double
UnitsFormat	Integer
VerticalTextPosition	Integer

DIMENSION: LINEAR

Property	Description	Data Type
AltRoundDistance		Double
AltSubUnitsFactor		Double
AltSubUnitsSuffix		String
AltSuppressLeadingZeros		Integer
AltSuppressTrailingZeros		Integer
AltSuppressZeroFeet		Boolean
AltSuppressZeroInches		Boolean
AltTextPrefix		String
AltTextSuffix		String
AltTolerancePrecision		Integer
AltToleranceSuppressLeadingZeroes		Integer
AltToleranceSuppressTrailingZeroes		Integer
AltToleranceSuppressZeroFeet		Boolean
AltToleranceSuppressZeroInches		Boolean
AltUnits		Integer
AltUnitsFormat		Integer
AltUnitsPrecision		Integer
AltUnitsScale		Double
Arrowhead1Block		String
Arrowhead1Type		Integer
Arrowhead2Block		String
Arrowhead2Type		Integer
ArrowheadSize		Double
DecimalSeparator		String
DimensionLineColor		Integer
DimensionLineExtend		Double
DimensionLinetype		String
DimensionLineWeight		Integer/Enum
DimLine1Suppress		Integer/Boolean
DimLine2Suppress		Integer/Boolean
DimLineInside		Integer
DimTxtDirection		Integer
ExtensionLineColor		Integer/Enum
ExtensionLineExtend		Double
ExtensionLineOffset		Double
ExtensionLineWeight		Integer/Enum
ExtLine1Suppress		Boolean
ExtLine2Suppress		Boolean
ExtLineFixedLen		Integer

ExtLineFixedLenSuppress		Integer
Fit		Integer
ForceLineInside		Integer
FractionFormat		Integer/Enum
HorizontalTextPosition		Integer/Enum
LinearScaleFactor		Double
Measurement (R0)		Double
PrimaryUnitsPrecision		Integer
Rotation		Double
RoundDistance		Double
ScaleFactor	Scaling factor value	Double
StyleName	DimStyle name	String
SubUnitsFactor		Double
SubUnitsSuffix		String
SuppressLeadingZeroes		Integer
SuppressTrailingZeroes		Integer
SuppressZeroFeet		Integer
SuppressZeroInches		Integer
TextColor	Text color	Integer/Enum
TextFill	Fill mode	Integer
TextGap	Gap distance	Double
TextHeight	Text height	Double
TextInside		Integer
TextInsideAlign		Integer/Enum
TextMovement	Text movement	Integer
TextOutsideAlign		Integer
TextOverride	Override string	String
TextPosition	Text position	Array
TextPrefix	Prefix string value	String
TextRotation	Rotation (radians)	Double
TextStyle	Name of text style	String
TextSuffix	Suffix string value	String
ToleranceDisplay		Integer
ToleranceHeightScale		Double
ToleranceJustification		Integer/Enum
ToleranceLowerLimit		Double
TolerancePrecision	Digits of precision	Integer
ToleranceSuppressLeadingZeroes		Integer/Boolean
ToleranceSuppressTrailingZeroes		Integer/Boolean
ToleranceSuppressZeroFeet		Integer/Boolean
ToleranceSuppressZeroInches		Integer/Boolean
UnitsFormat		Integer/Enum
VerticalTextPosition		Integer/Enum

Notes Regarding Rotated Dimension Objects:

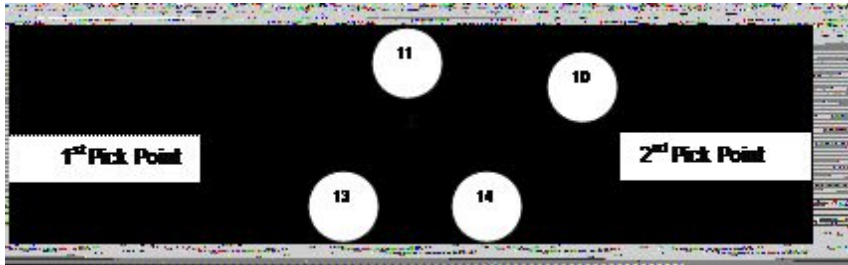
Control points for extension lines and dimension lines are not exposed through ActiveX. To obtain these control points you must use the DXF entity codes 10, 11, 13, and 14. They are described as follows:

13 = Start point of first extension line (first control point)

14 = Start point of second extension line (second control point)

11 = Middle-Center point of MTEXT label

10 = Arrowhead point of second dimension line



ELLIPSE

Property	Description	Data Type
Area	Enclosed area	Double
Center	Center Point	Array
Diameter	Diameter value	Double
EndAngle	End Angle (Arc)	Double
EndParameter	End Parameter	
EndPoint (RO)	Endpoint (Arc)	Array
MajorAxis	Axis Endpoint	Array/Doubles
MajorRadius	Major Radius	Double
MinorAxis	Axis Endpoint	Array/Doubles
MinorRadius	Minor Radius	Double
RadiusRatio	Ratio of Major/Minor	Double
StartAngle	Start Angle (Arc)	Double
StartParameter	Start parameter	
StartPoint (RO)	Start Point (Arc)	Array

Notes regarding ELLIPSE objects:

If the Ellipse is closed, the StartAngle value is 0 and the EndAngle value is 2π .

You cannot change the Startpoint or Endpoint properties of an Ellipse.

HATCH

Property	Description	Data Type
Area	Region area	Double
AssociativeHatch	Type	Boolean
BackgroundColor	Background fill color	Object

GradientAngle	Angle of linear gradient	Double
GradientCentered	Radial gradient	Boolean
GradientColor1	Color of gradient start	Object
GradientColor2	Color of gradient end	Object
GradientName	Name of gradient fill	String
HatchObjectType	Type of hatch	Integer
HatchStyle	Style assignment	Integer
ISOPenWidth	Pen assignment	Integer
NumberOfLoops (RO)	Loop quantity	Integer
Origin	Origin coordinate	Array (2D point)
PatternAngle	Angle of hatch pattern	Double
PatternDouble		Integer
PatternName (RO)	Name of hatch pattern	String
PatternScale	Scale of pattern fill	Double
PatternSpace	Spacing of pattern fill	Double
PatternType (RO)	Type of pattern	Integer

Methods

AppendInnerLoop
AppendOuterLoop
Evaluate
GetLoopAt
InsertLoopAt
SetPattern

LEADER

Property	Description	Data Type
ArrowheadBlock	Name of block	String
ArrowheadSize	Length of arrowhead	Double
ArrowheadType	Type assignment	Integer
Coordinate		
Coordinates	Array of points	Array
DimensionLineColor	Color number	Integer
DimensionLineWeight	Lineweight setting	Integer/Enum
ScaleFactor	Scale	Double
StartPoint	Start Point	Array
StyleName	Name of DimStyle	String
TextGap	Gap distance	Double
Type	Leader type	Integer
VerticalTextPosition	Vertical text option	Integer

Methods

Evaluate

LINE

Property	Description	Data Type
Angle (RO)	Angle	Double
Delta (RO)	Offset X and Y	Array

EndPoint	End Point	Array
Length (RO)	Length	Double
StartPoint	Start Point	Array

LWPOLYLINE

Property	Description	Data Type
Area	Enclosed Area	Double
Closed	Closed flag	Integer/Boolean
ConstantWidth	Default width	Double
Coordinate		Array
Coordinates	Vertices List	Array/Doubles
Elevation	Z-elevation	Double
LinetypeGeneration	Linetype Gen flag	Integer/Boolean
Type	Curve Fit Type	Integer/Enum

Methods

AddVertex
Explode
GetBulge
GetWidth
SetBulge
SetWidth

Notes regarding LwPolyline entities:

Breaking a LwPolyline results in the remaining pieces being converted into PolyLine entities. The TYPE property is transient, meaning that if the entity has not been curve-fitted (spline, bezier, cubic) this property is not exposed. Once a curve-fitting is applied, the TYPE property is available.

MLINE

Property	Description	Data Type
Coordinates	Vertices List	Array/Doubles
Justification	Justification setting	Integer
MlineScale	Scale factor	Double
StyleName	Name of MLINE style	String

NOTE: Deprecated Mline properties: Angle, EndPoint, StartPoint, Delta, Length

MTEXT

Property	Description	Data Type
AttachmentPoint	Basepoint	Array
BackgroundFill	Background region fill	Integer
DrawingDirection	Text Flow	Integer/Enum
LineSpacingDistance	Distance of line spacing	Double

LineSpacingFactor	Row Spacing Factor	Double
LineSpacingStyle	Mode to apply factor	Integer/Enum
Rotation	Rotation Angle	Double
StyleName	Style Name	String
TextString	String Value	String
Width	Frame Width	Double

Methods

FieldCode

Rotate3

Notes Regarding MTEXT objects:

Linespacing is factored using the base Height value. When varying heights are used in a given string, the LineSpacingFactor property is applied against the base Height property value only.

Fraction stacking behavior is controlled by the TSTACKSIZE and TSTACKALIGN system variables. TSTACKSIZE is an integer that denotes "per 100" or percentage of text height the size of the fraction is. A value of 70 denotes (0.7 * Height). TSTACKALIGN controls how stacking is applied. 0=no stacking, 1=diagonal (e.g. $\frac{1}{4}$), 2=vertical (e.g. horizontal bar).

Formatting Control Codes:

"\\P" denotes line-feed/carriage return

"\\S" denotes fraction stack begin grouping

"\\A" denotes relative height change (using relative factor against base Height property)

POINT

Property Description Data Type

CoordinatesBasepoint Array

Notes Regarding POINT Entities:

The display of POINT entities is controlled by the PDMODE system variable. A setting of 1 hides them. A setting of 0 or another positive number displays them with various symbol types. The PDSIZE system variable controls the relative size of POINT symbols with respect to the zoom factor.

POLYLINE

Property	Description	Data Type
Area (RO)	Enclosed Area	Double

Closed	Closed flag	Integer/Boolean
ConstantWidth	Default width	Double
Coordinate		Array
Coordinates	Vertices List	Array/Doubles
Elevation	Z-elevation	Double
Length (R0)	Overall length	Double
LinetypeGeneration	Linetype Gen flag	Integer/Boolean
Type	Curve Fit Type	Integer/Enum

Methods

AddVertex
Explode
GetBulge, SetBulge
GetWidth, SetWidth

NOTE: The Polyline "type" property has been deprecated

RasterImage

Property	Description	Data Type
Brightness	Brightness level	Integer
ClippingEnabled	Toggle clipping	Boolean
Contrast	Contrast level	Integer
Fade	Fade level	Integer
Height	Height value	Double
ImageFile	Filename and path	String
ImageHeight	Height of image	Double
ImageVisibility	Toggle display	Boolean
ImageWidth	Width of image	Double
Name	Image name	String
Origin	Basepoint insert	Array/Doubles
ShowRotation	Display rotation	Boolean

Methods

ClipBoundary

RAY

Property	Description	Data Type
BasePoint	Base point	Array/Doubles
DirectionVector	Vector Axis Point	Array/Doubles
SecondPoint	Pick Point	Array/Doubles

SOLID

Property	Description	Data Type
Coordinate ?		Array
Coordinates	Vertices List	Array/Doubles

SPLINE

Property	Description	Data Type
Area (RO)	Bounded regional area	Double
Closed (RO)	Is closed?	Boolean
Closed2		Boolean
ControlPoints	Array of frame points	Array/Doubles
Degree (RO)		
Degree2		
EndTangent	3D coordinate	Array/Doubles
FitPoints	Array of fit points	Array/Doubles
FitTolerance	Precision	Double
IsPeriodic (RO)	Periodic spline?	Boolean
IsPlanar (RO)	Planar spline?	Boolean
IsRational (RO)	Rational spline?	Boolean
KnotParameterization		Integer
Knots		Array/Doubles
NumberOfControlPoints (RO)	Number of points	Integer
NumberOfFitPoints (RO)	Number of points	Integer
SplineFrame	Frame type	Integer
SplineMethod		
StartTangent		Array/Doubles
Weights		Object
Methods		
AddFitPoint		
DeleteFitPoint		
ElevateOrder		
GetControlPoint		
GetFitPoint		
GetWeight		
PurgeFitData		
Reverse		
SetControlPoint		
SetFitPoint		
SetWeight		

TEXT

Property	Description	Data Type
Alignment	Alignment Type	Integer/Enum
Backward	Backwards flag	Integer/Boolean
Height	Text Height	Double
InsertionPoint	Base Point	Array/Doubles
ObliqueAngle	Oblique angle	Double
Rotation	Rotation Angle	Double
ScaleFactor	Width Factor	Double
StyleName	Text Style Name	String
TextAlignmentPoint	Alignment Point	Array/Doubles

TextGenerationFlag	Generation Flag	Integer/Enum
TextString	String Value	String
UpsideDown		Integer/Boolean

Methods

FieldCode

TRACE

Property	Description	Data Type
Coordinate		
Coordinates	Vertices List	Array/Doubles

VIEWPORT

Property	Description	Data Type
ArcSmoothness	View Resolution	Integer
Center	Center Point	Array/Doubles
Clipped (RO)	Clipped Boundary	Integer/Boolean
CustomScale	Scale in Mspace	
Direction	View direction vector	Array/Doubles
DisplayLocked	Locked zoom/pan	Integer/Boolean
GridOn	Grid display	Integer/Boolean
Height	Height in Paperspace	Double
LensLength	Lens length value	Double
RemoveHiddenLines	Hide lines	Integer/Boolean
SnapBasePoint	Snap basepoint	Array/Doubles (2D)
SnapOn	Display snap	Integer/Boolean
SnapRotationAngle	Snap rotation angle	Double
StandardScale	ZoomXP factor	Integer/Enum
Target	Target vector point	Array/Doubles
TwistAngle	Twist Angle	Double
UCSIconAtOrigin	Show UCS origin	Integer/Boolean
UCSIconOn	Show UCS icon	Integer/Boolean
UCSPerViewport	UCS per viewport	Integer/Boolean
ViewportOn	Display Viewport	Integer/Boolean
Width	Width in Paperspace	Double

XLINE

Property	Description	Data Type
BasePoint	Pick Point 1	Array/Doubles
DirectionVector	Axis Direction Point	Array/Doubles
SecondPoint	Pick Point 2	Array/Doubles

TABLE

Property	Description	Data Type
AllowManualHeights	Allow dynamic row height adjustments	Integer
AllowManualPositions	Allow dynamic positioning	Integer
BreaksEnabled	Allow breaking of cell contents	Integer
BreakSpacing	Line spacing of cell-value breaks	Double
Columns	Number of columns	Integer
ColumnWidth (RO)	Array of column widths	Array
Direction	Up or Down row direction	Array
EnableBreak (RO)	Enable breaks	
FlowDirection	Row direction	Integer
HasSubSelection (RO)	Items selectable within table (boolean)	Integer
HeaderSuppressed	Table header suppressed	Integer
Height	Overall height	Double
HorzCellMargin	Margin distance	Double
InsertionPoint	Basepoint of insertion	Array
MinimumTableHeight (RO)	Minimum height of table	Array
MinimumTableWidth (RO)	Minimum width of table	Array
RegenerateTableSuppressed	Regeneration suppressed (boolean)	Integer
RepeatBottomLabels	Repeat bottom labels	Integer
RepeatTopLabels	Repeat top labels	Integer
RowHeight (RO)	Row height	Array
Rows	Number of rows	Integer
StyleName	Table style name	String
TableBreakFlowDirection	Up or Down break flow direction	Integer
TableBreakHeight	Table break height distance	Double
TableStyleOverrides (RO)	Style overrides (nil, if none)	String
TitleSuppressed	Suppress title	Integer
VertCellMargin	Vertical margin distance of cells	Double
Width	Table width	Double

Methods

ClearSubSelection ()
 ClearTableStyleOverrides (1)
 CreateContent (3)
 DeleteCellContent (2)
 DeleteColumns (2)
 DeleteContent (2)
 DeleteRows (2)
 EnableMergeAll (3)
 FormatValue (4)
 GenerateLayout ()
 GetAlignment (1)
 GetAttachmentPoint (2)
 GetAutoScale (2)
 GetAutoScale2 (3)
 GetBackgroundColor (1)
 GetBackgroundColorNone (1)
 GetBlockAttributeValue (3)
 GetBlockAttributeValue2 (4)
 GetBlockRotation (2)

GetBlockScale (2)
GetBlockTableRecordId (2)
GetBlockTableRecordId2 (3)
GetBoundingBox (2)
GetBreakHeight (1)
GetCellAlignment (2)
GetCellBackgroundColor (2)
GetCellBackgroundColorNone (2)
GetCellContentColor (2)
GetCellDataType (4)
GetCellExtents (3)
GetCellFormat (2)
GetCellGridColor (3)
GetCellGridLineWidth (3)
GetCellGridVisibility (3)
GetCellState (2)
GetCellStyle (2)
GetCellStyleOverrides (2)
GetCellTextHeight (2)
GetCellTextStyle (2)
GetCellType (2)
GetCellValue (2)
GetColumnName (1)
GetColumnWidth (1)
GetContentColor (1)
GetContentColor2 (3)
GetContentLayout (2)
GetContentType (2)
GetCustomData (4)
GetDataFormat (3)
GetDataType (3)
GetDataType2 (5)
GetExtensionDictionary ()
GetFieldId (2)
GetFieldId2 (3)
GetFormat (1)
GetFormula (3)
GetGridColor (2)
GetGridColor2 (3)
GetGridDoubleLineSpacing (3)
GetGridLineStyle (3)
GetGridLinetype (3)
GetGridLineWidth (2)
GetGridLineWidth2 (3)
GetGridVisibility (2)
GetGridVisibility2 (3)
GetHasFormula (3)
GetMargin (3)
GetMinimumColumnWidth (1)

GetMinimumRowHeight (1)
GetOverride (3)
GetRotation (3)
GetRowHeight (1)
GetRowType (1)
GetScale (3)
GetSubSelection (4)
GetText (2)
GetTextHeight (1)
GetTextHeight2 (3)
GetTextRotation (2)
GetTextString (3)
GetTextStyle (1)
GetTextStyle2 (3)
GetValue (3)
HitTest (4)
InsertColumns (3)
InsertColumnsAndInherit (3)
InsertRows (3)
InsertRowsAndInherit (3)
IntersectWith (2)
IsContentEditable (2)
IsEmpty (2)
IsFormatEditable (2)
IsMergeAllEnabled (2)
IsMergedCell (6)
MergeCells (4)
MoveContent (4)
RecomputeTableBlock (1)
RemoveAllOverrides (2)
ReselectSubRegion ()
ResetCellValue (2)
Select (8)
SelectSubRegion (10)
SetAlignment (2)
SetAutoScale (3)
SetAutoScale2 (4)
SetBackgroundColor (2)
SetBackgroundColorNone (2)
SetBlockAttributeValue (4)
SetBlockAttributeValue2 (5)
SetBlockRotation (3)
SetBlockScale (3)
SetBlockTableRecordId (4)
SetBlockTableRecordId2 (5)
SetBreakHeight (2)
SetCellAlignment (3)
SetCellBackgroundColor (3)
SetCellBackgroundColorNone (3)

SetCellContentColor (3)
SetCellDataType (4)
SetCellFormat (3)
SetCellGridColor (4)
SetCellGridLineWidth (4)
SetCellGridVisibility (4)
SetCellState (3)
SetCellStyle (3)
SetCellTextHeight (3)
SetCellTextStyle (3)
SetCellType (3)
SetCellValue (3)
SetCellValueFromText (4)
SetColumnName (2)
SetColumnWidth (2)
SetContentColor (2)
SetContentColor2 (4)
SetContentLayout (3)
SetCustomData (4)
SetDataFormat (4)
SetDataType (3)
SetDataType2 (5)
SetFieldId (3)
SetFieldId2 (5)
SetFormat (2)
SetFormula (4)
SetGridColor (3)
SetGridColor2 (4)
SetGridDoubleLineSpacing (4)
SetGridLineStyle (4)
SetGridLinetype (4)
SetGridLineWidth (3)
SetGridLineWidth2 (4)
SetGridVisibility (3)
SetGridVisibility2 (4)
SetMargin (4)
SetOverride (4)
SetRotation (4)
SetRowHeight (2)
SetScale (4)
SetSubSelection (4)
SetText (3)
SetTextHeight (2)
SetTextHeight2 (4)
SetTextRotation (3)
SetTextString (4)
SetTextStyle (2)
SetTextStyle2 (4)
SetToolTip (3)

SetValue (4)
SetValueFromText (5)
UnmergeCells (4)

Chapter 18 – Documents

Drawings are considered Documents in a general sense and this is how they are referred to from a programmatic point of view within AutoCAD as well as within most other ActiveX-enabled applications. Document objects are members of the Documents collection within AutoCAD.

To access the current drawing session you can request the `ActiveDocument` property of the `AcadApplication` object, without having to go to the Documents collection. However, if you need to access another document or iterate through all opened documents, you will need to access the Documents collection.

The Documents Collection

The Documents collection contains all opened documents in the active AutoCAD session. Each time you create or open another drawing, it is immediately added to this collection. Documents are normally entered into the Documents collection in the order they were opened. To navigate a collection, you can use the `(vlax-for)` function to process all members, or use the `(vla-Item)` method to access an individual member by index location or name if desired.

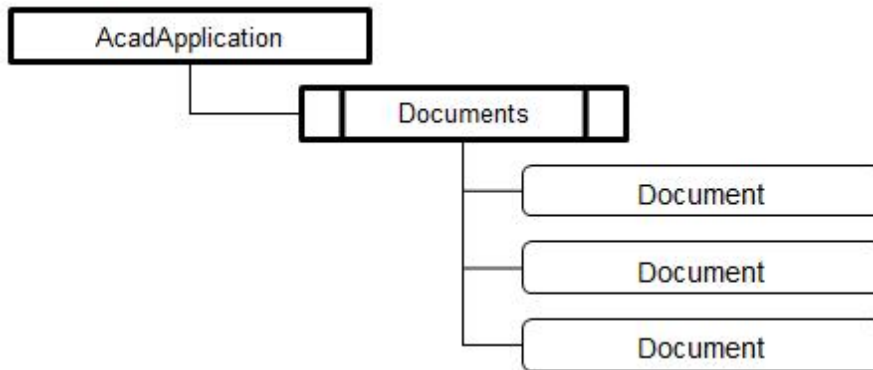


Figure 18-1 – The Documents collection and Document objects.

```
(defun Documents-ListAll ( / out)
  (vlax-for each (vla-get-documents (vlax-get-acad-object))
    (setq out (cons (vla-get-name each) out))
  )
  (if out (reverse out))
)
```

Figure 18-2

Figure 18-2 shows an example code snippet for retrieving a list of all opened document names in the current AutoCAD session. Using the (vlax-for) iteration function, which is almost identical to the AutoLISP (foreach) function, we can loop through the Documents collection and fetch the Name property of each document and produce a list output.

You could adapt this piece of code very easily to perform other tasks on each document, or to search the documents for a particular condition and act on them as a result.

What else can you do with the Documents collection? Well, let's begin by inspecting what properties and methods the Documents collection supports:

```
_$ (setq docs (vla-get-Documents acadapp))  
#<VLA-OBJECT IAcadDocuments 00f20440>  
  
_$ (vlax-dump-object docs T)  
; IAcadDocuments: The collection of all AutoCAD drawings open _  
in the current session  
; Property values:  
;   Application (RO) = #<VLA-OBJECT IAcadApplication 00a8a730>  
;   Count (RO) = 1  
; Methods supported:  
;   Add (1)  
;   Close ()  
;   Item (1)  
;   Open (2)
```

There are only two properties, but there are four methods. As I mentioned earlier, VLISP does not provide a means for modifying collection properties. It usually sports a set of methods for adding, accessing and deleting members within them however. In this case, the Add method is synonymous with the command NEW, and the Open method is, well, the same as the command OPEN.

To access an individual drawing that you have opened, you can use the Item method with either the name of the document or the index number (its position in the collection). I'll get the object for the "Drawing1.dwg" document that I happen to have opened right now:


```
_$ (setq dwg (vla-item docs "Drawing1.dwg"))  
#<VLA-OBJECT IAcadDocument 00ed1e0c>
```

Now I can inspect this document object to see what properties and methods it provides:

```
_$ Command: (vlax-dump-object dwg T)  
; IAcadDocument: An AutoCAD drawing  
; Property values:  
; Active (RO) = -1  
; ActiveDimStyle = #<VLA-OBJECT IAcadDimStyle 110ed974>  
; ActiveLayer = #<VLA-OBJECT IAcadLayer 110edb04>  
; ActiveLayout = #<VLA-OBJECT IAcadLayout 110edba4>  
; ActiveLinetype = #<VLA-OBJECT IAcadLineType 110edb54>  
; ActiveMaterial = #<VLA-OBJECT IAcadMaterial 110edbf4>  
; ActivePViewport = AutoCAD: No active viewport in paperspace  
; ActiveSelectionSet (RO) = #<VLA-OBJECT IAcadSelectionSet 11158d64>  
; ActiveSpace = 1  
; ActiveTextStyle = #<VLA-OBJECT IAcadTextStyle 110edc94>  
; ActiveUCS = AutoCAD: Null object ID  
; ActiveViewport = #<VLA-OBJECT IAcadViewport 110edd34>  
; Application (RO) = #<VLA-OBJECT IAcadApplication 01877c20>  
; Blocks (RO) = #<VLA-OBJECT IAcadBlocks 110edd84>  
; Database (RO) = #<VLA-OBJECT IAcadDatabase 11158ac4>  
; Dictionaries (RO) = #<VLA-OBJECT IAcadDictionaries 110edce4>  
; DimStyles (RO) = #<VLA-OBJECT IAcadDimStyles 110eddd4>  
; ElevationModelSpace = 0.0  
; ElevationPaperSpace = 0.0  
; FileDependencies (RO) = #<VLA-OBJECT IAcadFileDependencies 110d2eb4>  
; FullName (RO) = ""  
; Groups (RO) = #<VLA-OBJECT IAcadGroups 110ede74>  
; Height = 515  
; HWND (RO) = 2032484  
; Layers (RO) = #<VLA-OBJECT IAcadLayers 110edec4>  
; Layouts (RO) = #<VLA-OBJECT IAcadLayouts 110ede24>  
; Limits = (0.0 0.0 12.0 9.0)
```

```

; Linetypes (RO) = #<VLA-OBJECT IAcadLineTypes 110edf14>
; Materials (RO) = #<VLA-OBJECT IAcadMaterials 110edf64>
; ModelSpace (RO) = #<VLA-OBJECT IAcadModelSpace 110edfb4>
; MSpace = AutoCAD: Invalid mode
; Name (RO) = "Drawing1.dwg"
; ObjectSnapMode = 0
; PaperSpace (RO) = #<VLA-OBJECT IAcadPaperSpace 110ee054>
; Path (RO) = "C:\\\\Users\\dstein\\Documents"
; PickfirstSelectionSet (RO) = #<VLA-OBJECT IAcadSelectionSet 11158f74>
; Plot (RO) = #<VLA-OBJECT IAcadPlot 110d85ec>
; PlotConfigurations (RO) = #<VLA-OBJECT IAcadPlotConfigurations 110ee0a4>
; Preferences (RO) = #<VLA-OBJECT IAcadDatabasePreferences 110d2edc>
; ReadOnly (RO) = 0
; RegisteredApplications (RO) = _
    #<VLA-OBJECT IAcadRegisteredApplications 110ee0f4>
; Saved (RO) = -1
; SectionManager (RO) = Exception occurred
; SelectionSets (RO) = #<VLA-OBJECT IAcadSelectionSets 10fef9a4>
; SummaryInfo (RO) = #<VLA-OBJECT IAcadSummaryInfo 110d2e8c>
; TextStyles (RO) = #<VLA-OBJECT IAcadTextStyles 110ee144>
; UserCoordinateSystems (RO) = #<VLA-OBJECT IAcadUCSs 110ee004>
; Utility (RO) = #<VLA-OBJECT IAcadUtility 11114f54>
; Viewports (RO) = #<VLA-OBJECT IAcadViewports 110ee194>
; Views (RO) = #<VLA-OBJECT IAcadViews 110ee1e4>
; Width = 1020
; WindowState = 3
; WindowTitle (RO) = "Drawing1.dwg"

```

; Methods supported:

```

; Activate ()
; AuditInfo (1)
; Close (2)
; CopyObjects (3)
; EndUndoMark ()

```

```

;   Export (3)
;   GetVariable (1)
;   HandleToObject (1)
;   Import (3)
;   LoadShapeFile (1)
;   New (1)
;   ObjectIdToObject (1)
;   Open (2)
;   PurgeAll ()
;   Regen (1)
;   Save ()
;   SaveAs (3)
;   SendCommand (1)
;   SetVariable (2)
;   StartUndoMark ()
;   Wblock (2)

```

Wow! If you're not used to working with Visual LISP or ActiveX, you should be able to see how powerful this is for you as a software developer. A careful review of the above results will reveal all of the things you can get and modify with respect to a given document. This was simply not possible with AutoLISP prior to Visual LISP. As you can see, you now have direct access to all the tables, actually collections, within this document, as well as system variables, methods and so forth.

Note that the Plot property is not a method at all. This is because the Plot property of the Document object, is actually a pointer to the Plot object. The Plot object is how you configure and execute printing within the ActiveX world in AutoCAD.

Let's use some of these methods in conjunction with the Documents collection to see how we can iterate all opened documents and perform a simple task on each one. How about if we want to run the AUDIT command on all of our opened drawings:

```

(defun AllDocs-Audit ( / docs)
  (vlax-for dwg (vla-get-Documents (vlax-get-acad-object))
    (vla-AuditInfo dwg T); T denotes fix errors = Yes
  )
)

```

We can also Save all opened documents as follows:

```
(defun AllDocs-Save ( / docs)
  (vlax-for dwg (vla-get-Documents (vlax-get-acad-object))
    (vla-Save dwg)
  )
)
```

How about running the PURGE command on all opened documents?

```
(defun AllDocs-Purge ( / docs)
  (vlax-for dwg (vla-get-Documents (vlax-get-acad-object))
    (vla-PurgeAll dwg)
  )
)
```

WARNING: Be careful when iterating the Documents collection to perform certain tasks. Keep in mind that LISP operates in a document context, not an application context. This means that while you can operate on other opened documents within the same application namespace, you are still calling your changes from the document in which your function was executed. You should always try to have your code return focus to the originating document when it completes or when it fails due to an error. This is especially important if you plan to implement reactors and invoke their callbacks from other drawing sessions than the one in which you instantiated the reactors and callbacks.

Chapter 19 – The Preferences Objects

That's not a misprint, the title of this Chapter mentions Objects (plural). The reason is simply that there are two main Preferences collection objects within AutoCAD. The first is the AcadPreferences collection object, which applies to AutoCAD itself. The second is the Document Preferences collection object, also called the DatabasePreferences collection object. The latter applies only to Document objects, not to AutoCAD.

To give you a better example, if you open the OPTIONS dialog form and browse throughout all the available tabs, you'll notice that many settings have a small drawing icon symbol beside them. This denotes settings that are saved to the drawing only and do not carry across to other drawing sessions. These items are actually part of the DatabasePreferences collection.

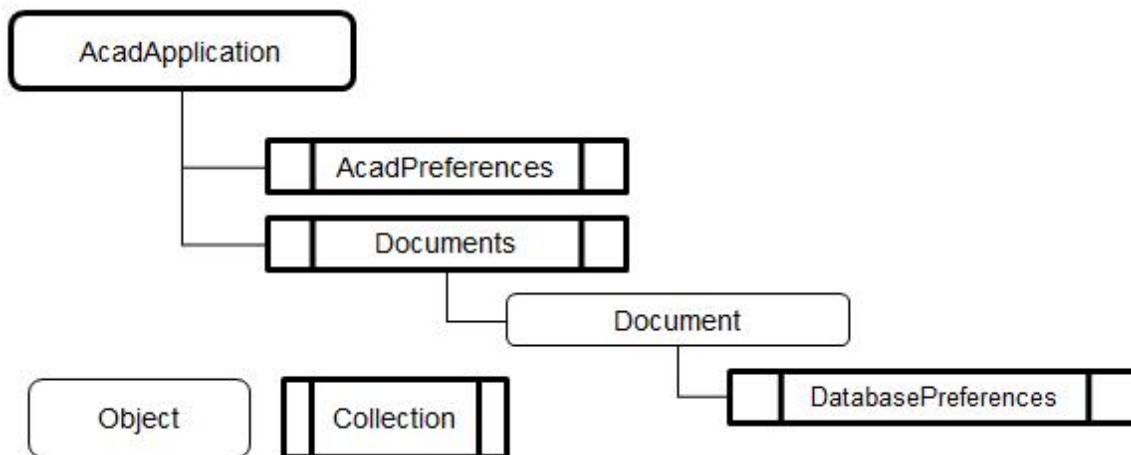


Figure 19-1 – The AcadPreferences and DatabasePreferences collection objects

AcadPreferences

The AcadPreferences collection is actually a container for other collections, each having their own objects. The graphical nature of the OPTIONS dialog form is not always correct in how it represents these collections and should not be used as a guide or map for understanding these collections. Some objects have different names and some are shown as collections in OPTIONS but stored as a single object in the AcadPreferences object.

For example, the Support Path list shown in the OPTIONS File tab is displayed as a list of sub items, string values of pathnames. This could easily be mistaken for being a collection of paths. But in actuality it is a single string value with a semi-colon delimiter between each path value and stored as

the SupportPath property within the Files collection. Confusing? It can be. Another example is the Data Sources Location path setting on the Files tab of the OPTIONS dialog form. This is actually stored as the WorkSpace property under the Files collection, not as DataSourcePath or something more intuitively named.

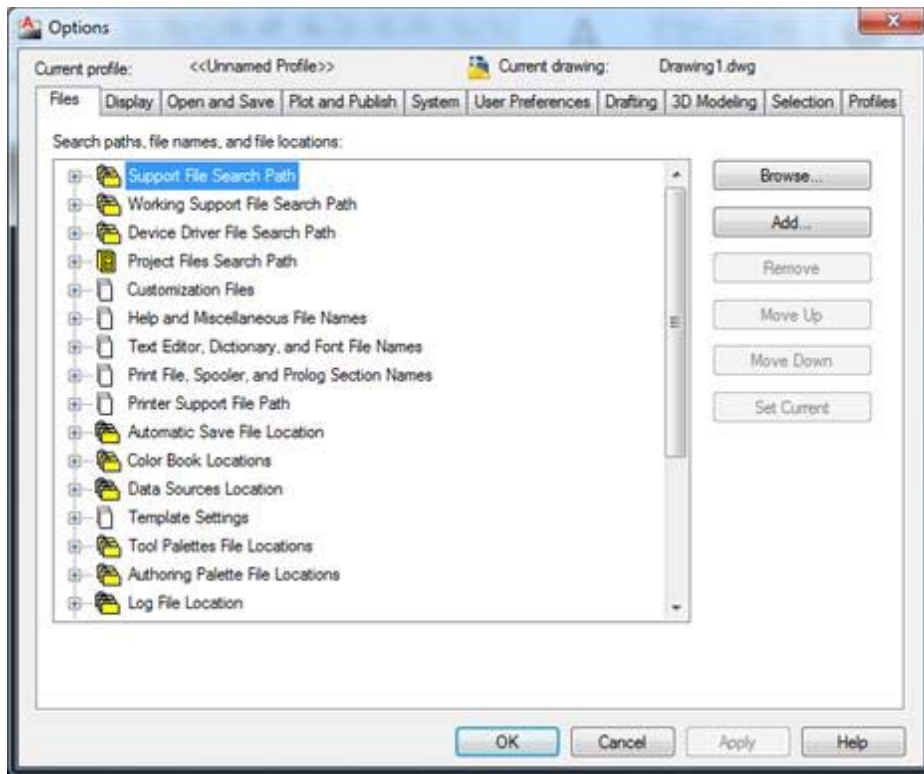


Figure 19-2 – The AutoCAD OPTIONS dialog form, Files tab displayed.

The AcadPreferences object has nine collection objects within it, one Property (the Application property) and no Methods. The AcadPreferences collections roughly correspond to the OPTIONS dialog tabs, sort of. Below is a list of the collection names and their corresponding tabs in the OPTIONS dialog form:

- Display = Display
- Drafting = Drafting
- Files = Files
- OpenSave = Open and Save
- Output = Plotting
- Profiles = Profiles
- Selection = Selection
- System = System
- User = User Preferences
- **NOTE:** The "3D Modeling" tab is conspicuously absent from the AcadPreferences object

Figure 19-3 shows a dump of the AcadPreferences object using (vlax-dump-object (vla-get-preferences (vla-get-acad-object)) T).

```
(vlax-dump-object (vla-get-Preferences (vlax-get-Acad-object)) t)

; IAcadPreferences: This object specifies the current AutoCAD settings
; Property values:
; Application (RO) = #<VLA-OBJECT IAcadApplication 00a8a730>
; Display (RO) = #<VLA-OBJECT IAcadPreferencesDisplay 04c5df7c>
; Drafting (RO) = #<VLA-OBJECT IAcadPreferencesDrafting 04c5df78>
; Files (RO) = #<VLA-OBJECT IAcadPreferencesFiles 04c5df80>
; OpenSave (RO) = #<VLA-OBJECT IAcadPreferencesOpenSave 04c5df84>
; Output (RO) = #<VLA-OBJECT IAcadPreferencesOutput 04c5df88>
; Profiles (RO) = #<VLA-OBJECT IAcadPreferencesProfiles 04c5df8c>
; Selection (RO) = #<VLA-OBJECT IAcadPreferencesSelection 04c5df90>
; System (RO) = #<VLA-OBJECT IAcadPreferencesSystem 04c5df94>
; User (RO) = #<VLA-OBJECT IAcadPreferencesUser 04c5df98>
; No methods
```

Figure 19-3 – Dump of the AcadPreferences collection object.

To go deeper, we'll examine the Files collection to see what it contains. Strings that would otherwise wrap oddly in this book have been broken with an underscore "_" to indicate a forced wrap.

```
(vlax-dump-object (vla-get-Files (vla-get-Preferences (vlax-get-Acad-object)))) T)

; IAcadPreferencesFiles: This object contains the options from _
the Files tab on the Options dialog

; Property values:
; AltFontFile = "simplex.shx"
; AltTabletMenuFile = ""
; Application (RO) = #<VLA-OBJECT IAcadApplication 01877c20>
; AutoSavePath = "C:\\Users\\dstein\\appdata\\local\\temp\\"
; ColorBookPath = "c:\\program files\\autodesk\\autocad_
2011\\support\\color;C:\\Users\\dstein\\appdata\\roaming\\_
autodesk\\autocad 2011\\r18.1\\enu\\support\\color"
; ConfigFile (RO) = "C:\\Users\\dstein\\AppData\\Local\\Autodesk\\_
AutoCAD 2011\\R18.1\\enu\\acad2011.cfg"
```

```

; CustomDictionary = "C:\\Users\\dstein\\appdata\\roaming\\autodesk\\_
autocad 2011\\r18.1\\enu\\support\\sample.cus"

; CustomIconPath = "C:\\Users\\dstein\\appdata\\roaming\\autodesk\\_
autocad 2011\\r18.1\\enu\\support\\icons"

; DefaultInternetURL = "http://www.autodesk.com"

; DriversPath = "C:\\Program Files\\Autodesk\\AutoCAD 2011\\drv"

; EnterpriseMenuFile = "."

; FontFileMap = "C:\\Users\\dstein\\appdata\\roaming\\autodesk\\autocad
2011\\r18.1\\enu\\support\\acad.fmp"

; HelpFilePath = "C:\\Program Files\\Autodesk\\AutoCAD 2011\\_
Help\\index.html"

; LogFilePath = "C:\\Users\\dstein\\appdata\\local\\autodesk\\_
autocad 2011\\r18.1\\enu\\"

; MainDictionary = "enu"

; MenuFile = "C:\\Users\\dstein\\appdata\\roaming\\autodesk\\_
autocad 2011\\r18.1\\enu\\support\\acad"

; PageSetupOverridesTemplateFile = "C:\\Users\\dstein\\appdata\\_
local\\autodesk\\autocad 2011\\r18.1\\enu\\template\\sheetsets\\_
architectural imperial.dwt"

; PlotLogFilePath = "C:\\Users\\dstein\\appdata\\local\\autodesk\\_
autocad 2011\\r18.1\\enu\\"

; PostScriptPrologFile = ""

; PrinterConfigPath = "C:\\Users\\dstein\\appdata\\roaming\\_
autodesk\\autocad 2011\\r18.1\\enu\\plotters"

; PrinterDescPath = "C:\\Users\\dstein\\appdata\\roaming\\autodesk\\_
autocad 2011\\r18.1\\enu\\plotters\\pmp files"

; PrinterStyleSheetPath = "C:\\Users\\dstein\\appdata\\roaming\\_
autodesk\\autocad 2011\\r18.1\\enu\\plotters\\plot styles"

; PrintFile = "."

; PrintSpoolerPath = "C:\\Users\\dstein\\appdata\\local\\temp\\"

; PrintSpoolExecutable = ""

; QNewTemplateFile = ""

; SupportPath = "C:\\Users\\dstein\\appdata\\roaming\\autodesk\\_
autocad 2011\\r18.1\\enu\\support;C:\\program files\\autodesk\\_

```



```

autocad 2011\\support;C:\\program files\\autodesk\\autocad 2011\\_
fonts;C:\\program files\\autodesk\\autocad 2011\\help;_
C:\\program files\\autodesk\\autocad 2011\\express;_
C:\\program files\\autodesk\\autocad 2011\\support\\color"
;   TempFilePath = "C:\\Users\\dstein\\appdata\\local\\temp\\"
;   TemplateDwgPath = "C:\\Users\\dstein\\appdata\\local\\_
autodesk\\autocad 2011\\r18.1\\enu\\template"
;   TempXrefPath = "C:\\Users\\dstein\\appdata\\local\\temp\\"
;   TextEditor = "Internal"
;   TextureMapPath = "C:\\Program Files\\Common Files\\Autodesk Shared\\Materials2011
\\assetlibrary_base.fbm\\1\\Mats"
;   ToolPalettePath = "C:\\Users\\dstein\\AppData\\Roaming\\_
Autodesk\\AutoCAD 2011\\R18.1\\enu\\support\\ToolPalette"
;   WorkspacePath = "C:\\Users\\dstein\\appdata\\roaming\\autodesk\\_
autocad 2011\\r18.1\\enu\\data links"

; Methods supported:
;   GetProjectFilePath (1)
;   SetProjectFilePath (2)

```

Figure 19-4 – Dump of the Files collection object within AcadPreferences

Note that the Files collection has many Properties and only two methods available. Also, you'll notice here that the SupportPath setting shows the search path list as a single string with semi-colon delimiters between each path value.

The most important understanding to come away from this is that you can use the `(vla-get-xxx)` and `(vla-put-xxx)` functions to get and modify any properties shown anywhere throughout the AcadPreferences collection objects as long as they are not read-only (RO). Think about this for a few minutes and it should dawn on you that this exposes an enormous amount of power and flexibility to you as the developer. You can programmatically manipulate the AutoCAD configuration with very little effort. Taking this farther, when you begin working with Profiles, you will find this opens up a whole world of possibilities to manage desktops remotely in a networked environment.

Let's demonstrate how this might be put to practical use with Visual LISP. Suppose you want to modify all the AutoCAD installations on your network to change a default path setting for where each client

looks for Drawing Template files. Maybe you want them to all use a standard set of customized templates stored in a folder on a shared server over the network. To do this, you only need to push out a change to the TemplateDwgPath property under the Files collection. Sure, you could do this using a profile (.ARG file) or a registry hack, but deploying those are difficult without some additional tools or some scripting to help it work.

One solution is to push the update through AutoCAD using ActiveX with Visual LISP coding and the AcadPreferences object interface. Figure 19-5 shows an example function for doing just that and shows an example of how it might be used within a program function. This could be deployed by using a hook from within the acaddoc.lsp (s::startup) function that you could deploy to all clients once, and be able to deploy code changes from then on with very little effort. The code in Figure 19-5 could be loaded from the (s::startup) routine and fire off automatically after it loads on the client.

```
(defun UpdateTemplatePath (pathname)
  (vla-put-TemplateDwgPath
    (vla-get-Files
      (vla-get-AcadPreferences
        (vlax-get-acad-object)
      )
    )
    pathname
  )
)

(UpdateTemplatePath "X:\\\\acad\\\\configs\\\\templates")
```

Figure 19-5 – Updating the TemplateDwgPath property

You might want to embellish this code a little to make it more robust and flexible. For example, you could add a check to make sure the existing path setting is not already correct before changing it, saving unnecessary work at the start of every drawing session on every client.

DatabasePreferences

The DatabasePreferences object is a collection of preferences that apply to the active document only. As stated previously, they appear in the OPTIONS dialog with a small drawing icon symbol beside them to indicate this.

Below is a dump of the collection from a drawing session to show what items it contains:

```
Command: (setq dbprefs (vla-get-Preferences activeDocument))
Command: (vlax-dump-object dbprefs t)

; IAcadDatabasePreferences: This object specifies the current_
AutoCAD drawing specific settings
; Property values:
;   AllowLongSymbolNames = -1
;   Application (RO) = #<VLA-OBJECT IAcadApplication 01877c20>
;   ContourLinesPerSurface = 4
;   DisplaySilhouette = 0
;   Lineweight = -1
;   LineWeightDisplay = 0
;   MaxActiveViewports = 64
;   ObjectSortByPlotting = -1
;   ObjectSortByPSOutput = -1
;   ObjectSortByRedraws = -1
;   ObjectSortByRegens = -1
;   ObjectSortBySelection = -1
;   ObjectSortBySnap = -1
;   OLELaunch = 0
;   RenderSmoothness = 0.5
;   SegmentPerPolyline = 8
;   SolidFill = -1
;   TextFrameDisplay = 0
;   XRefEdit = -1
;   XRefLayerVisibility = -1
; No methods
```

Figure 19-6 – The DatabasePreferences collection object

You can continue drilling down into each of the properties to query or modify its assigned value. In most cases they will be either :vlax-true or :vlax-false (indicated by -1 and 0 respectively). For example...

```
(vla-get-OLELaunch dbprefs)
```

```
:vlax-false
```

```
(vla-get-ObjectSortByPlotting dbprefs)
```

```
:vlax-true
```

You'll notice that there are no methods to this object. Just as with the AcadPreferences object, you can access and manipulate these properties using the same approach with VLISP. For example, to toggle Lineweight display on or off:

```
(vla-put-LineWeightDisplay activedoc :vlax-true);; turns LWT on
```

```
(vla-put-LineWeightDisplay activedoc :vlax-false);; turns LWT off
```

Reloading a Profile

Most AutoCAD developers are well aware of how Profiles work and what their little quirks are. However, I'm going to briefly assume you may not be aware, mainly because I'm assuming you may have a life, and spend it on things other than poking around AutoCAD profiles to figure out how they work.

You may already know that you can append the /p parameter to the acad.exe launch to instruct it to load a named profile (e.g. "acad.exe /p myProfile"). You can also use a profile filename instead of a profile name, which will cause it to load the profile file into the registry and then load it into the drawing session. However, this particular feature will ignore the .ARG file if the named profile already exists for the current user. To force a reload from an .ARG file, you can do any one of the following:

- Rename the profile in the HKCU registry path
- Rename the profile in the .ARG file
- Delete the profile in the HKCU registry path

NOTE: You cannot simply rename the .ARG file itself, since the profile name is a value stored within it, and not derived from the filename itself.

A typical scenario is as follows:

- You provide an ARG file to several users to import
- They import it and begin working
- You make a change to your source profile and export a new ARG file

- You provide the new ARG file to the same users
- They import the new ARG file
- They still have the original profile settings in effect

This is because the new ARG file has the same profile name as the original. When the users replace their copy of the ARG file with the new, and then launch AutoCAD with the /p parameter, AutoCAD reads the name of the profile within the ARG file, searches the HKCU registry path for an existing profile of the same name. When it finds the same name, it simply loads the profile from the registry and ignores the ARG file.

So, now what? Well, since you have the means to access and manipulate the AcadPreferences object through Visual LISP, you can easily work your way around this under the hood. Check out the example code functions below.

```
;;; Reloads a profile from an ARG file
;;; Replaces existing profile if defined
;;; Returns profile name if successful, otherwise returns nil

(defun Profile-Reload (name ARGname / bogus)
  (cond
    ( (and
      (Profile-Exists-p name)
      (findfile ARGname)
    )
      (if (/= (strcase name) (strcase (vla-get-ActiveProfile (AcadProfiles))))
        (Profile-Delete name)
        (progn
          (setq bogus "bogus")
          (Profile-Rename name bogus)
        )
      )
      (Profile-Import name ARGname)
      (vla-put-ActiveProfile (AcadProfiles) name)
      (if bogus (Profile-Delete bogus))
      name
    )
  )
)
```

```

)
( (and
  (not (Profile-Exists-p name))
  (findfile ARGname)
)
(Profile-Import name ARGname)
(vla-put-ActiveProfile (AcadProfiles) name)
name
)
( (not (findfile ARGname))
  (princ (strcat "\nCannot locate ARG source: " ARGname)) nil
)
)
)

```

;;; Renames an existing profile

;;; Returns new profile name if successful, otherwise returns nil

```

(defun Profile-Rename (from to / result)
  (if (Profile-Exists-p from)
    (if (not (Profile-Exists-p to))
      (cond
        ( (not
            (vl-catch-all-error-p
              (setq result
                (vl-catch-all-apply
                  'vla-RenameProfile
                  (list (AcadProfiles) from to)
                )
              )
            )
          )
        )
      )
    to ; Return new name if successful!
  )
)

```

```

    )

)

)

;;; Deletes an existing profile
;;; Returns T if successful, otherwise returns nil

(defun Profile-Delete (strName / result)
  (if (Profile-Exists-p strName)
      (cond
        ( (not
            (vl-catch-all-error-p
             (setq result
                  (vl-catch-all-apply
                   'vla-DeleteProfile
                   (list (AcadProfiles) strName)
                   )
                )
            )
          )
          T ; return T for success!
        )
      )
    )
  )

)

;;; Imports a profile from a given ARG file
;;; Returns profile name if successful, otherwise returns nil

(defun Profile-Import (argFile strName / result)
  (cond
    ( (findfile argFile)
      (cond

```


)

Chapter 20 – Menus and Toolbars

Just as AutoCAD drawing entities are part of the AutoCAD object model, so are menus and toolbars. Menus are organized into a root MenuGroup collection, containing one or more MenuGroup objects. Each MenuGroup object in turn contains a collection of "popmenus" (pull-down), and a collection of toolbars. You can add MenuGroups using the `(vla-load)` method on the MenuGroups object. This performs the same task as using the AutoCAD MENULOAD command.

The coolest thing about this is that you can add, modify and delete menu items and configurations programmatically. This enables you to build menus with complete control from within your VLISP programs. The only thing not exposed from the menugroups or menubar objects is the screen menu from ancient days. For this you must resort to the standard AutoLISP (`menucmd`) function to manipulate the screenmenu and the AcadPreferences collection to control the display (toggle it on or off).

The MenuBar Object

The MenuBar object contains all of the currently displayed pulldown or "pop" menu items in the AutoCAD session. It is a member of the AcadApplication object. If you have stub menus loaded that have any pop menu groups spliced in with the AutoCAD pop menus, the MenuBar object will return all of them in the order from left to right in the collection.

```
(setq acadApp (vlax-get-Acad-object))  
#<VLA-OBJECT IAcadApplication 00a8a730>
```

```
(setq mbar (vla-get-Menubar acadApp))
```

To access individual pop menus, use the Item method as follows:

```
(setq popmenu1 (get-item mbar 0))  
#<VLA-OBJECT IAcadMenuBar 00e8ae24>
```

To see more menubar info, dump the object as follows:

```
Command: (vlax-dump-object mbar T)  
; IAcadMenuBar: A collection of PopupMenu objects representing_
```

the current AutoCAD menu bar

; Property values:

; Application (RO) = #<VLA-OBJECT IAcadApplication 00a8a730>

; Count (RO) = 14

; Parent (RO) = #<VLA-OBJECT IAcadApplication 00a8a730>

; Methods supported:

; Item (1)

Getting MenuBar Items

To access a MenuBar item or check if a popmenu exists in the collection you can iterate the collection. To check for a particular popmenu, search for a matching name value in the MenuBar collection as follows:

```
(defun PopMenu-MenuBar-p (name / mbar i found)
  (setq mbar (vla-get-Menubar (vlax-get-Acad-object)) i 0)
  (while (and (not found) (< i (1- (vla-get-count mbar)))))
    (if (= (strcase name) (strcase (vla-get-name (get-item mbar i))))
      (setq found T)
    )
    (setq i (1+ i))
  )
  (vlax-release-object mbar)
  found
)
```

If you know the name of the pop menu, you can access it directly using Item and the name property in string form as follows:

```
(setq popmenu (get-item mbar "&File"))
```

TIP: Be aware that the name property includes the mnemonic character & as part of the name string. If you try to fetch the menu simply by the logical name of "File", the `(vla-item)` method will fail to return it from the MenuBar object. This is true in general for using the Item method with any collection where you are fetching by string name values.

Inserting PopMenus into the MenuBar collection

To insert a popmenu of a loaded menugroup into the MenuBar collection, use the (vla-InsertInMenuBar) method of the popmenu object itself.

```
(defun PopMenu-Insert (mgroup name loc / pmnu)
  (if (not (PopMenu-MenuBar-p name))
    (if (setq pmnu (PopupMenu mgroup name))
      (progn
        (vla-InsertInMenubar pmnu loc)
        (vlax-release-object pmnu)
        T
      )
      (princ (strcat "\nMenugroup or popmenu not loaded: " name))
    )
    (princ (strcat "\nPopmenu already loaded: " name))
  )
)
```

Removing PopMenus from the MenuBar collection

To remove a named popmenu from the MenuBar collection, use the (vla-removefrommenubar) method of the popmenu object itself.

The MenuGroups Collection Object

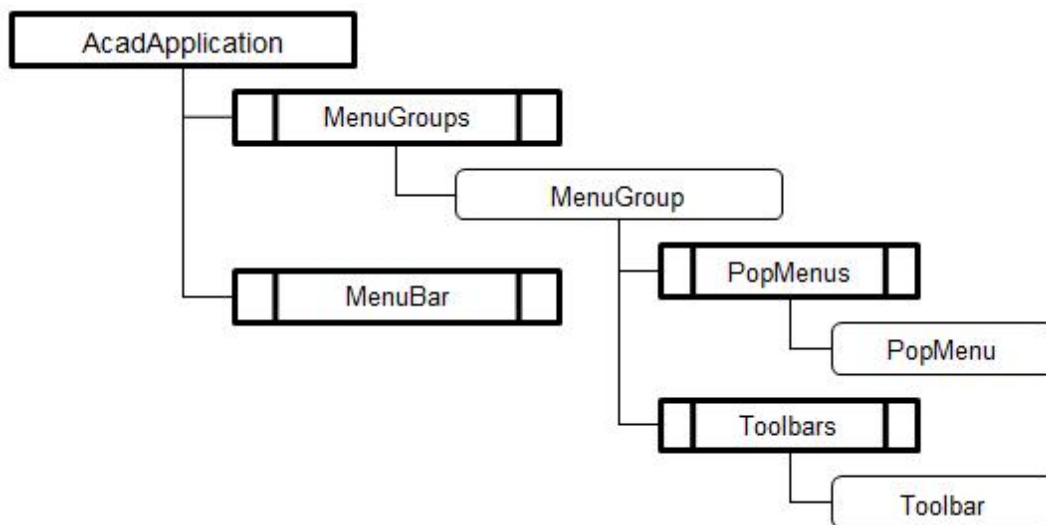


Figure 20-1 – The MenuGroup collection object

The MenuGroups collection object contains all the menugroups found in the AutoCAD session. Each menugroup is a source menu that has been loaded. Normally, you will see the menugroup "Acad", but you might also see "Express" for the Express Tools menugroup if it has been installed.

```
(defun MenuGroups-ListAll ( / out)
  (vlax-for each (vla-get-MenuGroups acadapp)
    (setq out (cons (vla-get-name each) out))
  )
  out
)
```

To add a new menugroup to the menugroups collection, you use the Add or Load methods and specify the appropriate arguments. To remove a menugroup, you must first get the menugroup object and then invoke its Delete method.

The MenuGroup Object

The menugroup object contains all the popmenus and toolbars for a given menugroup. It is a member of the MenuGroups collection object. To get the Acad menugroup, use the following:

```
(setq mgroups (vla-get-MenuGroups acadapp))
#<VLA-OBJECT IAcadMenuGroups 01433208>

(setq mg-acad (vla-item mgroups "Acad"))
#<VLA-OBJECT IAcadMenuGroup 00e9b38c>
```

The PopMenus Object

The PopMenus collection object contains all the popmenus, or pull-down menus, for a given menugroup. To access the popmenus collection for the Acad menugroup, use the following:

```
(setq pmnu (vla-get-PopMenus mg-acad))
```

A dump of the popmenus object shows its properties and methods:

The PopMenu Object

The PopMenu object represents a single popmenu or pull-down menu. You can use the PopMenu object

to insert itself into the MenuBar object as well as to access its internal objects, properties and methods.

The Toolbars Collection Object

The Toolbars object is a collection of all toolbars for a given menugroup. Use the (vla-get-toolbars) method to access the root of this collection from the menugroup object. For example, to get the Toolbars collection for the Acad menugroup, use the following:

```
(setq tbars (vla-get-Toolbars mg-acad))  
#<VLA-OBJECT IAcadToolbars 00efa7c4>
```

You may want return a list of all the toolbar names for a given toolbars collection. To do this you simply need to iterate through the toolbars and return a list of their respective Name property values...

```
(progn  
  (vlax-for each tbars  
    (setq out (cons (vla-get-name each) out))  
  )  
  (if out (reverse out))  
)
```

The Toolbar Object

The Toolbar object represents a single toolbar and its buttons. The buttons are contained as a collection which can be iterated using the (vla-item) method, instead I'll use the (get-item) function suggested earlier. For example, to access the "Dimension" toolbar object from the Acad menugroup, use the following:

```
(setq tbl (vla-item tbars "Dimension"))  
#<VLA-OBJECT IAcadToolbar 00eb6a7c>
```

```
Command: (vlax-dump-object tbl T)  
; IAcadToolbar: An AutoCAD toolbar  
; Property values:  
;   Application (RO) = #<VLA-OBJECT IAcadApplication 01877c20>  
;   Count (RO) = 27  
;   DockStatus (RO) = 4
```

```

; FloatingRows = 1
; Height (RO) = AutoCAD: The toolbar is invisible. Please make it visible
; HelpString = "Dimension Toolbar\n      "
; LargeButtons (RO) = 0
; left = 100
; Name = "Dimension"
; Parent (RO) = #<VLA-OBJECT IAcadToolbars 11115054>
; TagString (RO) = "ID_TbDimensi"
; top = 130
; Visible = 0
; Width (RO) = AutoCAD: The toolbar is invisible. Please make it visible
; Methods supported:
;   AddSeparator (1)
;   AddToolbarButton (5)
;   Delete ()
;   Dock (1)
;   Float (3)
;   Item (1)

```

The following example functions demonstrate how to get the Toolbars collection from a given menugroup object, and how to get a specified toolbar object by name from a specified menugroup object.

```

(defun get-MenuGroups ()
  (vla-get-menugroups (vlax-get-acad-object))
)

```

```

(defun get-MenuGroup (name)
  (if (menugroup name)
    (vla-item (get-MenuGroups) name)
  )
)

```

```

(defun get-Toolbars (mgroup / mg result)
  (if (setq mg (get-MenuGroup mgroup))

```



```

(progn
  (setq result (vla-get-Toolbars mg))
  (vlax-release-object mg)
)
)
result
)

(defun get-Toolbar (mgroup name / tbs result)
  (if (setq tbs (get-Toolbars mgroup))
    (progn
      (setq result (vla-item tbs name))
      (vlax-release-object tbs)
    )
  )
  result
)

```

The following example function docks a specified toolbar to the Left, Right, Top or Bottom. If the *side* argument is not "LEFT", "RIGHT", "TOP" or "BOTTOM" then it defaults to "LEFT". The argument is not case sensitive.

```

(defun Toolbar-Dock (mgroup name side / tb loc)
  (cond
    ( (= (strcase side) "LEFT")  (setq loc acToolbarDockLeft))
    ( (= (strcase side) "RIGHT") (setq loc acToolbarDockRight))
    ( (= (strcase side) "TOP")    (setq loc acToolbarDockTop))
    ( (= (strcase side) "BOTTOM") (setq loc acToolbarDockBottom))
    ( T (setq loc acToolbarDockLeft))
  )
  (if (setq tb (get-Toolbar mgroup name))
    (progn
      (vla-Dock tb loc)
      (vlax-release-object tb)
    )
  )
)

```

```

    (princ (strcat "\nToolbar (" name ") not found. "))
  )
)

```

The following example function floats a toolbar at a specified location (x and y offset values from top-left of screen). The arguments are the menugroup name, the toolbar name, y-coordinate, x-coordinate and toolbar row layout. The x and y coordinates are from the top-left corner of the screen. This is a Windows standard practice for dialog forms and toolbars. This function ignores toolbars that are hidden.

```

(defun Toolbar-Float (mgroup name top left rows)
  (if (setq tb (get-Toolbar mgroup name))
    (if (= (vla-get-Visible tb) :vlax-True)
      (progn
        (vla-Float tb top left rows)
        (vlax-release-object tb)
        1 ;; float and visible
      )
      -1 ;; toolbar not visible
    )
    0 ;; toolbar not found
  )
)

```

Creating a Toolbar

Let's assemble some code covered above and add some new ingredients to make a new toolbar and assign a few buttons to it. In this case, we'll add a new toolbar to the ACAD menugroup and name it MYTOOLBAR. The first function adds a button object to a toolbar object with some supplied property values. In this example, I use the same bitmap property for both large and small icon bitmap properties.

```

(defun Toolbar-AddButton
  (tb name macro bitmap1 tagstring helpstring / newButton index)
  (setq index (vla-get-Count tb))
  (cond
    ( (setq newButton

```

```

(vla-AddToolBarButton tb
  (vlax-make-variant index vlax-vbInteger)
  name helpstring macro
)
)
(vla-put-TagString newButton tagstring)
(vla-SetBitMaps newButton bitmap1 bitmap1)
newButton
)
)
)

```

Now, we'll see how to create a new toolbar and assign a new button to it. This function will create a new toolbar named "MyToolbar" and add one button to it that invokes the LINE command. Load the sample file Toolbars.lsp from the book CD samples and run the function (toolbar-make) at the AutoCAD command prompt.

```

(defun Toolbar-Make ( / tb)
  (cond
    ( (setq tb (vla-add (get-toolbars "acad") "MyToolbar"))
      (if (Toolbar-AddButton tb
        "Line" "\003\003\020\nLine"
        "ICON_16_LINE" "MyButton001" "Draws a line: LINE"
      )
        (alert "I just added a button to my toolbar!")
        (alert "Uh oh! ...")
      )
      (vlax-release-object tb)
    )
  )
)

```

You can continue much further with this by tapping the other methods such as Add, Delete and so on to build out your toolbars. You can also manipulate toolbar row configurations, change button ordering and hide or display the toolbar. When you combine this with your program code you can create some

very sophisticated menu management features.

Ribbon Menus

Ribbon menus are not exposed through ActiveX to Visual LISP nor to AutoLISP. They are only exposed to .NET interfaces

Chapter 21 – External Interfaces

While Visual LISP is a bit more cumbersome to use for dealing with external applications than VBA, it does have the capability to do some very powerful things. While it is very common to use ObjectARX applications from within Visual LISP, such as DOSlib, it is only a small taste of what more can be done. Some examples might be passing data between AutoCAD and Microsoft Office applications, and performing specialized desktop, file, folder and network tasks using the Windows Scripting Host.

Microsoft Excel

Older releases of Microsoft Office depended more upon Type Libraries for external COM interfacing than do newer versions. You can still invoke TLB interfaces for some versions of Office, but many times you may find the effort isn't worth the hassle. You can simply instantiate an Office object and perform iterative dumps (vlax-dump-object) to explore the interfaces.

```
(setq objExcel (vlax-create-object "Excel.Application"))  
#<VLA-OBJECT _Application 11dd1f74>  
  
(vlax-dump-object objExcel t)
```

I'm not going to bother pasting the results of the dump statement above. It's pretty lengthy and you should do it on your own anyway. But you will notice that the "Visible" property is set to 0 (zero), which indicates "false" (or :vlax-false). If you execute the following line of code it should cause the Excel session to become visible.

```
(vla-put-Visible objExcel :vlax-true)
```

If you execute the following line of code it will close/terminate the Excel session

```
(vla-Quit objExcel)
```

Let's explore a little Excel interfacing by opening Excel, creating a new Workbook, and populating it with a list of all the layers in the current/active drawing:

```
(vl-load-com)  
(setq acad (vlax-get-acad-object))
```

```

(setq activeDoc (vla-get-ActiveDocument acad))

(setq layers (vla-get-Layers activeDoc))


(setq excel (vlax-create-object "Excel.Application"))

(setq workbooks (vlax-get-property excel 'Workbooks))


(princ "\nSetting visible to True")

(vlax-put-property excel 'Visible :vlax-true)


(princ "\nGetting active workbook...")

(vlax-invoke-method workbooks 'Add)

(setq workbook (vlax-get-property excel 'ActiveWorkbook))


(princ "\nGetting active worksheet...")

(setq sheet (vlax-get-property excel 'Activsheet))


(princ "\nRename active worksheet...")

(vlax-put-property sheet 'Name "Layers")


(princ "\nGetting cells...")

(setq cells (vlax-get-property sheet 'Cells))


(princ "\nPrinting column headings...")

(vlax-put-property cells 'Item 1 1 "LayerName")

(vlax-put-property cells 'Item 1 2 "Color")

(vlax-put-property cells 'Item 1 3 "Linetype")


(princ "\nPopulating cells...")

(setq row 2)

(vlax-for layer layers

  (vlax-put-property cells 'Item row 1 (vla-get-Name layer))

  (vlax-put-property cells 'Item row 2 (itoa (vla-get-Color layer)))

  (vlax-put-property cells 'Item row 3 (vla-get-Linetype layer))

  (setq row (1+ row)))

```

```
)

(princ "\nSaving workbook...")

(vlax-invoke-method workbook 'Save)

(vlax-invoke-method workbooks 'Close)

(vlax-invoke-method excel 'Quit)

(foreach obj (list cells sheet workbook workbooks excel)
  (vlax-release-object obj))

)

(gc)
```

Using Legacy Type Libraries

The example code below shows how to initialize the Excel Type Library (for Excel 2000 or XP) and create a new Excel spreadsheet file in Excel from Visual LISP. Be careful of one particular aspect of Visual LISP: TypeLib interfaces. Why would I say this? Well, while VB and VBA give you the nice auto-complete feature called Intellisense®, Visual LISP does not.

When working in VB or VBA and setting a *reference* to a component library, it takes care of mapping the syntax awareness and pop-up help strings. Visual LISP does not. Even though you may be familiar with Excel 2000 from a Visual LISP standpoint, don't assume everything is the same when it comes to Excel 10 (also called XP).

There's not enough space to cover this in detail, but be assured that it's well worth the time to investigate changes anytime you intend to use your code with a newer version of an external application.

```
(defun Excel-TypeLib-2000 ( / sysdrv officepath)
  (setq sysdrv (getenv "systemdrive"))
  (setq officepath (strcat sysdrv "\\program files\\microsoft office\\office"))
  (findfile (strcat officepath "\\excel9.olb"))
)

(defun Excel-TypeLib-XP ( / sysdrv officepath)
  (setq sysdrv (getenv "systemdrive"))
  (setq officepath (strcat sysdrv "\\program files\\microsoft offices\\office10"))
)
```



```

(findfile (strcat officepath "\\excel.exe"))
)

(defun Excel-Load-TypeLib ( / tlbfile tlbver out)
  (cond
    ( (null msxl-xl24HourClock)
      (if (setq tlbfile (Excel-TypeLib-2000))
        (progn
          (vlax-import-type-library
            :tlb-filename      tlbfile
            :methods-prefix    "msxl-"
            :properties-prefix "msxl-"
            :constants-prefix  "msxl-"
          )
          (if msxl-xl24HourClock (setq out T))
        )
      )
    )
    ( T (setq out T) )
  )
  out
)

(defun Excel-New-Spreadsheet (dmode / appsession result)
  (princ "\nCreating new Excel Spreadsheet file...")
  (cond
    ( (vl-catch-all-error-p
      (setq appsession
        (vl-catch-all-apply
          'vlax-create-object '("Excel.Application")))
      )
      (vl-exit-with-error
        (strcat "Error: " (vl-catch-all-error-message appsession))
      )
    )
  )
)

```

```

( T
  (princ "\nOpening Excel Spreadsheet file...")
  (cond
    ( (vl-catch-all-error-p
        (setq result
              (vl-catch-all-apply 'vlax-invoke-method
                                   (list (vlax-get-property appsession "Workbooks") "Add")
                                   )
              )
        )
      )
    )
    (princ (strcat "\nError: " (vl-catch-all-error-message result)))
  )
  ( T
    (if (= (strcase dmode) "SHOW")
      (vla-put-Visible appsession 1)
      (vla-put-Visible appsession 0)
    )
  )
)
)
)
appsession
)

```

You should pay special attention to the section in the `()` function above that defines the type library interfaces. This is not very clearly documented actually, but the string prefixes assigned to the properties, methods and constants is arbitrary. In this example, I used the same value for all three, but other examples you'll find will use unique prefixes such as `msxp-` `msxm-` and `msxc-` to differentiate each of the types of interface objects.

```

(vlax-import-type-library
  :tlb-filename      tlbfile
  :methods-prefix    "msxl-"
  :properties-prefix "msxl-"
  :constants-prefix  "msxl-"
)

```

)

Theoretically, you could also forego assigning a prefix by using "" for each property in the declaration expression above. But doing so will make it difficult to work with multiple application type library interfaces, such as Word and Excel that might be used within the same Visual LISP code. Yes, you can define and use as many type library interfaces as you need to do the job. It's usually better to modularize your Visual LISP code to avoid this if possible, and keep each type library reference isolated. Debugging and testing will be much easier to manage by keeping things orderly and organized.

You can verify background processes by using the Windows Task Manager and watching the Processes list for a given application. For example, if you open a session of Excel 10 (part of Office XP) and call the Quit method of the `Excel.Application` object, you would expect that after you release the object in VLISP that the process would terminate, but it usually will not. The following example code can be used to test this on your computer:

```
(defun excel-test ( / xlapp)
  (cond
    ( (setq xlapp (vlax-create-object "Excel.Application"))
      (vlax-put-property xlapp "Visible" T); show Excel
      (vlax-invoke-method xlapp "Quit"); close Excel
      (vlax-release-object xlapp); release object
      (gc); force garbage collection
    )
    ( T (princ "\nUnable to open Microsoft Excel.") )
  )
)
```

Load the above code into the VLIDE edit window and load it into AutoCAD. Open the Windows Task Manager and pick the Processes list tab. Go back to AutoCAD and run the function (`excel-test`) and watch the Task Manager process list for `Excel.exe` to appear in the list.

Proper behaviour would be that the `Excel.exe` process would appear and then disappear, which it may do in your case. But in the majority of cases it will not disappear. The problem this creates is if you attempt to reopen a given spreadsheet and the Excel process has not let go of it. The spreadsheet file may often be opened in Read-Only mode since it thinks someone else has the file already opened.

Autodesk suggests using (gc) after releasing such objects to force a termination, however, (gc) simply places a call to the garbage collection service on a stack which is managed by the Windows resource services. In other words, regardless of how you try to terminate the session from VLISP, it may often not terminate at all. Be careful when manually terminating the process using Task Manager as it can often break the RPC channel to AutoCAD and make subsequent calls to Excel fail with errors.

NOTE: I am often asked about working with Microsoft Access and SQL Server or Oracle from within AutoLISP or Visual LISP. Rather than reinventing the wheel, I would prefer to point readers to Jon Fleming's web site: <http://acad.fleming-group.com/index.html> and suggest downloading and inspecting ADOLISP to see how to do this.

Windows ScriptControl

I've posted several examples of using one scripting language to leverage another to do the heavy lifting for things which are more efficiently done by the other language. In those examples, I typically called VBScript from KiXtart, or PowerShell, or some variation of one of those three. In this example, I'm going to invoke the DateDiff() function from Windows Scripting Host (the engine that runs Vbscript) in order to calculate the age of a past date (in days).

```
(defun daysold (d / sc cmd result)
  (setq sc (vlax-create-object "ScriptControl"))
  (vlax-put-property sc 'Language "vbscript")
  (setq cmd (strcat "DateDiff(\"d\", \"\" d \"\", Now)" ))
  (setq result (vlax-invoke-method sc 'Eval cmd))
  (vlax-release-object sc)
  (eval result)
)

(setq age (daysold "12/1/2010"))
```

This opens a small, yet useful doorway to other scripting tools which can help expand your reach. You can invoke Jscript, Vbscript and even ActivePerl using the ScriptControl interface.

Windows Scripting Host

Microsoft's Windows Scripting Host (WSH) is a powerful, yet often overlooked free service available as part of Windows operating systems. Basically, WSH is a script engine that runs scripts either from a

command line interface or from a GUI interface. The command line interface command is CSCRIPT, while the GUI interface command is WSCRIPT. You can view the available runtime options by typing `CSCRIPT /?`, or `WSCRIPT /?` at the Windows Command Shell (DOS Window).

The example below demonstrates how to use the WSH Shell object to create shortcuts in the Favorites collection. You can also access the Desktop and Start Menu shortcuts repositories, for both the current user and the AllUsers group profiles (depending upon the local rights of the current user).

```
(defun AddFavoritesShortcut
  (target title / oWsh spfolders favorites shortcut)
  (cond
    ( (setq oWsh (vlax-create-object "WScript.Shell"))
      (setq spfolders (vlax-get-property oWsh "SpecialFolders")
        favorites (vla-item spfolders "Favorites")
        shortcut (vlax-invoke-method oWsh
          "CreateShortcut"
          (strcat favorites "\\\" title ".lnk")
        )
      )
    )
    (vlax-put-property shortcut "TargetPath" target)
    (vlax-invoke-method shortcut "Save")
    (vlax-release-object oWsh)
    (gc);; forced garbage collection after object release
    (princ "\nShortcut created in Favorites...")
  )
  ( T (alert "Failed to obtain shortcut class object..."))
)

(defun C:FAV ( / target name)
  (setq target (getstring "\nURL for Favorite shortcut: ")
    name (getstring t "\nName for Favorite: ")
  )
  (AddFavoriteShortcut target name)
  (princ)
)
```

Figure 21-1 – Using WSH to add a Favorites shortcut link

You can invoke the `ExpandEnvironmentStrings` method of the `WshShell` object to read Windows environment variables. You can do this with the `(getenv)` function as well, but there ARE DIFFERENCES to be aware of. Let's try it out...

```
(getenv "programfiles")

"C:\Program Files"

(vl-load-com)

(setq objShell (vlax-create-object "Wscript.Shell"))

(vlax-invoke-method objShell
  'ExpandEnvironmentStrings "%programfiles%")

_$ "C:\Program Files"
```

Do you see the difference?

Here's another difference test:

```
(getenv "programfiles(x86)")

_$ nil

(vlax-invoke-method objShell
  'ExpandEnvironmentStrings "%programfiles(x86)%")

_$ "%programfiles(x86)%"
```

See the difference again? Yes baby! You gotta love it. Never assume that poking at the same wild beast from two different sides will yeild the same results. When `(getenv)` fails, it returns `nil`. When the `WshShell` interface call fails, it just spits back the request string. You can still use that as a means to test if it failed, but the point is that they behave differently.

Figure 22-1a - Using WshShell to get environment variables

KiXtart

I'm not suggesting you start using KiXtart, even though I happen to personally LOVE it. But this is just

another example of reaching through a COM interface to invoke another tool to help expand the reach and flexibility of your LISP code. To make this work, you need to download KiXtart from <http://www.kixtart.org> and extract the files to get kixtart.dll. Simply copy it to your hard drive and register it (e.g. "regsvr32 kixtart.dll") and you should now have an entry in the registry for KiXtart.Application under HKCR.

```
(setq kix (vlax-create-object "KiXtart.Application"))
(setq username (vlax-get kix "UserID")
      computer (vlax-get kix "WKSTA")
      userpriv (vlax-get kix "PRIV")
)
```

Refer to the KiXtart reference guide for the "Macro" names which you can invoke using this interface. Macro items are how KiXtart refers to global variables.

The FileSystem Object

The FileSystem object, or "FSO" for short, is a powerful tool for interfacing with, and manipulating files, and folders through the Windows operating system. For example, we can use it to iterate all drive mappings and return a list of drive mappings.

```
(defun ListDriveMappings (/ fso drive drives lst pth grp)
  (setq fso (vlax-Create-Object "Scripting.FileSystemObject"))
  (vlax-for drive (setq drives (vlax-get-Property fso "Drives"))
    (setq ltr (strcat (vlax-get-property drive "DriveLetter") ":")
          pth (vlax-get-property drive "ShareName")
          grp (cons ltr pth)
          lst (cons grp lst)
    )
  )
  (vlax-Release-Object drives)
  (vlax-Release-Object fso)
  (reverse lst)
)
```

Figure 21-2 – Using the FileSystem object to list drive mapping properties

The above function returns a list of drive mappings in paired sub-lists such as (("C:" . "") ("D:" . "") ("F:" . "\\server\\share") ...). This can be useful for building lists and for validating a users' configuration to support your application drive mapping needs. We can also use the FileSystem object to see if a particular UNC path is mapped as a drive letter, and if so, return the actual drive letter.

```
(defun get-MappedShare (share / fso drives drive letter)
  (setq fso (vlax-create-object "Scripting.FileSystemObject"))
  (vlax-for drive (setq drives (vlax-get-property fso "Drives"))
    (if
      (=
        (strcase (vlax-get-property drive "ShareName"))
        (strcase share)
      )
      (setq letter (strcat (vlax-get-property drive "DriveLetter") ":"))
    )
  )
  (vlax-release-object drives)
  (vlax-release-object fso)
  letter
)
```

Figure 21-3 – Using the FileSystem object to resolve a UNC path to a drive letter mapping

Using the above example, you can resolve UNC paths to actual drive letters if they have been mapped by the current user. The syntax is as follows:

```
(get-MappedShare "\\server\\myshare")
might return a drive letter such as "F:"
```

The FileSystem object provides many other methods and accesses to various object properties. For instance, you can copy, rename and delete files and folders. You can even use it to copy a file directly to a named port, such as when performing direct-port printing with plot files:

```
(defun CopyFileToLPT1 (filename / file fso)
  (setq fso (vlax-create-object "Scripting.FileSystemObject"))
  (setq file (vlax-invoke-method fso "GetFile" filename))
  (vlax-invoke-method file "Copy" "LPT1")
)
```



```

(vlax-release-object file)

(vlax-release-object fso)

)

```

Figure 21-4 – Using the FileSystem object to copy a file to the LPT1 port

WMI and SWbemLocator

The Microsoft Windows Management Instrumentation (WMI) service is an abstraction layer that provides programmatic interfacing with system resource data. This includes hardware and software but also includes security and security context features. For a quick example of what WMI enables, open the Computer Management utility in Windows 2000 or Windows XP. Just about everything you can find in that collection of information is exposed by the WMI interfaces. WMI is accessible by any ActiveX programming language, including Visual LISP. WMI is Microsoft's implementation of the Desktop Management Task Force (DMTF) CIM specification reference model.

Invoking WMI from within Visual LISP is best handled through the use of the Web-Based Enterprise Management or "WBEM" Scripting interface. The programmatic interface is "WbemScripting.SwbemLocator". If you look at most of the examples for invoking WMI from VBScript posted on MSDN or TechNet, you will not typically see it done this way. But there are plenty of examples out there if you look. Once you establish the WMI connection, you submit a query to obtain a collection (a Safearray) which can be iterated to fetch individual property values. For example, the Win32_BIOS class exposes information about the computer system BIOS:

Win32_BIOS

```

(setq wbem (vlax-create-object "WbemScripting.SWbemLocator"))

(setq strUser nil strPwd nil)

(setq wmiConn (vlax-invoke wbem 'ConnectServer nil nil strUser strPwd nil nil nil nil))

(setq colItems (vlax-invoke wmiConn 'ExecQuery "Select * from Win32_BIOS"))

(vlax-for objItem colItems
  (princ (vlax-get objItem 'Name))
  (terpri)
  (princ (vlax-get objItem 'Version))
)

```

Might return:

```
"PhoenixBIOS 4.0 Release 6.0"
```

```
"INTEL - 6040000"
```

Win32_OperatingSystem

```
(setq colItems (vlax-invoke wmiConn "ExecQuery" "Select * from Win32_OperatingSystem"))
(vlax-for objItem colItems
  (princ
    (strcat
      (vlax-get objItem 'Manufacturer) ", "
      (vlax-get objItem 'Caption)
    )
  )
)

"Microsoft Corporation, Microsoft Windows 7 Ultimate"
```

Mapping WMI Property Names

You can pass in a delimited list to make it easier to parse through the property names, such as shown in the following example:

```
(setq query "ExecQuery" "Select * from Win32_BIOS")
(setq colItems (vlax-invoke wmiConn query))
(setq fields
  "Caption,InstallDate,Manufacturer,ReleaseDate,SerialNumber,SMBIOSBIOSVersion,Version")
(vlax-for objItem colItems
  (foreach field (acet-str-to-list "," fields)
    (princ (vlax-get objItem field))
  )
)
```

In the first section, you may notice where I set strUser and strPwd both to nil. Then I'm passing in those null values into the ConnectServer method invocation. If you're using a secure connection, you can specify an explicit username and password, however, you should keep in mind that doing so will transmit the information in clear text, exposing it to potential network traffic monitoring.

The most common errors that occur are "Access Denied" (0x80041003 or 2147749891), and "Invalid Namespace" (0x8004100E or 2147749902). There are other potential errors as well. This is another situation where using vl-catch-all-apply is highly recommended.

For more information about the SwbemLocator interface and the ConnectServer method, look at Microsoft MSDN document: [http://msdn.microsoft.com/en-us/library/aa393720\(v=vs.85\).aspx](http://msdn.microsoft.com/en-us/library/aa393720(v=vs.85).aspx)

[For more information on WMI Win32 Classes, go to http://msdn.microsoft.com/en-us/library/aa394554\(v=vs.85\).aspx](http://msdn.microsoft.com/en-us/library/aa394554(v=vs.85).aspx)

Working with Services

TIP: When invoking Windows services, you normally use the GetObject method (`vlax-get-object`) with the explicit prog-id identifier. One problem exists in that Visual LISP cannot invoke certain services using this interface. Examples include the LanmanServer service, and Windows Management Instrumentation (WMI) mentioned above.

The only available workaround at the time of this publication is to call an external script or executable, or provide a "wrapper", or intermediate component to perform the desired operations and return the results to VLISP in a variant form. You can develop wrapper DLL's for almost any exposed service using Visual Basic and invoke that DLL from Visual LISP or VBA and do whatever you need to do.

Of course, you can always use the AutoCAD shell command to invoke the Windows SC.EXE command or the Sysinternals PsService utility.

Chapter 22 –Using Visual Basic DLLs with Visual LISP

UPDATE: I thought about removing this section entirely, since VB6 is ancient history, but you can still compile DLL components from Visual Studio 2008 and 2010, so there's still a bit of relevancy.

Now that you've seen how to use interfaces to other applications, it's time to consider making your own custom tools. More accurately, this involves developing your own services as components that can be referenced by Visual LISP (or other ActiveX language options like VB or VBA). For example, you can develop your own ActiveX controls or DLLs and use them from Visual LISP. This opens up an unlimited potential for creating efficient pathways to other resources from within Visual LISP.

One such example might be to define a set of database interface routines that execute stored procedures and returns them as a list to your Visual LISP application. Then the DLL can take care of the ADO connections and doing the commands and recordset management itself. This frees you from having to worry about doing this in Visual LISP, which although can be done, it is much more tedious to do than with more suitable languages like Visual Basic or Delphi. Conversely, the use of a VLX application function library allows you to provide a similar purpose for other LISP or Visual LISP applications. Huh? Yes, you can wrap DLL functionality within VLX applications so that even your calls to your DLL's remain private and protected.

As an example, we'll create an ActiveX DLL that performs a simple function of concatenating strings and returning a combined string result. This will involve using Microsoft Visual Basic 6.0 and a new ActiveX DLL project (see Figure 22-1 below).



Figure 22-1 – The Microsoft Visual Basic 6.0 *New Project* form.

Once you pick the Open button, the Visual Basic 6.0 development environment will open and a default code window will be displayed. Change the name of the default project from Project1 to **vbStringClass**, and change the name of the default class module from Class1 to **vbStrings**. Then, enter the code shown in Figure 22-2 in the code window to define three distinct Public Functions. A *public function* is one that can be exposed to any ActiveX consumer when the vbStringClass class is loaded.

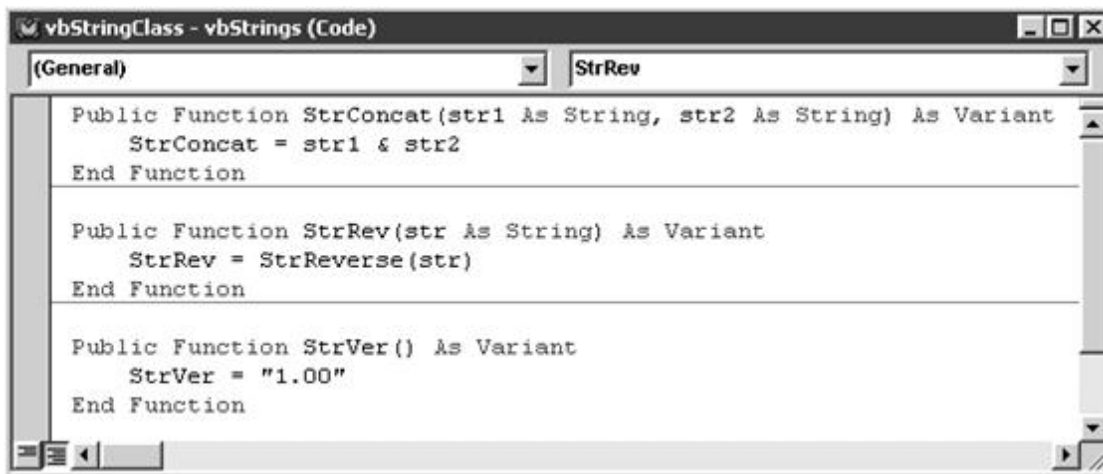


Figure 22-2 – Creating a public function in the class module code window.

Once you have entered the code to define the class function, save the class module as vbStrCat.cls and the project itself as vbStringClass.vbp. Then pick the File pulldown menu and select the *Make*

vbStringClass.DLL option. Pick the OK button on the form that appears and Visual Basic will compile your class module into a DLL and register it on the local operating system. This DLL is now ready for use by any other program, be it Visual LISP, VB.NET, C#.NET, F#, Python, C/C++ or whatever. The next step is to load this DLL using its TypeLib interface within Visual LISP and try it out.

TIP: You should avoid using the variable/symbol name "acad" in your program code. Some third-party VLX applications will apply symbol protection to this name and it may cause you to experience an error message when you try to use that name in your code.

Open the Visual LISP editor, create a new code window and enter the following code, with these three distinct LISP functions.

```
(vl-load-com)

(defun vbStrCat (string1 string2 / $acad vbstrcs out)

  (setq $acad (vlax-get-acad-object))

  (setq vbstrcs

    (vla-GetInterfaceObject $acad "vbStringClass.vbStrings")

  )

  (setq out (vlax-invoke-method vbstrcs "StrConcat" string1 string2))

  (vlax-release-object vbstrcs)

  (vlax-release-object $acad)

  out

)

(defun vbStrRev (string / $acad vbstrcs out)

  (setq $acad (vlax-get-acad-object))

  (setq vbstrcs

    (vla-GetInterfaceObject $acad "vbStringClass.vbStrings")

  )

  (setq out (vlax-invoke-method vbstrcs "StrReverse" string))

  (vlax-release-object vbstrcs)

  (vlax-release-object $acad)

  out

)
```

```

(defun vbStrVer ( / $acad vbstrcls out)

  (setq $acad (vlax-get-acad-object))

  (setq vbstrcls (vla-GetInterfaceObject $acad "vbStringClass.vbStrings"))

  (setq out (vlax-invoke-method vbstrcls "StrVer"))

  (vlax-release-object vbstrcls)

  (vlax-release-object $acad)

  out

)

```

Figure 22-3 – Visual LISP code to implement the DLL class functions.

Each (defun) function uses the AcadApplication object method "GetInterfaceObject" to fetch your registered DLL from the operating system and expose the class functions within your Visual LISP code. Notice how the objects are explicitly released before returning result values.

TIP: When working with Visual Basic, it is important to be careful about defining *Functions* as opposed to *Sub* routines. Functions can return values, Subs cannot. Also, if you fail to use the Function=Result return at the end of a given function, the return will be *nil* to your LISP expressions. You might expect an ActiveX error to be generated, but this is not the case. Also, you must define the return data type as a Variant for all Functions in order to use them with VLISP. If you retrun some other data type, it will cause an ActiveX error in your LISP code because it expects a Variant data type.

Now, load this Visual LISP code into AutoCAD and test it by entering these function examples following at the AutoCAD command prompt:

```
Command: (vbStrCat "THE " "DOG")
```

This should return something like the following result:

```

Initializing VBA System... "THE DOG"

Command: (vbStrRev "THE DOG BARKED") returns "DEKRAB GOD EHT"

Command: (vbStrVer) returns "1.00"

```

This is a very simple example and is only intended to demonstrate that you can develop components in other language tools and use them from Visual LISP and other language environments to get the job done. Note that the first time you reference an imported function like this; you will see a notice saying "Initializing VBA System..." just before the result is returned. This is because AutoCAD uses the VBA

system services to interact with ActiveX DLL components that involve certain ActiveX functions. After the first invocation in a given drawing session, you will not see that message again, only the return value.

Registering DLLs

If you plan to use this approach, you need to be aware of how DLL components are used and how to *register* them on a given computer. When you compile an ActiveX DLL in Visual Basic, it handles this chore for you on your local machine. But other users on other machines will have to register the DLL another way before it can be used on their machine. The Windows REGSVR32 command is used to manually register DLL components a given machine. The syntax is REGSVR32 filename.dll where filename.dll is the full path and filename to where the DLL resides (it can be local or on a network share).

For example, if you were to deploy this DLL we created above on another machine, and you had copied the vbStringClass.DLL file to a network folder named G:\acadsupport\components\vbStringClass.DLL you would use the following command on each client computer:

```
C:\>REGSVR32 G:\ACADSUPPORT\COMPONENTS\VBSTRINGCLASS.DLL
```

This can be done from any command prompt (on that local machine), or through a SHELL operation from within AutoCAD (again, on that local machine), or programmatically within Visual LISP using some code to check for the registration and taking care of registering the DLL if it hasn't already been registered on the machine.

Re-Registering DLLs

Whenever you release an updated version of your custom DLL it will also receive a new GUID identifier. This lets other applications know what specific version of your DLL they are using. In order to update a DLL on another machine, you must first un-register it using REGSVR32 /U and then re-register it using REGSVR32 to install the newer version and register the new GUID. The function shown in figure 14-1 (`dllunregister`) can be used from within VLISP to unregister a known DLL. Then you can use the (`dllregister`) function to register a newer version.

This type of approach is very common and forms the basis of how many web development environments work. One example is with ASP web programming and the use of MTS (Microsoft Transaction Server) with Visual Basic DLLs. The ASP code can invoke the DLL just as we can do with

Visual LISP, in order to hand off complex processing tasks to a dedicated component, which in turn returns the result to ASP for use within rendering a web page to the user. DLL libraries provide their functionality to all ActiveX languages at once. So when you create a new DLL, remember that it can normally be used by VLISP, VBA, VB.NET, C#.NET, F#, Python, WSH and many more languages.

Finally, if you do decide to pursue creating custom DLL components, you should seriously consider using the Class Builder Wizard add-in for Visual Basic 6.0. This handy utility helps you define a new class and develop an object model for your own DLL classes. This opens up yet greater possibilities to you as well as other programmers using other ActiveX-enabled languages in your organization.

Chapter 23 – Working with Dialog Forms

Since Visual LISP hasn't added anything new to the world of DCL interfacing from LISP, this chapter will instead focus on how DCL can be used within VLX applications. There are quite a few methods for dealing with callbacks from dialog forms. I am not going to preach any particular method to you. The methods shown herein are only my own habitual ways of working with DCL callbacks. If you have other preferences, please continue on your merry way unless you feel like changing habits now.

Referencing DCL Definitions

In the old days of AutoLISP, you had two files for any application that used a dialog form. You had the LSP file and the DCL file, and both had to be present and available to the user at runtime to execute the application successfully. With the new VLISP Application features, you can now compile the LSP and DCL source code files into a single VLX application file to provide to your users. This not only protects your source code somewhat, but it makes for easier deployment and maintenance, especially in a networked or distributed environment.

For example, in AutoLISP you might setup a LSP application to access the DCL source as follows (again, your style may be different. This is for example only):

```
(cond
  ( (setq dcfl (findfile "mydialog.dcl"))
    (setq dcid (load_dialog dcfl))
    (cond
      ( (new_dialog "myform" dcid)
        ;; ...do something with dialog callbacks here...
        (action_tile "accept" "(done_dialog 1)")
        (action_tile "cancel" "(done_dialog 0)")
        (start_dialog dlgstatus)
        (unload_dialog dcid)
      )
    )
  )
  ( T (princ "\nUnable to locate DCL form file!") ) )
```

```
)
```

You can still use this "legacy" code with only very minor changes to enable it to be compiled into a Visual LISP VLX application file. Simply remove the check for the file location and assume it is always there (because, when you compile it into the VLX it will be). You would only need to check for the form loading itself, which is already being done in the original code.

```
(setq dcid (load_dialog "mydialog"))  
(cond  
  ( (new_dialog "myform" dcid)  
    ...leave the rest as-is...  
  )  
)
```

As you can see, it also shortens your code a bit. You can use this to help guide you in porting your older AutoLISP dialog form applications into Visual LISP VLX applications by referring to chapter 13 for how to build VLX applications.

Dynamic Dialog Interaction

A very common feature requirement in dialog-based applications is the need to have form features dynamically change in response to user interaction. Such things as changing an image or edit box values based upon selections in other parts of the form. Probably the most common is the need to enable or disable features based upon user selections.

The following example will step through how to make a dialog form that enables or disables certain features based upon selections in another part of the form. First, we'll show the example dialog form definition:

```
// save as MyDialog.dcl  
  
myform : dialog {  
  label = "My Dialog Form";  
  : row {  
    : boxed_radio_column {  
      key = "viewpoint";  
      label = "ViewPoint Options";  
    }  
  }  
}
```

```

      : radio_button {key = "TOP"; label = "Top"; }
      : radio_button {key = "SIDE"; label = "Side"; }
      : radio_button {key = "FRONT"; label = "Front"; }
    }
    : boxed_column {
      label = "Other Options";
      : edit_box {key = "TOP2"; label = "Top Scale"; edit_width = 6; }
      : edit_box {key = "SIDE2"; label = "Side Scale"; edit_width = 6; }
      : edit_box {key = "FRONT2"; label = "Front Scale"; edit_width = 6; }
    }
  }
  ok_cancel;
}

```

Now, we'll see how to enable only one of the edit-boxes at a time, with respect to which of the radio-buttons are selected on the left-hand side of the form. To do this, we'll define a few functions. The first will handle the dialog form and the call-backs using an (action_tile) call-back for the radio_column "viewpoint", which will receive the key-name of the radio button selection within its collection. Then we can use that key name to perform a conditional action using the other two functions to manipulate the other tiles.

```
;;; Save as MyDialog.lsp
```

```

(defun C:Myform ( / *error* dcid ok choice)
  (defun *error* (s)
    (princ (strcat "\nError: " s))
    (vl-bt)
    (princ)
  )
  (setq dcid (load_dialog "mydialog"))
  (if (null $MYFORM1) (setq $MYFORM1 "TOP"))
  (cond
    ( (new_dialog "myform" dcid); form name is case sensitive!
      (set_tile "viewpoint" $MYFORM1)
      (change-form $MYFORM1); initialize tiles using default value
    )
  )

```

```

(action_tile "viewpoint" "(setq choice (change-form $value))")
(action_tile "accept" "(setq ok 1)(done_dialog)")
(action_tile "cancel" "(setq ok 0)(done_dialog)")
(start_dialog)
(unload_dialog dcid)
(if (= ok 1)
    (if choice (setq $MYFORM1 choice))
    )
)
( T (princ "\nUnable to load form from dialog definition.") )
)
(princ)
)

```

;;; apply tile mode changes in response to given tile to enable

```

(defun change-form (val)
  (cond
    ( (= val "TOP")
      (mode-tiles '("TOP2") 0)
      (mode-tiles '("SIDE2" "FRONT2") 1)
    )
    ( (= val "SIDE")
      (mode-tiles '("SIDE2") 0)
      (mode-tiles '("TOP2" "FRONT2") 1)
    )
    ( (= val "FRONT")
      (mode-tiles '("FRONT2") 0)
      (mode-tiles '("TOP2" "SIDE2") 1)
    )
  )
  val
)

```

```

;;; apply tile mode to list of tilenames

(defun mode-tiles (tiles mode)

  (foreach tile tiles (mode_tile tile mode))

)

```



Now simply follow the steps in Chapter 13 to compile both of these source files into a single VLX application file and load it into your AutoCAD session. Type in MYFORM to run the command and see how the edit boxes react when you select the radio buttons.

Your dialog display should look something like this example image if you compile and load it correctly.

Controlling Images from DCL Call-Backs

Now that we've seen how to enable and disable tiles from call-back values, let's try going a tiny step farther and use this to change the slide image in a dialog form image tile. To demonstrate this, you should load the sample code slide files into a common folder and make sure the folder is in your default search path. Once we compile the VLX application and load it, it will still need to find the .SLD files used for the image tile display. Unfortunately, VLISP doesn't provide a means to compile slide files into the VLX as it does for DCL, DVB, INI and LSP files.

Let's take the dialog form defined above and modify it slightly to add a single image_tile:

```

// save as MyDialog2.dcl

myform : dialog {

```



```

label = "My Dialog Form";

: row {
  : boxed_column {
    label = "Preview";

    : image_button {
      key = "image";

      height = 10;

      aspect_ratio = 1.25;

      color = 0;

      fixed_height = true;

      fixed_width = true;
    }
  }

  : boxed_radio_column {
    key = "viewpoint";

    label = "ViewPoint Options";

    : radio_button {key = "TOP"; label = "Top"; }
    : radio_button {key = "SIDE"; label = "Side"; }
    : radio_button {key = "FRONT"; label = "Front"; }
  }

  : boxed_column {
    label = "Other Options";

    : edit_box {key = "TOP2"; label = "Top Scale"; edit_width = 6; }
    : edit_box {key = "SIDE2"; label = "Side Scale"; edit_width = 6; }
    : edit_box {key = "FRONT2"; label = "Front Scale"; edit_width = 6; }
  }
}

ok_cancel;
}

```

In order to properly control the image_tile, we should define a special function that takes care of finding the image file and adjusting scaling to suit the DCL configuration. You can load this example from MyDialog2.LSP in the sample files collection for this book. If you look closely, you'll notice that this function accepts either a SLD or SLB (slide-library) file, thereby making it possible to bundle your slides

into a SLB and keep the total deployment down to just the VLX and SLB files.

```
(defun slide-show
  (tile sld slb / w ky xc yc sldnam)
  (cond
    ( (or
        (and slb (findfile slb))
        (findfile sld)
      )
      (setq
        xc (dimx_tile tile)
        yc (dimy_tile tile)
      )
      (start_image tile)
      (fill_image 0 0 xc yc 0)
      (if slb
        (progn
          (setq slb (vl-filename-base slb))
          (setq sldnam (strcat slb "(" sld ")" ))
        )
        (setq sldnam sld)
      )
      (slide_image 0 0 xc yc sldnam)
      (end_image)
    )
    ( T (alert "Slide image file not found...") )
  )
)
```

Assuming that you use the provided slide files TOP.SLD, SIDE.SLD and FRONT.SLD and place them in a folder that is in the current default search path, you should be able to compile and load the MYDIALOG2.VLX and run it successfully.

Chapter 24 – Code Examples

This chapter will suggest some ideas for solving common tasks that combine aspects of previous chapters. You may find some of these useful, maybe not. In any case, they are provided simply to demonstrate how VLISP can be used to do things AutoLISP alone is not capable of doing.

Example 1 – Dumping a List of Layer Properties

This example involves the task of producing an HTML report of all layers in the current drawing, including their properties (color, linetype, etc.) and opening the report in a web browser after completion. When loaded, the command is DUMPLAYERS.

```
(defun C:DUMPLAYERS
  ( / acadapp doc dwg layers name col ltp lwt pst onoff frz dat
    path olist outfile output)
  (vl-load-com)
  (setq acadapp (vlax-get-Acad-object)
        doc      (vla-get-ActiveDocument acadapp)
        dwg      (vla-get-Name doc)
        path      (vla-get-Path doc)
        layers    (vla-get-Layers doc)
  )
  (vlax-for each layers
    (setq name (vla-get-Name each)
          col  (itoa (vla-get-color each))
          ltp  (vla-get-Linetype each)
          lwt  (itoa (vla-get-LineWeight each))
          pst  (vla-get-PlotStyleName each)
          onoff (if (= :vlax-True (vla-get-LayerOn each))
                    "ON" "OFF"
          )
          frz  (if (= :vlax-True (vla-get-Freeze each))
                    "FROZEN" "THAWED"
          )
    )
  )
)
```

```

        )
        dat (list name col ltp lwt pst onoff frz)
        olist (cons dat olist)
    )
)

(vlax-release-object layers)
(vlax-release-object doc)
(vlax-release-object acadapp)

(cond
  ( olist
    (setq outfile (strcat (vl-filename-base dwg) ".htm"))
    (setq outfile (strcat path outfile))
    (cond
      ( (setq output (open outfile "w"))
        (write-line "<html>" output)
        (write-line "<head><title>" output)
        (write-line (strcat "Layer Dump: " dwg) output)
        (write-line "</title></head><body>" output)
        (write-line (strcat "<b>Drawing: " dwg "</b><br>" ) output)
        (write-line "<table border=1>" output)
        (foreach layset olist
          (write-line "<tr>" output)
          (foreach prop layset
            (write-line (strcat "<td>" prop "</td>") output)
          )
          (write-line "</tr>" output)
        ); foreach layer set
        (write-line "</table></body></html>" output)
        (close output)
        (setq output nil)
        (princ "\nReport finished! Opening in browser...")
        (vl-cmdf "_.browser" outfile)
      )
    )
  )
)

```

```

    )
    ( T (princ "\nUnable to open output file.") )
  )
)
( T (princ "\nUnable to get layer table information.") )
)
)

```

Example 2 – Set All Entities to "ByLayer"

This example involves the task of assigning all entities in the current working space to "ByLayer" with respect to Color, Linetype, and Lineweight properties.

```

(defun C:BYLAYER
  ( / acadapp doc ssall i obj)
  (vl-load-com)
  (setq acadapp (vlax-get-acad-object)
        doc (vla-get-activedocument acadapp))
  )
  (vla-startundomark acadapp)
  (vla-zoomextents acadapp)
  (cond
    ( (setq ssall (ssget "x")); get all entities
      (setq i 0)
      (repeat (sslength ssall)
        (setq obj (vlax-ename->vla-object (ssname ssall i)))
        (vlax-put-property obj "Color" acByLayer)
        (vlax-put-property obj "Linetype" "ByLayer")
        (vlax-put-property obj "Lineweight" acLnWtByLwDefault)
        (vlax-release-object obj)
        (setq i (1+ i))
      )
    )
  )
  (vla-endundomark acadapp)
)

```

```

(princ "\nFinished processing all entities.")
(princ)
)

```

Example 3 – Purge, Audit and Save all Opened Drawings

This example involves the task of iterating through the Documents collection and performing a Purge, Audit and Save operation on each document.

```

(defun C:DOALL ( / $acad docs dnum this)
  (vl-load-com)
  (setq $acad (vlax-get-acad-object)
        docs (vla-get-documents $acad)
        this (vla-get-activedocument $acad)
        dnum (vla-get-count docs)
  )
  (vlax-for each docs
    (vla-purgeall each)
    (vla-auditinfo each T)
    (vla-save each)
  )
  (vla-get-activedocument this)
  (vlax-release-object docs)
  (vlax-release-object this)
  (vlax-release-object $acad)
  (princ (strcat "\nProcessed " (itoa dnum) " drawings."))
  (princ)
)

```

Example 4 – Zoom Extents and Save all Opened Drawings

This example involves iterating through each opened document, zooming to extents in the current (active) space and tab, and saving the document. Finally, it returns to the starting document when finished.

```

(defun C:ZOOMALL ( / $acad docs dnum this)

```

```

(vl-load-com)

(setq $acad (vlax-get-acad-object)
      docs  (vla-get-documents $acad)
      this  (vla-get-activedocument $acad)
      dnum  (vla-get-count docs)
)

(vlax-for each docs
  (vla-put-ActiveDocument each)
  (vla-ZoomExtents $acad)
  (vla-save each)
)

(vla-put-activedocument this)
(vlax-release-object docs)
(vlax-release-object this)
(vlax-release-object $acad)

(princ (strcat "\nProcessed " (itoa dnum) " drawings."))

(princ)
)

```

Example 5 - Create a Table

```

(if (setq pt (getpoint "\nSelect table basepoint: "))
  (progn
    (setq
      acad (vlax-get-acad-object)
      doc  (vla-get-ActiveDocument acad)
      ms   (vla-get-ModelSpace doc)
    )
    (setq objTable
      (vla-addTable ms
        (vlax-3d-point pt)
        3 ; rows
        3 ; columns
        0.75 ; row height
        2.0 ; column width
      )
    )
  )
)

```



```

    )
)
(vla-setText objTable 0 0 "Heading")
(vla-setText objTable 1 0 "Row 1, Col 0")
(vla-setText objTable 1 1 "Row 1, Col 1")
(vla-setText objTable 1 2 "Row 1, Col 2")

(vla-setText objTable 2 0 "Row 2, Col 0")
(vla-setText objTable 2 1 "Row 2, Col 1")
(vla-setText objTable 2 2 "Row 2, Col 2")

(vla-put-RegenerateTableSuppressed objTable :vlax-true)

(vla-settextstyle objTable actitlerow "Standard")
(vla-settextstyle objTable acheaderrow "Standard")
(vla-settextstyle objTable acdatarow "Standard")
(vla-put-TitleSuppressed objTable :vlax-false)
(vla-put-headerSuppressed objTable :vlax-false)
(vla-put-horzcellmargin objTable 0.4)
(vla-put-vertcellmargin objTable 0.4)
(vla-put-RegenerateTableSuppressed objTable :vlax-false)

(vlax-release-object objTable)
(vlax-release-object ms)
); end progn
); end if

```

If all goes well, the above code should crank out a table that looks like the following example:

Heading		
Row 1, Col 0	Row 1, Col 1	Row 1, Col 2
Row 2, Col 0	Row 2, Col 1	Row 2, Col 2

Chapter 25 - Changes in AutoCAD 2011

I'm not going to provide an exhaustive review of every difference introduced between AutoCAD 2004 and 2011. I'll leave that for Autodesk and other people to provide.

General Changes

Most of the changes to the application footprint are aimed at improving Windows Vista and Windows 7 compatibility, which benefits IT professionals as well as making their products easier to troubleshoot and support overall.

Overall the majority of the changes since AutoCAD 2004 have been with the UI or "user interface" itself: Menus, Palettes, Ribbons, Toolbars, commands and newer internal interfaces. Some new objects have been added like Dynamic Blocks, as well. The DWG format changed at AutoCAD 2004, again at 2007 and again at 2011. The newest format, .DWGX, is similar to the Office 2007 and Office 2010 formats in that it includes compression for added storage and transfer benefit.

ObjectARX (and ObjectDBX as well) have been updated and recompiled to be compatible with newer .NET assemblies. The result is that ObjectARX and ObjectDBX components built for use on versions prior to AutoCAD 2011 will no longer work. You may also need to download newer ObjectARX add-ons like DOSLib (<http://www.mcneel.com>).

COM Type Libraries must be invoked with the appropriate product version (18.0). In other words, where you might have invoked AutoCAD as `AutoCAD.Application`, or `AutoCAD.Application.16`, you now must use `AutoCAD.Application.18`.

Visual LISP Changes in AutoCAD 2011

I guess that the best way to sum up the changes to Visual LISP between 2004 and 2011 would be to say it was woken up with a bucket of ice water and smeared with dollar store lipstick and dragged back out for another party. There are some minor adjustments and tweaks here and there, but overall it's pretty ho-hum. The poor orphaned LISP API is outside in the cold, shoeless, watching the little well-dressed and groomed .NET children getting fresh-cooked meals inside the warm house. If you listen closely, you can hear them laughing about how funny the little homeless LISP kid looks breathing on the cold window glass. I can still hear the violins playing too.

Conclusion

While this book covers a lot of information about using Visual LISP, it cannot cover everything. Visual LISP has (had) a lot of potential, and provides a lot of powerful tools to LISP developers. I wish Autodesk would commit some resources to improving it to bring it up to speed with current development tools. At the very least, fix some of the incomplete features and irritating quirks, but I think Autodesk is letting LISP die on the vine in favor of VBA and ObjectARX. The future of AutoCAD programming appears to be aimed at .NET and possibly Java, but not LISP. Ignoring LISP within AutoCAD would be unfortunate and a big mistake in my humble opinion.

With the announcement that VBA will be deprecated after AutoCAD 2011, or at least relegated to an external add-on, the fact that the LISP engine remains speaks volumes for not only how integral it has become, but how vital it is to so many customers and partners.

Most of the features that could be improved would require very minimal investment in time and budget and would yield a much more robust development tool. Some improvements might be fixing the project management tools, better compilation controls, fixing dialog box inconsistencies, adding "Intelli-Sense" completion, streamlined functionality for referencing external objects and components, making a standalone version and so on.

Hopefully, the information and examples provided herein will give you some additional motivation to further explore Visual LISP and become a better software developer as a result. If not, it makes a great coffee cup stand. In any case, I hope you find this book useful and helpful.

Happy Coding! - Dave

Appendix A - VLAX Enumerations

Constant Symbol	Value
:vlax-False	:vlax-False
:vlax-Null	:vlax-Null
:vlax-True	:vlax-True
vlax-vbAbort	3
vlax-vbAbortRetryIgnore2	
vlax-vbApplicationModal0	
vlax-vbArchive	32
vlax-vbArray	8192
vlax-vbBoolean	11
vlax-vbCancel	2
vlax-vbCritical	16
vlax-vbCurrency	6
vlax-vbDataObject	13
vlax-vbDate	7
vlax-vbDefaultButton1	0
vlax-vbDefaultButton2	256
vlax-vbDefaultButton3	512
vlax-vbDirectory	16
vlax-vbDouble	5
vlax-vbEmpty	0
vlax-vbError	10
vlax-vbExclamation	48
vlax-vbHidden	2
vlax-vbHiragana	32
vlax-vbIgnore	5
vlax-vbInformation	64
vlax-vbInteger	2
vlax-vbKatakana	16
vlax-vbLong	3
vlax-vbLowerCase	2
vlax-vbNarrow	8
vlax-vbNo	7
vlax-vbNormal	0
vlax-vbNull	1
vlax-vbObject	9
vlax-vbOK	1
vlax-vbOKCancel	1
vlax-vbOKOnly	0
vlax-vbProperCase	3
vlax-vbQuestion	32
vlax-vbReadOnly	1
vlax-vbRetry	4

vlax-vbRetryCancel	5
vlax-vbSingle	4
vlax-vbString	8
vlax-vbSystem	4
vlax-vbSystemModal	4096
vlax-vbUpperCase	1
vlax-vbVariant	12
vlax-vbVolume	8
vlax-vbWide	4
vlax-vbYes	6
vlax-vbYesNo	4
vlax-vbYesNoCancel	3

Note: There is no vlax-vbDecimal or vlax-vbNothing enumeration. Also, the vlax-vbNull does not translate well into ActiveX consumers such as VBA as a true "Null" object or value. Be aware of the data type changes between VBA 6, VB6 and the .NET environments.

Appendix B – VLA Names

vla-Activate
vla-Add
vla-Add3DFace
vla-Add3DMesh
vla-Add3DPoly
vla-AddArc
vla-AddAttribute
vla-AddBox
vla-AddCircle
vla-AddCone
vla-AddCustomInfo
vla-AddCustomObject
vla-AddCylinder
vla-AddDim3PointAngular
vla-AddDimAligned
vla-AddDimAngular
vla-AddDimArc
vla-AddDimDiametric
vla-AddDimOrdinate
vla-AddDimRadial
vla-AddDimRadialLarge
vla-AddDimRotated
vla-AddEllipse
vla-AddEllipticalCone
vla-AddEllipticalCylinder
vla-AddExtrudedSolid
vla-AddExtrudedSolidAlongPath
vla-AddFitPoint
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vla-put-ShowRasterImage
vla-put-ShowRotation
vla-put-ShowWarningMessages
vla-put-SingleDocumentMode
vla-put-Smoothness
vla-put-SnapBasePoint
vla-put-SnapOn
vla-put-SnapRotationAngle
vla-put-SolidFill
vla-put-SourceObjects
vla-put-SplineFrame
vla-put-SplineMethod
vla-put-StandardScale
vla-put-StandardScale2
vla-put-StartAngle
vla-put-StartDraftAngle
vla-put-StartDraftMagnitude
vla-put-StartParameter
vla-put-StartPoint
vla-put-StartSmoothContinuity
vla-put-StartSmoothMagnitude
vla-put-StartTangent
vla-put-State
vla-put-StoreSQLIndex
vla-put-StyleName
vla-put-StyleSheet
vla-put-Subject
vla-put-SubUnitsFactor
vla-put-SubUnitsSuffix
vla-put-SupportPath
vla-put-SuppressLeadingZeros
vla-put-SuppressTrailingZeros
vla-put-SuppressZeroFeet

vla-put-SuppressZeroInches
vla-put-SurfaceNormals
vla-put-SymbolPosition
vla-put-TableBreakFlowDirection
vla-put-TableBreakHeight
vla-put-TablesReadOnly
vla-put-TabOrder
vla-put-TagString
vla-put-TaperAngle
vla-put-Target
vla-put-TempFileExtension
vla-put-TempFilePath
vla-put-TemplateDwgPath
vla-put-TemplateId
vla-put-TempXrefPath
vla-put-TextAlignmentPoint
vla-put-TextAlignmentType
vla-put-TextAngleType
vla-put-TextAttachmentDirection
vla-put-TextBackgroundFill
vla-put-TextBottomAttachmentType
vla-put-TextColor
vla-put-TextDirection
vla-put-TextEditor
vla-put-TextFill
vla-put-TextFillColor
vla-put-TextFont
vla-put-TextFontSize
vla-put-TextFontStyle
vla-put-TextFrameDisplay
vla-put-TextGap
vla-put-TextGenerationFlag
vla-put-TextHeight
vla-put-TextInside
vla-put-TextInsideAlign
vla-put-TextJustify
vla-put-TextLeftAttachmentType
vla-put-TextLineSpacingDistance
vla-put-TextLineSpacingFactor
vla-put-TextLineSpacingStyle
vla-put-TextMovement
vla-put-TextOutsideAlign
vla-put-TextOverride
vla-put-TextPosition
vla-put-TextPrecision
vla-put-TextPrefix
vla-put-TextRightAttachmentType
vla-put-TextRotation
vla-put-TextString

vla-put-TextStyle
vla-put-TextStyleName
vla-put-TextSuffix
vla-put-TextTopAttachmentType
vla-put-TextureMapPath
vla-put-TextWidth
vla-put-TextWinBackgrndColor
vla-put-TextWinTextColor
vla-put-Thickness
vla-put-TimeServer
vla-put-Title
vla-put-TitleSuppressed
vla-put-ToleranceDisplay
vla-put-ToleranceHeightScale
vla-put-ToleranceJustification
vla-put-ToleranceLowerLimit
vla-put-TolerancePrecision
vla-put-ToleranceSuppressLeadingZeros
vla-put-ToleranceSuppressTrailingZeros
vla-put-ToleranceSuppressZeroFeet
vla-put-ToleranceSuppressZeroInches
vla-put-ToleranceUpperLimit
vla-put-ToolPalettePath
vla-put-Top
vla-put-TopHeight
vla-put-TopRadius
vla-put-TranslateIDs
vla-put-Transparency
vla-put-TrueColor
vla-put-TrueColorImages
vla-put-TurnHeight
vla-put-Turns
vla-put-Twist
vla-put-TwistAngle
vla-put-Type
vla-put-UCSIconAtOrigin
vla-put-UCSIconOn
vla-put-UCSPerViewport
vla-put-UIsolineDensity
vla-put-UnderlayLayerOverrideApplied
vla-put-UnderlayName
vla-put-UnderlayVisibility
vla-put-Units
vla-put-UnitsFormat
vla-put-UpsideDown
vla-put-URL
vla-put-URLDescription
vla-put-URLNamedLocation
vla-put-UseEntityColor

vla-put-UseLastPlotSettings
vla-put-UseStandardScale
vla-put-Value
vla-put-Verify
vla-put-VertCellMargin
vla-put-VerticalDirection
vla-put-VerticalTextPosition
vla-put-Vertices
vla-put-ViewingDirection
vla-put-ViewportDefault
vla-put-ViewportOn
vla-put-ViewToPlot
vla-put-VisibilityEdge1
vla-put-VisibilityEdge2
vla-put-VisibilityEdge3
vla-put-VisibilityEdge4
vla-put-Visible
vla-put-VIsolineDensity
vla-put-VisualStyle
vla-put-Weights
vla-put-Width
vla-put-WindowLeft
vla-put-WindowState
vla-put-WindowTop
vla-put-WireframeType
vla-put-WorkspacePath
vla-put-XEffectiveScaleFactor
vla-put-XrefDemandLoad
vla-put-XRefEdit
vla-put-XRefFadeIntensity
vla-put-XRefLayerVisibility
vla-put-XScaleFactor
vla-put-XVector
vla-put-YEffectiveScaleFactor
vla-put-YScaleFactor
vla-put-YVector
vla-put-ZEffectiveScaleFactor
vla-put-ZScaleFactor
vla-PutRemoteFile
vla-Quit
vla-RealToString
vla-RecomputeTableBlock
vla-RefreshPlotDeviceInfo
vla-Regen
vla-Reload
vla-Remove
vla-RemoveAllOverrides
vla-RemoveCustomByIndex
vla-RemoveCustomByKey

vla-RemoveEntry
vla-RemoveFromMenuBar
vla-RemoveItems
vla-RemoveLeader
vla-RemoveLeaderLine
vla-RemoveMenuFromMenuBar
vla-RemoveVertex
vla-Rename
vla-RenameCellStyle
vla-RenameProfile
vla-Replace
vla-ReselectSubRegion
vla-ResetBlock
vla-ResetCellValue
vla-ResetProfile
vla-Restore
vla-Reverse
vla-Rotate
vla-Rotate3D
vla-RunMacro
vla-Save
vla-SaveAs
vla-ScaleEntity
vla-SectionSolid
vla-Select
vla-SelectAtPoint
vla-SelectByPolygon
vla-SelectOnScreen
vla-SelectSubRegion
vla-SendCommand
vla-SendModelessOperationEnded
vla-SendModelessOperationStart
vla-SetAlignment
vla-SetAlignment2
vla-SetAutoScale
vla-SetAutoScale2
vla-SetBackgroundColor
vla-SetBackgroundColor2
vla-SetBackgroundColorNone
vla-SetBitmaps
vla-SetBlockAttributeValue
vla-SetBlockAttributeValue2
vla-SetBlockRotation
vla-SetBlockScale
vla-SetBlockTableRecordId
vla-SetBlockTableRecordId2
vla-SetBreakHeight
vla-SetBulge
vla-SetCellAlignment

vla-SetCellBackgroundColor
vla-SetCellBackgroundColorNone
vla-SetCellClass
vla-SetCellContentColor
vla-SetCellDataType
vla-SetCellFormat
vla-SetCellGridColor
vla-SetCellGridLineWidth
vla-SetCellGridVisibility
vla-SetCellState
vla-SetCellStyle
vla-SetCellTextHeight
vla-SetCellTextStyle
vla-SetCellType
vla-SetCellValue
vla-SetCellValueFromText
vla-SetColor
vla-SetColor2
vla-SetColorBookColor
vla-SetColumnName
vla-SetColumnWidth
vla-SetContentColor
vla-SetContentColor2
vla-SetContentLayout
vla-SetControlPoint
vla-SetCustomByIndex
vla-SetCustomByKey
vla-SetCustomData
vla-SetCustomScale
vla-SetDatabase
vla-SetDataFormat
vla-SetDataType
vla-SetDataType2
vla-SetDoglegDirection
vla-SetFieldId
vla-SetFieldId2
vla-SetFitPoint
vla-SetFont
vla-SetFormat
vla-SetFormat2
vla-SetFormula
vla-SetGridColor
vla-SetGridColor2
vla-SetGridDoubleLineSpacing
vla-SetGridLineStyle
vla-SetGridLinetype
vla-SetGridLineWidth
vla-SetGridLineWidth2
vla-SetGridSpacing

vla-SetGridVisibility
vla-SetGridVisibility2
vla-SetInvisibleEdge
vla-SetLayoutsToPlot
vla-SetLeaderLineVertices
vla-SetMargin
vla-SetNames
vla-SetOverride
vla-SetPattern
vla-SetProjectFilePath
vla-SetRelativeDrawOrder
vla-SetRGB
vla-SetRotation
vla-SetRowHeight
vla-SetScale
vla-SetSnapSpacing
vla-SetSubSelection
vla-SetTemplateId
vla-SetText
vla-SetTextHeight
vla-SetTextHeight2
vla-SetTextRotation
vla-SetTextString
vla-SetTextStyle
vla-SetTextStyle2
vla-SetTextStyleId
vla-SetToolTip
vla-SetValue
vla-SetValueFromText
vla-SetVariable
vla-SetView
vla-SetWeight
vla-SetWidth
vla-SetWindowToPlot
vla-SetXData
vla-SetXRecordData
vla-SliceSolid
vla-Split
vla-StartBatchMode
vla-StartUndoMark
vla-SwapOrder
vla-SyncModelView
vla-TransformBy
vla-TranslateCoordinates
vla-Unload
vla-UnloadArx
vla-UnloadDVB
vla-UnmergeCells
vla-Update

vla-UpdateEntry
vla-UpdateMTextAttribute
vla-Wblock
vla-ZoomAll
vla-ZoomCenter
vla-ZoomExtents
vla-ZoomPickWindow
vla-ZoomPrevious
vla-ZoomScaled
vla-ZoomWindow
VLARTS-INIT

Appendix C - VLAX Names

vlax-3d-point
VLAX-ADD-CMD
vlax-create-object
vlax-curve-getArea
vlax-curve-getClosestPointTo
vlax-curve-getClosestPointToProjection
vlax-curve-getDistAtParam
vlax-curve-getDistAtPoint
vlax-curve-getEndParam
vlax-curve-getEndPoint
vlax-curve-getFirstDeriv
vlax-curve-getParamAtDist
vlax-curve-getParamAtPoint
vlax-curve-getPointAtDist
vlax-curve-getPointAtParam
vlax-curve-getSecondDeriv
vlax-curve-getStartParam
vlax-curve-getStartPoint
vlax-curve-isClosed
vlax-curve-isPeriodic
vlax-curve-isPlanar
vlax-dump-Object
vlax-ename->vla-object
vlax-erased-p
VLAX-FOR
vlax-get
vlax-get-acad-object
vlax-get-object
vlax-get-or-create-object
vlax-get-property
vlax-import-type-library
vlax-invoke
vlax-invoke-method
vlax-ldata-delete
vlax-ldata-get
vlax-ldata-list
vlax-ldata-put
vlax-ldata-test
vlax-make-safearray
vlax-make-variant
vlax-map-Collection
vlax-method-applicable-p
vlax-object-released-p

vlax-product-key
vlax-property-available-p
vlax-put
vlax-put-property
vlax-queueexpr
vlax-read-enabled-p
vlax-reg-app
vlax-release-object
VLAX-REMOVE-CMD
vlax-safearray->list
vlax-safearray-fill
vlax-safearray-get-dim
vlax-safearray-get-element
vlax-safearray-get-l-bound
vlax-safearray-get-u-bound
vlax-safearray-put-element
vlax-safearray-type
vlax-tmatrix
vlax-typeinfo-available-p
vlax-variant-change-type
vlax-variant-type
vlax-variant-value
vlax-vbAbort
vlax-vbAbortRetryIgnore
vlax-vbApplicationModal
vlax-vbArchive
vlax-vbArray
vlax-vbBoolean
vlax-vbCancel
vlax-vbCritical
vlax-vbCurrency
vlax-vbDataObject
vlax-vbDate
vlax-vbDefaultButton1
vlax-vbDefaultButton2
vlax-vbDefaultButton3
vlax-vbDirectory
vlax-vbDouble
vlax-vbEmpty
vlax-vbError
vlax-vbExclamation
vlax-vbHidden
vlax-vbHiragana
vlax-vbIgnore
vlax-vbInformation
vlax-vbInteger
vlax-vbKatakana
vlax-vbLong
vlax-vbLowerCase

vlax-vbNarrow
vlax-vbNo
vlax-vbNormal
vlax-vbNull
vlax-vbObject
vlax-vbOK
vlax-vbOKCancel
vlax-vbOKOnly
vlax-vbProperCase
vlax-vbQuestion
vlax-vbReadOnly
vlax-vbRetry
vlax-vbRetryCancel
vlax-vbSingle
vlax-vbString
vlax-vbSystem
vlax-vbSystemModal
vlax-vbUpperCase
vlax-vbVariant
vlax-vbVolume
vlax-vbWide
vlax-vbYes
vlax-vbYesNo
vlax-vbYesNoCancel
vlax-vla-object->ename
vlax-write-enabled-p

Appendix D - VLISP IDE Keyboard Shortcuts

The following table shows the available default keyboard shortcuts provided within the Visual LISP IDE or VLIDE editor.

F1	Help
F3	Find / Replace Next
F6	Display LISP Console Window
F8	Step Into
SHIFT+F8	Step Over
CTRL+SHIFT+F8	Step Out Of
F9	Toggle BreakPoint
CTRL+SHIFT+F9	Clear All BreakPoints
CTRL+W	Add Watch
CTRL+R	Reset to Current Level
CTRL+Q	Quit to Current Level
ALT+F6	Zoom
ALT+Q	Exit / Quit Visual LISP IDE

Appendix E – Tips & Tricks for Visual LISP

Adding VLX support to the (autoload) function

By default, the AutoLISP (autoload) function will only look for .LSP, .FAS or .MNL file types when searching for a specified file loading. It will not consider .VLX files at all. This is a minor but often significant oversight by Autodesk, but fortunately it is an easy fix. Simply open the Acad2000doc.lsp file located in the Support folder of your AutoCAD installation. Then locate the (defun ai_ffile) function definition and add an additional check for .vlx files, save the file and close it. This will need to be done on every machine that you wish to perform this change.

Saving your VLIDE configuration settings

When you modify the editor configuration settings your changes are saved in a configuration file named VLIDE.DSK in the Support folder where your local copy of AutoCAD (or network client) is installed. You should keep a copy of this file elsewhere to avoid it being overwritten when reinstalling AutoCAD or installing a service pack update. This file contains your formatting preferences (colors, tabs, indentation, etc.).

Recovering DCL Code from VLX Files

In Chapter 13 the details of how LSP and DCL are compiled into VLX output was discussed. One thing to remember is that while the LSP code is first compiled into FAS form before being compiled into the VLX output, DCL code is not compiled at all. It is simply appended to the bottom of the VLX output file. Therefore, you can open VLX files in any standard text editor such as Windows Notepad, and browse to the bottom of the file to find all the DCL code in tact. You can copy and paste it from there back into a new DCL file whenever you delete a DCL file by mistake but happen to have the VLX available.

Using Projects and DCL with the Make Application Wizard

To put Projects to their full use, it is a good practice to add all related files for a given VLX into a project. Then order them in the proper sequence based upon the order of function definition statements (load order). Next, when using the Make Application wizard, select the Project PRJ file instead of the individual LSP files.

Since DCL files cannot be included in a Project list, you would normally have to add them individually in the Resource files list of the Make Application wizard (Expert mode only). However, another approach can be to concatenate all the DCL files into a single DCL file. This will result in having to add one PRJ and one DCL file to make the VLX application.

To concatenate multiple DCL files into a single DCL file, use the age-old DOS command COPY as follows:

```
COPY *.DCL ALL.DCL
```

This will copy all .DCL files into a single file named ALL.DCL. Remember to consider the relative paths, or run everything from within the same path location.

Team-based VLX Development

If you're developing a network based project along with several other developers, you should keep a few things in mind. First, the PRV format stores the path/drive information for your source files when compiling VLX applications. Secondly, sharing PRV setup files only works when the relative pathing is portable to all intended users. By "portable", I mean that the relative path/drive information must be equally applicable by all intended users. It's a good idea to have all the developers copy the entire source code set to their local hard drives and use local pathing for all your PRV file setups. Then after the VLX apps are built, copy them up to the intended network server(s).

In addition, if you have some sort of change management software, such as Visual Source Safe, StarBase, PVCS-DOORS or whatever, you should use that in order to manage check-out, check-in and version control over all the various files to avoid stepping on each other's work and creating confusion.

Appendix F – Useful Resources

Unlike the list I included with the 2003 edition, some have since fallen off the Internet. Those that are still available:

<http://download.rhino3d.com/McNeel/1.0/doslib>

<http://support.autodesk.com>

<http://www.augi.com>

<http://www.vbdesign.net>

<http://www.myitforum.com>

<http://www.upfront.com>

<http://www.microsoft.com/scripting>

<http://www.cadinfo.net>

<http://www.adminscripts.net>

<http://sites.google.com/site/skatterbrainz>

<http://scriptzilla.blogspot.com>

Glossary

ActiveX	(boy, oh boy. Ask Microsoft)
Bookmark	A location marker placed in a document that enables the user to return to that location quickly.
Breakpoint	A marker placed in program code that instructs the compiler or interpreter to pause execution at runtime and wait for the user to perform debugging tasks or continue execution.
Call-Back	A requested response to a given action or event. For example, a call-back to clicking a button might be "accept" which then triggers a call to a particular function or expression.
Collection	A group of objects with a common parent and related properties or methods that enable processing the objects in a logical manner as a group.
COM	Component Object Model. A Microsoft technology that defines a hierarchical organization of software components, and services and provides intrinsic properties, methods and events for components and services that enable more efficient programmatic manipulation and promotes componentized functional reuse. Other flavors include Distributed COM or DCOM and the newer COM+ included with Windows 2000 and XP platforms.
Constant	A variable or symbol with a static value assignment.
Consumer	Any software component or application that imports or uses the exposed component services of another software component or service. The source of the imported components or services is known as a <i>provider</i> .
Control	An ActiveX DLL component.
Data Type	The intrinsic nature of a particular value with respect to what form of data is represented. Examples of ActiveX data types include Integer, Long, Double, String, and Array.
DCL	Dialog Control Language, a C-based language construct used to define dialog box forms within the AutoCAD LISP and Visual LISP environments.

Debug	The process of isolating, diagnosing and correcting errors in program code or programming logic.
Dictionary	A type of collection that provides direct access to member objects by a using unique identifier for each object.
DLL	A <i>dynamic link library</i> is a Windows-based ActiveX component that usually exposes functions, properties, methods, and constants for use by other applications. It is something like a packaged library of tools that can be loaded by applications to perform specialized tasks.
Element	An individual member of an array or safearray construct.
Enumeration	(need an official definition for this one)
Evaluate	The process of executing a LISP expression or extracting an associated value from a LISP symbol and returning a result.
Event	A moment when some action occurs in a software program. This can be the click of a button or moving an entity. An event usually provides programmatic notification that can be detected and responded to using a <i>reactor</i> or <i>callback</i> .
Expression	A program statement within the context of AutoLISP or Visual LISP interpreter environments.
Focus	The state of a given item within a DCL dialog box either having control by the active cursor location. If an editbox has the cursor active and is editable, it is said to <i>have the focus</i> . When the cursor is moved out of a given item, it is said to have <i>lost the focus</i> .
Function	In the context of software development, this is an expression or group of expressions that processes some type of input and returns a result. In the context of Visual LISP, a <i>subroutine</i> and a <i>function</i> are synonymous. In the context of other languages like Visual Basic or C/C++ a <i>subroutine</i> returns no result, while a <i>function</i> returns a result.
Global	Any variable, symbol or expression that is exposed for either read or write manipulation by all other variables, symbols or expression running in the same namespace. A symbol or expression that is hidden from access by other expressions is said to be Localized or Local to its parent function or expression.
Heap	A pile of trash that needs to be cleaned up, or a logical memory address space

allocated for a particular group of related expression definitions and/or their results.

Interface (Programming) any means by which one software component or service can connect to another for the purposes of requesting services or values from the other component or service. This can also involve the passing of information in either direction through a common logical programmatic reference.

Iterate A loop process where items are accessed in a sequential order within a group of related items. Examples of iteration functions are (while), (do while), (foreach), (repeat), and (vfor).

Local Any variable, symbol or expression that is not shared or accessible outside of its parent function or expression.

Marshalling The process of controlling an external process remotely from another process. Launching another application in serialized fashion is but one example of marshalling.

Method A built-in function of a given object that enables automated retrieval or modification of that object. Examples of methods provided by a Line object include Move, Rotate, and Copy.

Modal / Modeless Refers to the nature of how a dialog form can be displayed and controlled within the environment in which it is launched. If the dialog can remain visible while the user can continue to interact with other aspects of the parent application, the form is said to be Modeless. If the visible form prevents interaction with other aspects of the parent application until it is closed, that form is said to be Modal in nature.

Namespace An isolated memory address range allocated to a given application or process. The address range is protected from access by other address ranges, and thereby creates a protected environment for the process to execute within.

Object In the context of software development: An instance of a class that provides intrinsic functionality such as properties, methods or events that can be used to interact with other services, components or objects to perform some programming task.

Object Model A logical, hierarchical organization of objects within a parent software application or process. For example, Windows 2000 has an object model provided by the Win32 and DCOM or COM+ class environments. AutoCAD 2002 has its own object model provided by the

ActiveX framework and exposed through ObjectDBX, ObjectARX, VBA and Visual LISP environments.

Project (Visual LISP) a named collection of program source code files.

Property An intrinsic attribute of a given object that enables unique identification of that object in some way.

Provider A software application or component that exposes some functionality for use by other applications or components. In particular, it becomes a provider while it is actually used by a *consumer* application, component or service.

Reactor A special type of software service provided by Visual LISP that acts as a listening device for specific events within the AutoCAD application session and optionally performs some task when a specified condition is met by an intercepted event.

Recursion The process of evaluating inputs to a given function whereby the repetitive processing to achieve a desired result involves one or more self-invocations of the same function by itself until a final, terminating condition is met.

RPC A Remote Procedure Call process that is provided by the Windows operating system to allow a local process to request a process to be created on another machine to perform some action remotely.

SafeArray An array of elements whereby the array has a fixed length and cannot be modified to increase or decrease the length (number of elements that can be stored within it). It is said to be "safe" because it cannot change length, and thereby reduces the possibility of errors as a result of attempting to enter or retrieve elements from an index that is *out of bounds* (beyond the end of the array).

Scope A minty mouthwash, or a logical boundary with respect to the reach or lifespan of a specific symbol or expression

Stack A logical container that can collect objects or values and allow for systematic addition or removal of members in an orderly or sequential manner.

Stepping The process of stopping program execution and allowing the user to manually advance execution one statement or one line at a time. There are several types of stepping: Step Into, Step Over and Step Out Of.

Type Casting The process of converting one data type to another, such as converting an integer number value to a string value.

Type Library Also called a TypeLib, is a dedicated software component that identifies the object model and member objects, properties, methods, and constants of that object model to any other applications or processes that request programmatic interaction.

Variant A data type that is defined to be capable of storing all other data types, thereby avoiding the concern of verifying a given data type before assigning or retrieving it from a given variable or symbol.

WorkSpace The active set of related program documents opened in the programming development environment.

WSH Microsoft's Windows Scripting Host, a software service that provides runtime support for executing script code files on a machine. WSH allows scripts to be run either in the Windows namespace or within the namespace of a calling application or process from a programmatic interface. The default WSH enabling services are CSCRIPT (command line interface) and WSCRIPT (graphical user interface).

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