TreeDyn Overview

version May 2006

chevenet@ird.fr

This TreeDyn overview includes references to TreeDyn tutorials @ www.treedyn.org
TreeDyn is a graphical editor

- raw data
  sequences, morphology ...
- Phylogeny Classification
- Topology
  String characters representation
  recursive parenthesis (newick)
- Topology graphical representation
- Graphical analysis
- TreeDyn
The tree graphical object is much used

http://iphylo.blogspot.com/
R. Page phyloinformatic blog, iPhylo, December 2005:

« This graph shows the cumulative growth of publications on phylogenetics, based on the number of papers found in the Web of Science by searching on the key words “molecular” and “phylogenetic” since 1981 the growth of the TreeBASE, which launched in 1996 (a study in TreeBASE is equivalent to a single paper). The idea for this diagram came from Mark Pagel's article "Inferring the historical patterns of biological evolution" Nature 401, 877 - 884 (28 October 1999) »
Lot of tree editors (~70)!

APE 2004 R package
ARB 2003 Linux Mac OS X complete environment
Arbor3D 2000 SGI immersive 3D
ATV 2002 all Java (see also FORESTER+)
BAOBAB 2005 all JAVA
Bionumerics Commercial
Bosque 2005 C++ Qt
Compare 2 trees 2006 applet compare 2 trees
DAMBE 2001 Windows
DendroMaker 1998 Mac
DoubleTree 2003 DoubleTree
Drawtree and DrawGram... 1998 included in PHYLIP
FORESTER 2002 Java relies on ATV
Geneious 2006 all Java
GeneTree 2001 Mac Windows GeneTree
H3Viewer 2001 all H3Viewer
Hypergeny web hyperbolic tree browser
HyperTree Java 2001 HyperTree Java
PHYDIT for rRNA
HYPERTREE 2004 all Java
MacClade 2005 Mac Commercial
Mavric 2001 all python module
MEGA 2005 all complete environment
Mesquite 2005 all complete environment (uses Tree Set Viz).
MrEnt 2006 Windows requires .NET Framework 1.1
NJplot 2006 all C Vibrant
NJplot unrooted same as NJplot
PAL 2004 all PAL (JAVA)
Paloverde 2006 all 3D C OpenGL
PAUP 2001 all Commercial
PhyphyloTree 2005 all web application
Phylogenetic Tree 1999 all Java + web
Phyldraw 2000 Windows PhyloDraw
Phylogenetic Tree Drawing 2003 all perl module

Phylogenetic Tree Viewer 2000 IRIX 6.5 for dnaml
PhyloGrapher 2001 all Tcl/Tk
Phylomatic 2006 web, and standalone
Phylo_win 1996 all environment, uses njplot
PoinTree 2005 Windows polar trees
RadCon 2002 Mac RadCon
SARAgene
SpaceTree 2003 all Java (or Java Web Start)
Spectronet 2002 Windows C++
Spectrum 1997 Mac Windows Spectrum
TaxonTree 2003 TaxonTree
THEA 2004 all Java
TREEBOLIC all hyperbolic, Java + web
TREECON 1994 Windows TREECON
Tree Draw Deck 1998 Mac OS9 HyperCard
TreeDyn 2006 all Tcl/Tk
TreeEdit 2002 MAC OS X TreeEdit
TreeExplorer 1999 for MEGA; outdated
TREEFINDER 2005 all Java
TreeGraph 2005 all C++, command line
TreeIllustrator 2005 all Java (webstart or source)
TreeJuxtaposer 2004 all Java
TreeMap 2004 all Java
TreeMe 2005 Windows TreeMe
TreePlot TreePlot
TreePlus 2006 ??? Download ???
TreeSetViz 2004 Mac, Windows included in Mesquite
TreeThief ??? Mac Scan images.
TreeTool 2006 X windows TreeTool
TreeView 2006 all wxWidgets
TreeWiz applet 2002 all Java
T-REX 2005 all phylogeny software
Walrus 2005 all Hyperbolic 3D (Java)

For more details, see http://www.treedyn.org/Tree_editors.html
...so, why TreeDyn?

many powerful tree editors, but they make little use of information related to the entities under study. Consequently a tedious manual analysis and post processing of tree’s images is required, particularly with:

- large trees (let’s say more than 1000 leaves)
  for instance micro-arrays analysis, or rRNA phylogenies

- multiple trees management
  different data (nucleotids seq. vs amino-acid seq.), methods, different family genes, genes/species phylogenies, host/parasites cospeciation, supertree analyses...
The TreeDyn project

- Solving technical problem
  for instance: saving/restoring graphical analysis. At present the user has to copy
  the tree from the tree editor to a graphic editor for a post-processing before publication.

- Looking for graphical analyses methods spec.
  to tree management
  information visualization, human-computer interaction, dynamic graphics

- Use of meta-information
  Leaf labels as keys to address information related to the entities under studies
TreeDyn

dynamic graphics and annotations for tree investigations

1. Interface
2. Import/Export
4. Projection
5. Identification localization and labelization
6. Reflection transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreeIG, TreeXY, TreePAT…
1. Interface
2. Import/Export
4. Projection
5. Identification localization and labelization
6. Reflection transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreeIG, TreeXY, TreePAT…
Interface: Panels

Main panel

Secondary panels & specific packages
Interface: Multi-Windows / Multi-trees per window

multiple point of views
Interface: Trees selection

Tree targeting system

TreeDyn documents

Target on/off
Verb to Object Interaction.
Tool selection and use “on the fly” to graphical items. Tools are represented by icons organized into toolboxes (from basic to experts users).

Object to Verb interaction. User selection of graphical items (tree, sub-tree, leaf, etc.) and selection of a tool through specific contextual menus.
Interface: Toolbox edition

Graphical interface adapted to the user profile/preferences

default toolboxes: from the basic set tools (beginner user) to the complete collection of tredyn tools (expert users)

tool selection, tool color, tools order, toolbox row x columns
Interface: TreeDyn update

TreeDyn is under active development. Upgrade it without download/install again
Interface: Dynamic graphics

direct manipulation and instantaneous reaction of graphical items

For instance:
• brushing the tree results in highlighting the corresponding sub-trees AND the corresponding elements of the scatterplot matrix.
• brushing the scatterplot matrix results in highlighting the enclosed entities on all the PCA factors combinations AND the tree.
• different modes: transient, lasting and undo and brush resizeable

a phylogenetic analysis of entities (for instance molecular level)

a scatterplot matrix of 3 PCA factors analyse related to the same entities (for instance morphological data, geographical distribution, …)
1. Interface
2. Import/Export
4. Projection
5. Identification localization and labelization
6. Reflection transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreeIG, TreeXY, TreePAT…
Import/Export

Inputs
- newick, nexus,
- TGF (TreeDyn Graphic File) saving/loading graphical analysis
- TLF (TreeDyn annotations file)
- TDS (TreeDyn script files)
- bitmap files (GIF, JPG: adding pictures to tree)
- several newick strings in one file
- multi-files selection (newick and/or TGF)

Copy/Paste:
- intra TreeDyn documents
- inter TreeDyn documents
- Navigators (local/global views)
- Clipboard

Outputs:
- TGF
- Postscript
- Bitmap: gif, jpg, tiff, bmp, png…
- SVG
- GIF + HTML encapsulation
- Newick strings (trees, sub-tree)
- Leaf labels list
Import/Export

Load

a file with multiple newick strings

ctrl/shift keys for multiple selection
Import/Export: GIF+HTML encapsulation

« Online suplementary material » for publications: big trees, colors, contextual information

URLs linked to leaf labels

HTML « alt » tag displaying contextual information

Virginie Chapon, Richard Christen
1. Interface
2. Import/Export
3. **Edition** Toolbox Navigation Figuration Conformation Abstraction Illustration Construction
4. Projection
5. Identification localization and labelization
6. Reflection transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreeIG, TreeXY, TreePAT…
Edition Navigation

« Fit to contents », « Fit to window », translations, size, zooms, navigators « focus + context »
Edition Navigation
trees collection management
Edition Conformation

Configuration

Outgroup, Swap, Ladder…

Orientation (W/E, E/W)

Rotation
Edition Abstraction: Shrink, Collapse
Edition Abstraction : Décomposition
drawing tools more or less specific to trees edition (to be extend)

Insertion of comments in regards of leaf labels:
- select the corresponding tool,
- enter a text, select a color, a font
- apply it « on the fly » to subtrees

Bracket link to a sub-tree
« free bracket »
Edition Construction

polytomy all
polytomy next level
delete subtree
copy/paste subtree
1. Interface
2. Import/Export
4. Projection
5. Identification localization and labelization
6. Reflection transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreelG, TreeXY, TreePAT…
Projection

Posting annotations (symbol/text) to tree graphical representations:

- manual posting (user)
- semi-automatic (posting information from the newick string)
- massive posting (meta-information: annotations files)
Projection: from user

1. select a tool
2. choose options
3. browse the tree

enter a text, select a symbol, a color, a font...
Projection: from newick string

semi-automatic (information from the newick string)

often branch lengths

often bootstrap values
Projection: from annotation files

meta-information related to entities under study (quantitative or qualitative variables, binary variables, multi-values variables)

<table>
<thead>
<tr>
<th></th>
<th>V0</th>
<th>V1</th>
<th>V2</th>
<th>V3</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>1</td>
<td>1</td>
<td>x</td>
<td>y 1.270 1.250...</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>1</td>
<td>z</td>
<td>2.30 2.55...</td>
</tr>
<tr>
<td>c</td>
<td>1</td>
<td>2</td>
<td>x</td>
<td>y 0.95 0.86...</td>
</tr>
</tbody>
</table>

see TreeDyn Library for translation

TreeDyn:

annotationfile.tlf (TreeDyn Labels File), a text format

<table>
<thead>
<tr>
<th></th>
<th>V0</th>
<th>V1</th>
<th>V2</th>
<th>V3</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>V0</td>
<td>1</td>
<td>{1}</td>
<td>V2 {x y} V3 {1.270 1.250...}</td>
</tr>
<tr>
<td>B</td>
<td>V0</td>
<td>0</td>
<td>{1}</td>
<td>V2 {z} V3 {2.30 2.55...}</td>
</tr>
<tr>
<td>c</td>
<td>V0</td>
<td>1</td>
<td>{2}</td>
<td>V2 {x y} V3 {0.95 0.86...}</td>
</tr>
</tbody>
</table>

variable names
Projection: from annotation files
massive posting (meta-information file)

pattern visualization using a binary variable
Projection: from annotation files

Jean Pierre Dujardin
1. Interface
2. Import/Export
4. Projection
5. Identification  localization and labelization
6. Reflection  transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages  TreeSPU, TREEbaseInterf, TreelG, TreeXY, TreePAT…
Identification: Find

Tutorial @ www.treedyn.org
Identification : Localization/Labelization

Identification

LOCALIZATION

list

\[a \quad b \quad c\]

tree

 LABELIZATION

\[
\text{tree} \\
\text{list}
\]

\[a \quad b \quad c\]

« highlighting »

COUPLAGE

\[v_1 \ldots v_i \ldots v_n\]

\[a \quad b \quad c\]

Information relative aux feuilles

querying

highlighting operation

$av_1 \ldots$

\[
\ldots
\]

« highlighting »
Identification: Localization/Labelization

(a) localization (b) labelization

Tutorial @ www.treedyn.org
Identification : Localization

- multi annotation files management
- multi-trees, multi-window
- multi-highlighting operations
- on the fly updating annotations file
- SQL like interpreter

requêtes SQL
operators : == ; != ; > ; < ; >= ; <= ; ## et !#
connectors : and, or patterns

edit the query manually or...
Identification : Localization

or... Use the variable-query panel

automatic checking of the domain values of a variable with a given operator

identification panel

variable-query panel
Identification : Multi-Localization

localization on multi-trees (whatever their window) using the tree selection system
Identification: Labelization
1. Interface
2. Import/Export
4. Projection
5. Identification localization and labelization
6. Reflection transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreeIG, TreeXY, TreePAT…
Reflection

localization: from annotation to trees
labelization: from tree to annotations

Reflection?

... From tree to trees through annotations
Reflection: Transition

Strict equality of leaf labels between trees

no annotations file needed!
Reflection : Transition

Gene # 1   Gene # 2
Species a   Species b
Species b   Species c

variable/value link

annotations file:

<table>
<thead>
<tr>
<th>Gene # 1</th>
<th>Gene # 2</th>
<th>Species a</th>
<th>Species b</th>
<th>Species c</th>
</tr>
</thead>
<tbody>
<tr>
<td>a1</td>
<td>a2</td>
<td>b1</td>
<td>b2</td>
<td>c1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>m</td>
</tr>
<tr>
<td>a2</td>
<td>a1</td>
<td>b2</td>
<td>b1</td>
<td>c2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>o</td>
</tr>
<tr>
<td>c2</td>
<td>c1</td>
<td>b2</td>
<td>b1</td>
<td>a1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>z</td>
</tr>
</tbody>
</table>

Reflection: Transition
Phylogeny for pocket gophers and their chewing lice based on nucleotide sequence data analysed by (Hafner, 1994)
Reflection: Connection

graphical description of subtrees networks

Link by graphical connectors

contextual menu of a connector

a connector iconified
1. Interface
2. Import/Export
4. Projection
5. Identification localization and labelization
6. Reflection transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreeIG, TreeXY, TreePAT…
Scripting

saving a graphical analysis
automating repetitive tasks

interactive mode using a console (scripting panel)
or by loading scripts files (.tds TreeDyn Script)

"standard" format for publication
Scripting

### one color, several symbols, several columns
operation 105
tabulation = 50
tabulation auto 5
legend on
color black
symbol 31 10
ID EU from sample04 where Key3 == -
symbol 32 10
ID EU from sample04 where Key3 == Puit_4131
legend off
### one symbol, several colors, one column
operation 105
font (Helvetica 8 normal)
legend on
tabulation + 50
tabulation auto 0
symbol 21 10
color black
ID EU from sample04 where Key3 == -
color red
ID EU from sample04 where Key3 == Puit_4131
color green
legend off
### background colors
operation n01
legend on
color #ff00000000
stipple 1
shape 4
ID EU from sample04 where Phylum == Acidobacteria
color #ff0000000
legend off
1. Interface
2. Import/Export
4. Projection
5. Identification localization and labelization
6. Reflection transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreeIG, TreeXY, TreePAT…
command line:
treedyn –tree treefile.nwk –label labelfile.tlf –script –scriptfile.tds –out filename
TreeDyn prompt : PWS

http://crfb.univ-mrs.fr/webdistin
1. Interface
2. Import/Export
3. Edition *Toolbox Navigation Figuration Conformation Abstraction Illustration Construction*
4. Projection
5. Identification *localization and labelization*
6. Reflection *transition*
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreeIG, TreeXY, TreePAT…
Scripts working at the newick string level

Nexus to Newick translation
Newick concatenation
Leaf labels translation
TreeDyn annotations file from tabulated ascii files

(to be extend)
1. Interface
2. Import/Export
3. Edition boîte à outils TreeDyn Navigation Figuration Conformation Abstraction Illustration Construction
4. Annotation manuelle, semi-automatique, projection
5. Identification localisation et labélisation, multi-localisation, multi-labélisation
6. Reflection transition
7. Scripting
8. TreeDyn prompt
9. (Library)
10. Packages TreeSPU, TREEbaseInterf, TreeIG, TreeXY, TreePat…
Packages

Modules for specific trees graphical management

TreeSPU
TreeBASEInterf
TreeIG
TreeXY
TreePAT

As TreeDyn is under GPL licence, any development by a third party is welcome 😊
Package TreeBASEInterf
Package TreeIG
Package TreeXY
Package TreePAT