

ESTEEM™

Enabling Solutions Through Experience Modeling

To run ESTEEM, you need:

- Microsoft Windows version 3.1 or higher
- Personal computer using 80386 or higher
- 4 MB of memory (optimally 8MB)
- 4.5 MB of disk space
- 3.5" high-density (1.44 MB) disk drive
- VGA or higher resolution monitor

If networked, you need:

- Networks that are compatible with Microsoft Windows

Case-Based Reasoning Application Development Tools

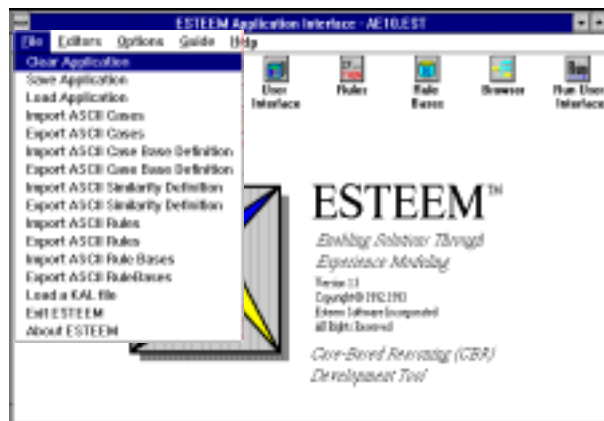
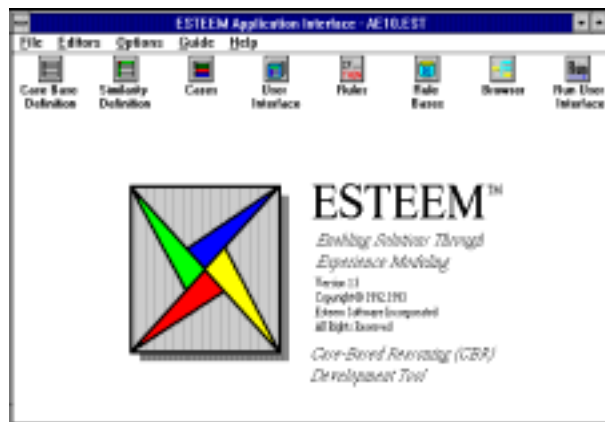
ESTEEM is a Windows-based software tool that enables individuals (both non-programmers and programmers) to quickly construct decision enabling applications which utilize case-based reasoning technology. ESTEEM delivers a new and exciting set of technologies including case-based reasoning, hybrid cases and rules, similarity assessment, and learning through adaptation of prior experience. Case-based applications are used to represent descriptions of prior problems, their solutions, and even the processes used to solve for those prior problems.

ESTEEM delivers these capabilities in a form which makes it easy to learn and apply. The following pages will walk you through various portions of the ESTEEM development environment and briefly show a basic end-user interface for a building construction management application.

ESTEEM's interface is organized following the basic process used to construct a case-based reasoning application. Buttons situated across the top of the interface provide easy entry into the six editors used to build the application, including:

- Case-Base Definition Editor
- Similarity Definition Editor
- Case Editor
- Rule-Base Definition Editor
- Rule Editor
- End User Interface Editor

Buttons are provided for the system browser facility and for running a loaded application.



ESTEEM's system commands are provided via pull down menus at the top of the interface. They include:

- **File** (as shown) contains the file management commands as well as the commands for importing and exporting the components of a case-based application. Breaking down the case-base application components allows for reuse of the components in other applications. KAL files can also be loaded. A KAL file is a KAPPA-PC function which can be loaded into a CBR application to perform a coded task.
- **Editors** gives you menu control of the editors
- **Options** delivers indexing, database access and other options referred to later in this material
- **Guide** is the on-line CBR process assistant
- **Help** is the on-line documentation for the tools



Case Base Definition Editor			
Current Case-Base: CB1		Current Similarity Definition: SimDef	
Feature Names	Feature Value Types	Feature Names	Feature Value Types
Description	Text	ProjectNumber	Text
NumberOfDrawings	Numeric	EstimatedCost	Numeric
ActualCost	Numeric	ProjectManager	Text
SquareFootage	Numeric	Type	One of a List
YearFinished	Numeric	Client	Text
ClientType	One of a List	NumberOfRooms	Numeric

Features are described by a textual name and an associated type definition. Features can have the following types:

- Text
- Numeric
- One of a list
- Yes or No
- Case (a feature can have a value which is case from another case-base)

ESTEEM 1.4.1 provides multiple value feature types!

ESTEEM's Case-Base Definition Editor is used to create the basic definition of what a case is and to instantiate the features for that case. A case consists of a set of features which detail how best to describe the attributes of a prior experience. The case-base definition is used as the basis for the following:

- Association of similarity assessment at the feature level (see below)
- Rules which operate against feature-value pairs
- End-user interface definitions, and more

Similarity Definition Editor			
Current Case-Base: CB1		Current Similarity Definition: SimDef	
Type of Similarity: Weighted Feature Computation			Threshold 10 %
Selected	Feature Name	Type of Feature Matching	Weight/Rule Base Name
<input type="checkbox"/>	EstimatedCost		
<input type="checkbox"/>	ActualCost		
<input checked="" type="checkbox"/>	ProjectManager	Exact	14
<input checked="" type="checkbox"/>	SquareFootage	Fuzzy Range : 40	20
<input checked="" type="checkbox"/>	Type	Exact	20
<input checked="" type="checkbox"/>	YearFinished	Fuzzy Range : 30	5

Types of feature matching vary according to the feature type (i.e. text vs. numeric). Matching types include:

- Exact
- Partial match (letters)
- Partial word match (words)
- Range (numeric range)
- Fuzzy Range (tolerance)
- Equal
- Inferred (uses rules to determine match)

Types of similarity assessment include:

- Feature Counting
- Weighted Feature Counting
- Inferred Feature Computation
- Weighted Inferred Feature Comp.

ESTEEM's Similarity Definition Editor is used to define how similarity is assessed between a new problem description and the case-base of cases. Similarity is assessed both at the case level (comparing case against case) as well as at the feature level (comparing the value of each case's feature value to the new entered feature values).

The developer selects which features are to be used in similarity assessment, and then which type of feature level matching will be used. Feature level mapping can use weights to describe relative importance of one feature over another. The developer can also select the similarity assessment approach at the case level. A threshold would display only those cases which have a computed similarity value greater than the threshold value entered.

ESTEEM Version 1.4.1 provides automatic similarity feature weight setting via ID3!

Case Editor	
Current Case-Base: CB1	Case Name: QualitySuites
<input type="button" value="Save Case"/> <input type="button" value="Get Case"/>	
Feature Names	Feature Values
Description	Quality Suites Hotel, Oceanside, Melbourne, FL
ProjectNumber	86101
NumberOfDrawings	55
EstimatedCost	100000
ActualCost	101879
ProjectManager	Bill Starmer
SquareFootage	80000
Type	Hotel

Cases are given individual names used to order for browsing and for display to the end-user at runtime. Cases can be managed using the following buttons:

- Save Case (save to the case-base)
- Get Case (retrieve a case)
- Clear Case (delete a case)

ESTEEM 1.4.1 provides multimedia data types!

ESTEEM's Case Editor is used to fill in the case information for each case to be stored in the case-base. Cases can also be imported from ASCII files and from databases.

A case is a representation of an individual experience. Feature values must conform to their defined type. Pop menus can appear for Yes-or-No or One-of-A-List feature types, as well as numeric range features. Text values can be longer than the displayed screen length. The down arrow button is used to display the entire feature's text.

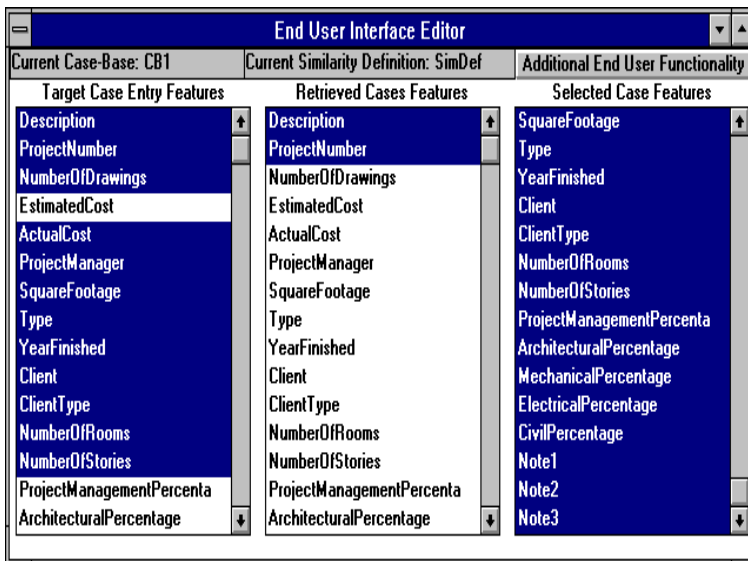
Rule Editor	
Current Rule: ActualCost	
If:	TRUE
Then:	$\text{CB1SC:ActualCost} = \text{Floor}(\text{CB1SC:ActualCost} * \text{CB1TC:NumberOfRooms} * \text{CB1TC:SquareFootage} * 1.04 * (\text{CB1TC:YearFinished} - \text{CB1SC:YearFinished}) / \text{CB1SC:NumberOfRooms} / \text{CB1SC:SquareFootage})$

Rules are defined following this syntax.:

- Individual Clauses are linked by the logical operators, And, Or, or Xor. Not() is also supported.
- Numeric values may be compared with ==, !=, <, >, <=, and >=.
- Other values may be compared with #=.
- Math Operators: +, -, *, /, =, ^
- Non-Numeric Operators
- String Operators
- Numeric Functions: cos, sin, abs ...
- Additionally the functions Partial-Match, PartialWordMatch, or any other legal function may also be used.

Rules are used to compute similarity and to adapt a retrieved similar case to better meet the needs of the new problem. Rules are used to address the differences that exist between a new situation (target case) and the retrieved similar case. The rules are applied to account for the differences and advise on what the plausible outcomes of a comparison might be. Rules can be used to change feature values based on comparison.

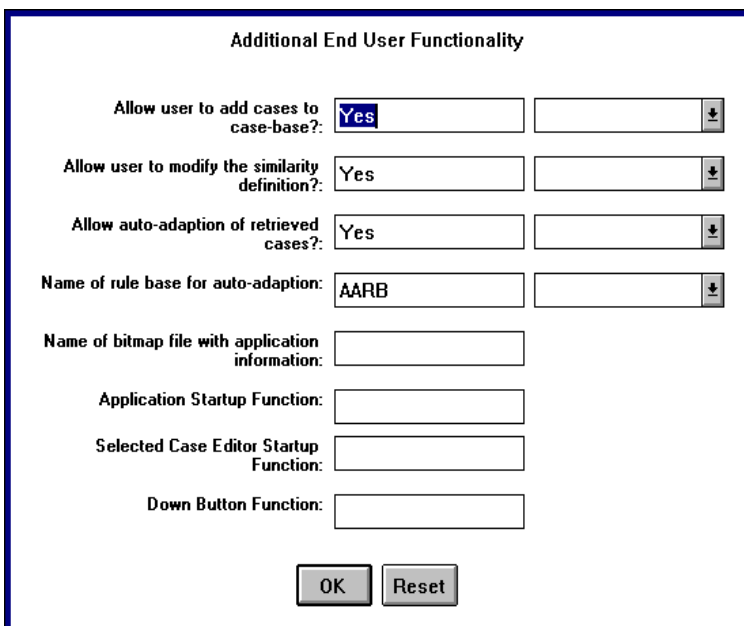
Rules used in adaptation are very task and domain specific. Each CBR application, that uses rules, will have tailored rules used in adaptation. As stated rule-based systems can be shallow and brittle. A developer should try to limit the use of rules as much as possible and place as much value into the creation of the case-base and what knowledge the cases will contain.



This editor consists of:

- Current Case-Base: <case-base name> in the upper-left
- Current Similarity Definition: <similarity definition name> in the upper-center
- ADDITIONAL END-USER FUNCTIONALITY button on the upper-right
- Three selectable areas composed of:
 - Target Case Entry Features builds the Target Case Entry Screen
 - Selected Case Features builds the Selected Case Screen
 - Retrieved Case Features builds the Retrieved Case Screen

ESTEEM's End User Interface Editor is used to create the basic functionality of an end-user interface to the case-based application. The developer uses this editor to select the features that will be used in each of the three end-user interface screens: Target Case Entry Screen (new problem), Retrieved Case Screen (list of retrieved candidate cases), and the Selected Case Screen (case chosen from the retrieved list).



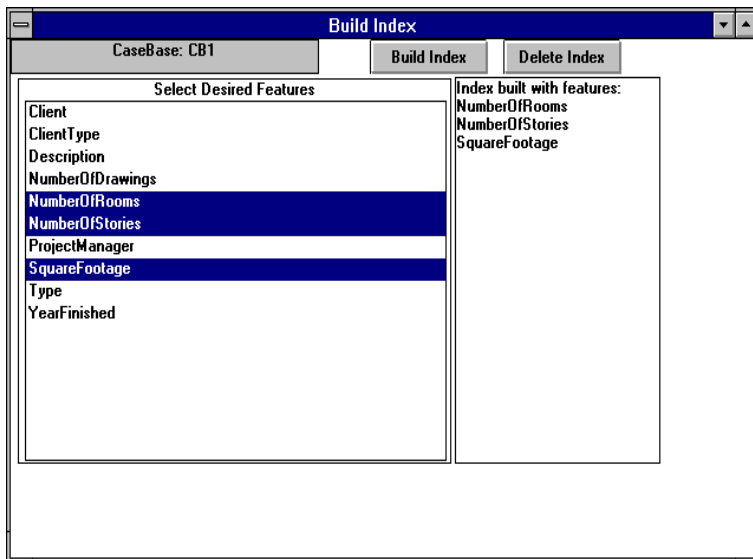
Functions include:

- What actions to take when a case is selected for viewing at runtime
- What action to take for adaptation, including what rule-base to use.
- What functions are called at application startup.
- Toggles for allowing an end-user to modify the similarity definition, or add a new case to the case-base.
- Down button functions for use to display a value for a feature which may be a document or an image.

ESTEEM 1.4.1 also delivers the power of gradient descent computation for weighting features for retrieval.

Additional End User Interface Editor is used to tailor the application interface to meet the needs of the end-user. For example it is important for the developer to decide whether an end-user should have the ability to modify the similarity definition, or be able to save a modified case to the case-base.

System level requirements are also described here, including the name of the rule-base used for auto-adaptation, any bitmaps used when the application is started, etc.



Indices are built for case-bases using the Build Index button.

An index can be deleted using the Delete Index button.

A single feature can be selected for building an index.

Multiple features can be selected to build more complex indices.

ESTEEM 1.4.1 provides the ID3 algorithm for indexing!

Case-bases can be indexed for more efficient retrieval. ESTEEM provides a window facility for identifying which features are to be used in indexing. Indexing orders cases based on the specified features. At runtime those features are used as the primary search attributes.

Case-base information can be imported or exported from ASCII files and databases. *Using this facility allows database record fields to be mapped to a case-base and the selected database information can then be automatically incorporated into the case-base application at runtime.*

Networked databases are accessed by describing their logical drive.

The runtime interface for a case-based application starts with this as the main window. The runtime interface is accessed either directly from the developer's interface or as a standalone executable.

Pull-down menu options include **File** and **Help**. File options allow for loading and clearing case-bases, saving the current runtime session or loading a saved session, starting a new search, and other functions. The Help pull down menu provides runtime facility help.

The seven buttons are used to perform application functions including retrieval, changing similarity assessment definitions, performing adaptation based on a retrieved case, saving the current case to the case-base, help information specific to the application, printing the retrieved case, and exit.

An end-user uses the case-based application by describing their current situation based on the features described in the case-base definition.

The end-user could enter one or more values for their new problem and then perform a retrieval. The CBR system uses the similarity assessment and/or indexing capabilities of the system to find the best match.

ESTEEM Application Interface

File Help

Change Retrieval Attributes Retrieve Adaptation Incorporate New Case Help Print Exit

Selected Case - QualitySuites

Description	Quality Suites Hotel, Oceanside, Melbourne, FL	↓
ProjectNumber	86101	↓
NumberOfDrawings	55	
EstimatedCost	100000	
ActualCost	101879	
ProjectManager	Bill Starmer	↓

Retrieved Case List

Score	Case Name	Description	ProjectNumber
53	QualitySuites	Quality Suites Hotel, O86101	
20	Wexford	Wexford Luxury Condomin86446	
15	Devereaux	Hospital Campus for the86859	

Selected Case - QualitySuites

Description	Quality Suites Hotel, Oceanside, Melbourne, FL	↓
ProjectNumber	86101	↓
NumberOfDrawings	55	
EstimatedCost	100000	
ActualCost	101879	
ProjectManager	Bill Starmer	↓

After retrieval is complete the system returns a list of cases with a score indicating their similarity value to the Target Case (new problem). The score indicates the relevance of the case to the problem at hand. The user can apply the Selected Case to help decide how to solve for the current problem. The Selected Case can then be adapted to better assist the user in making a decision.

This example uses the basic functions of the end-user interface. In order to provide more sophisticated end-user interfaces developers can use tools such as Asymetrix Toolbook. A full range of ESTEEM DDE calls are available and can be used to make calls to and from a more sophisticated user interface.

