

Event Structure Analysis with *Ethno*

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Preface

The first public version of *Ethno*, the Event Structure Analysis (ESA) program, was published in 1988 by David Heise. A Java version of the program was first published in 1997. *Ethno*, and a list of publications on ESA, are available at the ESA website:

<http://www.indiana.edu/~socpsy/ESA/>

Ethno is a qualitative methodology for understanding sequential events. *Prerequisite* analysis focuses on how events are connected logically. The program draws a chart showing the prerequisite structure. *Composition* analysis focuses on how events link agents and things. The program creates tables showing how a narrative associates agents with each other and with non-human entities.

The following table outlines procedures for conducting analyses with *Ethno*. Each column displays steps involved in a particular kind of analysis. "Careful" and "Thorough" analyses involve more work, but provide more information.

Prerequisite Analyses			Composition Analyses	
Quick	Careful	Thorough	Careful	Thorough
	Copy a narrative text into ESA to save quotes with	Copy a narrative text into ESA to save quotes with events.		Copy a narrative text into ESA to save quotes with events.
Enter sequence of short names.	Enter sequence of short names.	Enter sequence of short names.	Enter sequence of short names.	Enter sequence of short names.
			Compute associations of key agents and entities.	Compute associations of key agents and entities. Define abstract types and compute their associations.
	Enter full sentence descriptions of each event.	Enter full sentence descriptions of each event.		
Link the events	Link the events	Link the events		
	Eliminate unneeded detail with summary events.	Eliminate unneeded detail with summary events.		
Test the model to refine it.	Test the model to refine it.	Test the model to refine it. Specify and test a generalized model.		

This document has the following sections.

Introduction Description of the opening display.

Sequence How to define new actions by typing short names. How to use a narrative text in analyses. How to edit the sequential record of actions.

Actions How to edit short names. How to enter full action descriptions and comments. How to code an action's Agent, Act, Object, Instrument, Alignment, Setting, Product, and Beneficiary. How to define entities, agents, and acts. How to change some action parameters in a process model.

Associations How to define entities, agents, and acts, and generalizations of these. How to analyze associations among entities, agents, and acts that are created by co-occurrences in actions.

Linking How to specify prerequisites for actions. How to change the questioning that helps you specify an action's prerequisites.

Chart How to modify an ESA model, working directly on the chart. How to refine a model's ability to account for sequential process. How to find blocks of actions that can be summarized as a single action. How to develop a model of generalized actions that interprets a narrative at a higher level of abstraction. How to print the chart.

Import-Export How to import a sequence of actions that you prepared in a text processor. How to save data generated in the program. How to re-use saved data at a later time. How to save and recall a generalized model.

Report page Viewing information about errors in your work. Copying tables constructed by the program.

Introduction

Ethno's opening display has a colored area at the top of the display, in which there are two popup menus for moving around in the program.

The **Operations** popup menu invokes different program functions. Selecting *Define sequence* takes you to the opening display of the program, being described here. *Link actions* takes you to a page where you specify action prerequisites. *Chart* shows you a picture of the linked actions, and allows you to develop a process model and abstracted actions. *Import-Export* allows you to save and recall your analyses. *Report page* provides information regarding your work.

The rightmost popup menu, **Actions**, allows you to examine actions that you have defined. The actions are listed in alphabetic order. While examining an action, you are able to define and examine entities, agents, and acts.

Below the colored area is the work area, consisting of the following parts.

Narrative. The box in the lower-right part of the opening display is where you put the text of a narrative you are analyzing.

Sequence. The box on the left lists the sequence of actions that you have defined. The buttons and popup menu at the bottom are for searching and for editing the sequence. If you define generalized actions during your work with *Ethno*, the generalized actions will be added automatically to the sequence, immediately following each instantiation.

Short Name Field. The field labeled *Next action* is where you type a short name for an action. Press Enter when you have the short name as you want it.

Sequence

For an alternative way to enter actions, see the section below on “Import-Export”.

Including Narrative Text

In your word processor, display the narrative text describing the episode. Select all of the narrative text, and copy the text to the clipboard. In *Ethno*, click inside the Narrative box, and clear whatever was there. Paste the narrative text from the clipboard into the Narrative box.

Now you can scroll through the narrative, using it as a reference while you define actions. The narrative will be saved with the study when you export your work to a file.

Event Name

Optional. As you begin naming the next action, drag the mouse over the relevant text in the Narrative box in order to select it. Selected narrative text will be saved with the action for later reference. (This is true even though the text will seem to de-select when you go to the short-name field.) The selection must be made prior to pressing Enter after typing the action's short name.

Compose a short name for the next action in the abbreviated-name field. Names should be short, so that they fit on the action structure chart. This is especially important with narratives involving 50 or more distinct actions because charts of big structures get quite crowded. Short names that work well as reminders of the full action usually include a verb. Individuals often can be abbreviated to a single letter. For example, the short name *P welcomes Q* probably will remind you of the full action.

Press Enter on the keyboard. The short name of the action will appear at the end of the sequence list. It also will be added to the Actions popup menu, allowing you to visit a display for that action.

At any time you may visit the action's display in order to add a longer description for the action. The long description appears at the bottom of *Ethno*'s opening display when you click on the action's short name in the sequence list, and if available the long description is the text presented when linking actions. Visiting the action's display also allows you to edit any text that you entered previously.

Repeating an action

Select the action in the popup menu below the sequence list. Another instance of the action will appear at the end of the sequence. The pair of radio buttons below the popup menu must be set to *Repeat* for this to work.

Searching the Sequence

When *Find* is selected in the pair of radio buttons below the popup menu, the popup menu allows you to find all instances of an action in the action sequence. Selecting an action in the popup menu causes all instances of that action in the sequence to be highlighted in the action sequence box. You may have to scroll through the sequence to see all instances.

Editing the Sequence

New actions may be added at any time by entering another short name. The new action will be placed at the end of the sequence, but may be repositioned as described next.

Moving an action: First click on the action that you want to move in order to select it. Second, click the *Move* button. The button will turn red to signal that the selected action will be moved. Third, click the action that should follow the selected action after it is moved. The selected action will be taken from its old position and inserted just ahead of the second action that you clicked.

Keep in mind that an action that instantiates a generalized action should immediately precede the generalized action.

Cutting an action: With *Repeat* selected in the pair of radio buttons next to the popup menu, click on an action in the sequence list to select it. Then click on the *Cut* button. The selected instance will be removed from the sequence.

If that is the last instance of the action in the list, then a *Confirm* dialog will appear asking if you truly want to remove the action from your study. You may cancel the deletion. If you confirm that you want the action deleted, the action will be purged from the analysis. Consequences of the purged action will be transferred to actions that are prerequisites of the purged action.

Multiple instances can be deleted when *Find* is selected in the pair of radio buttons below the popup menu. Select an action in the popup menu in order to select all instances of that action in the action sequence. Click on the *Cut* button. All but the first instance of the action will be deleted from the action sequence. A *Confirm* dialog will appear to ascertain whether you want the remaining instance deleted from the sequence and the action deleted from your study.

Actions

The rightmost popup menu in the darkened area at the top of *Ethno*, lists actions that you have defined. Select one to examine and modify information on that action. While you are examining an action, three popup menus appear as a second line of menus in the darkened area at the top. The second line of menus allows you to go to entities, agents, and acts that you have defined. Entities are things or places. Agents are individuals, groups, or non-human entities that instigate actions. Acts are verbs in descriptions of actions. Each of the menus has three functions, as follows.

- Choosing the top line that says “New ...” lets you define a new entity, agent, or act.
- After you have defined an element, you can choose its name in a popup menu in order to visit a screen relating to that element. The names are listed in alphabetic order.
- Clicking on a radio button at the right of the screen, then choosing an element from a popup menu, adds the element to one of the lists at the right, as described below in the section on Action Frame Coding.

Texts

The four boxes on the left of the screen are editable text fields. Click in a box to get a cursor. Then you may type or edit the contents of the box.

The text field labeled *Short name of the action* and the text box labeled *Event description* present the short and long descriptions of the action. The short name has a maximum of 35 characters.

The description of an action has important effects on Event Structure Analyses because the description cues judgments about logical interrelations of actions. Usually a more specific description makes it easier to identify logical relations while using the program's linking routine. You can make an action description more specific by identifying more of the elements involved in the action - instrument, alignment of instrument, setting, etc. On the other hand, an action that is described too concretely may never repeat, even though essentially the same thing happens again. Thus, actions described too concretely will make an action structure seem more complex than necessary. So you should try to describe an action with considerable specificity, while avoiding details that hold for just one occurrence.

The text box labeled *Source text* shows the portion of narrative that you selected when defining the action.

The text box labeled *Comments* is a place where you may type notes regarding the action. The notes are saved and retrieved as part of the model with the Import-Export option on the **Operations** menu.

Modeling Information

The middle portion of the Event form presents information accumulated while linking actions, testing a process model, and developing a generalized model. (These procedures are described in the sections on linking and on the chart.)

The box labeled *Prerequisites* shows the actions that must occur before the action being examined can occur.

The box labeled *Consequences* shows the actions that can occur only after the action being examined has occurred.

Double-clicking an action in the *Prerequisites* box or in the *Consequences* box brings the clicked action up in the Action form. The new action replaces the action currently being viewed in the Action form.

The box labeled *Summarizes* shows concrete actions that have been summarized by the action being examined. The box labeled *Generalizations* shows abstract actions that are instantiated by the action being examined.

Clicking on the two checkboxes below the boxes changes parameters of the focal action. All prerequisites must occur before the focal action can occur if *Disjunctive prerequisites* is unchecked. If this item is checked, then occurrence of any one prerequisite enables the focal action. The focal action cannot repeat until at least one of its consequences has occurred if *Repeats without depletion* is unchecked. Activity among consequences is irrelevant for occurrence of the focal action if this item is checked.

The line beginning with the word "linked" shows whether questions have been answered regarding the prerequisites of the action being examined.

Action Frame Coding

Radio buttons and scrollable lists appear at the right side of the screen. The eight categories—Agents, Acts, Objects, Instruments, Alignments, Settings, Products, and Beneficiaries—are for defining the composition of the action.

Agents are persons or groups engaging in the action. *Acts* are verbs describing what is happening. *Objects* are entities or agents that change as a result of the action. *Instruments* are entities or persons or organizations which the agent uses to process the object. *Alignments* indicate parts of the object, instrument, and setting where the act is focused, often being objects of prepositions in the action description. *Settings* are encompassing entities within which the act is done. *Products* are the entities or changed individuals or organizations produced by the action. *Beneficiaries* are the persons or organizations to whom the product is transferred for use in a subsequent action; beneficiaries include *Experiencers*, who are perceivers for whom the action is performed.

Here, for example, is an action and its categorizations.

In the emergency room (setting) the doctor (agent) injected (act) a sedative (object) into the raving man's (object) shoulder (alignment) with a hypodermic (instrument) so the nurse (beneficiary) would have a tranquil patient (product).

Codes for the Action-Frame categories are generated by making selections from the **Entity**, **Agent**, and **Act** pop-up menus. Follow these steps.

1. Click the radio button for the category you are coding. The button will be highlighted.
2. If coding an act select the appropriate verb from the **Act** popup menu. Otherwise, select the appropriate thing from the **Entity** pop-up menu, or the appropriate agent from the **Agent** pop-up menu.
3. Your selection will appear as a line in the box of the category you are coding.

Deleting Codes

You can delete an element from an action-frame list by double-clicking on the element.

Adding Entities, Agents, or Acts

An entity or agent that is not yet in the pop-up menus has to be added. Do this as follows.

1. Select the top line of the relevant popup menu which says "New ...". A window for defining an entity, agent, or act will appear.
2. Name the element by typing in the *Name of...* text field. Press Enter.
3. Click the *Return to action* button. This returns you to the Action window where you were working. At that point the element you just defined is available in the pop-up menus.

Additional uses of the Entity, Agent, and Act forms are described in the section on Associations.

Deleting an Element

To remove a defined element from your study, present that element in the Element Form. Substitute the word "delete" for the name of the element, and press Enter. This removes the element, and leaves the form ready for defining a new element.

Generalizations of a deleted element are transferred to the deleted element's concrete manifestations.

Relevant Actions

When you first arrive at the screen for an element, the *Containing Actions* box lists the actions in which the element appears. An action is included in the list if the element was coded in any of the Action-Frame categories for that action.

After an association analysis, the *Containing Actions* box lists actions which contributed to the reported results.

Generalizations

You can specify how an entity, agent, or act is related to more general categories by using the popup menu titled **Choose a generalization**. An item selected from the popup menu will be listed in the *Generalizations* box below the popup menu.

Element X is a generalization of Y if you answer "yes" to the question: Is Y a kind of X? Or simply, Is Y an X? (Sometimes you may prefer the question: Is Y a part of X?) Here are some examples.

A Ford is a kind of car, so car is a generalization of Ford. Heather is a woman, so woman is a generalization of Heather. Tutoring is a kind of helping, so helping is a generalization of tutoring.

An element has to be defined before it appears in the **Choose a generalization** popup menu. For example, you would have to define the entity "car", the agent "woman", and the action "help" before the generalizations above could be specified. Generalized elements are defined in the usual way, by selecting New entity or New agent or New act in the popup menus within the darkened area at the top of the screen. You may define entities or agents or acts that do not appear directly in any action, but which are generalized versions of elements that do appear.

Choosing a generalization may cause the addition of more than one element in the generalizations listing. The program lists the generalization that you chose, and all of its generalizations, and all of their generalizations, etc. For example, suppose that you previously defined "car" as a kind of "machine".

Then when you specify Ford as a kind of car, the program infers that a Ford is a kind of machine, and both "car" and "machine" are listed.

Removing Generalizations

Clicking on an item in an element's generalizations list to select it, then clicking the *Cut selected generalization* button, removes the item. However, this works only for items that are directly linked to the element. For example, suppose you are working on the agent "husband", with husband identified as a kind of "man", while man separately is identified as a kind of "male". Both "man" and "male" appear as generalizations of husband. "Male" reappears if you try to delete it, as long as "man" remains, because the program keeps inferring that a man is a kind of male. But cutting "man" removes both "man" and "male".

Concrete Forms

When you specify that X is a generalization of Y, you simultaneously are specifying that Y is a more concrete form of X. For example, a Ford is a concrete form of car, Heather is a concrete form of woman, tutoring is a concrete form of helping. The box labeled *Concrete forms* lists the element's concrete forms, plus all of their concrete forms, etc.

Moving Between Elements

Double-clicking an action in the *Generalizations* box or in the *Concrete forms* box fetches the clicked element to the Element Form. The new element replaces the element currently being viewed in the Element Form.

Associations

You can determine how actions in a narrative associate entities and agents and acts. The analyses are based on Action-Frame codings, which must be completed before beginning association analyses. The procedure for analyzing direct associations is as follows.

Go to the window for a particular entity or agent or act. Association analyses will show how this focal element is related to other elements. Click the *Constrain associations* button at the bottom left of the window. This brings up a dialog, where you define the kinds of relationships that interest you. For example, you may limit analyses to actions in which the focal person was agent in order to determine which entities or agents served as objects of the person's actions. When done defining constraints, click the *Continue* button to return to the window for the focal element.

Clicking the *Compute associations* button fills (or refills) the three lists at the bottom of the window. The results also are printed *Report page*, viewable by selecting from the **Operations** menu. Printed results on the *Report page* can be copied and pasted into a word-processor document.

The *Act associations* box lists acts that occurred when the focal element served in ways specified in the constraints. The *Entity associations* box lists entities that appeared within the constrained Action-Frame categories. The *Agent associations* box lists agents who appeared in the constrained categories. If a agent is the focal element in an association analysis, then the results in the *Agent associations* box show the agent's social networks, as manifested in the narrative.

The listings show the numbers of actions in which the focal element was associated with other Action-Frame elements. The counts include repetitions of actions. The actual actions contributing to the results are specified in the *Containing Actions* list.

Concrete Versus Generalized Actions

If you have defined generalized actions (as opposed to generalizations of act elements) then the radio button for *Generalized containing actions* at the top middle of the form will be enabled. Select this and you will see all of the generalized actions in which the focal element occurs. The lists at the bottom of the window will display association analyses using the generalized actions. Only concrete actions are analyzed when the button for *Concrete containing actions* is checked. Only generalized actions are analyzed when the button for *Generalized containing actions* is checked.

Analyses Using Generalizations of Elements

If the *Generalize* checkbox at the lower left of the form is unmarked, the program determines how actions relate the focal element to other elements, working only with actions in which the focal element directly appears, and reporting only entities and agents that have been coded directly in those actions. (The analysis uses concrete actions or generalized actions, depending on which radio button is selected at the top middle of the form.) However, if the *Generalize* checkbox is marked, the program uses generalization specifications to expand the number of actions considered, and to reduce the variety of entities, agents, and acts reported. The analysis includes any action that involves the focal element, and also any action that involves a concrete form of the focal element. The analysis reports only the most generalized forms of entities, agents, and acts that arise in the included actions. (Again, the analysis is conducted over either concrete actions or generalized actions, depending on the selected radio button at the top middle of the form.)

Suppose, for example, that the definitions of "Mary" and "Jane" specify that each is a "wife," and the definitions of "Bob" and "Joe" specify that each is a "husband." When analyzing "wife" as agent with the *Generalize* checkbox marked, the program considers any action in which the agent was "wife," or "Mary," or "Jane." On finding actions involving "Bob" or "Joe," the report gives information about "husband."

Linking

An action can occur only after other actions have produced necessary conditions for occurrence of the focal action. The *Link Actions* form asks questions that help you identify which actions in a narrative are prerequisites for other actions. The elicitation procedure taps your understanding of the process in order to build a model of the overall event. Actions must be defined and time ordered before their linkages can be specified.

The *Link Actions* form has multiple components. A popup menu titled **Type of question** allows you to use different elicitation questions. Radio buttons under the label *Begin questioning with* allow you to change the order in which questions are asked. A *Redo* button restarts questions regarding the action shown just above the button. A *Done* button terminates questions regarding the action shown just above the button, leaving just the links established in prior questions. The pop-up menu titled **Unlink Actions** allows you to clear linking information for some or all actions.

The elicitation question presents two actions within a question frame. *Yes* and *No* buttons allow you to answer the question. A *Next question* button records your answer and displays the next question. A thumbnail chart showing linkages among actions is displayed at the middle of the screen.

A scroll box titled *Log of answers and comments* automatically indexes all questions that have been asked, and indicates whether the answer to each question generated a link or not. You can type comments in this box while engaged in linking. You also may type comments in the box after linking is completed. Information is appended in this box when you change linkages by editing the chart, or while testing a model. The entire log is included in the saved data when you export a model.

Specifying Linkages

The basic procedure is as follows.

An action name is printed in the topmost box at the right of the screen, and another action name is printed in the box below it. The texts appearing in the boxes are full descriptions of actions if you have entered such descriptions. Otherwise the boxes show the short names of the actions.

The two action descriptions are embraced within a question asking you if the actions relate. Answer the question by clicking either the *Yes* or *No* button below the boxes. The *Yes* and *No* buttons disappear after you click one of them. The buttons reappear as usual when the next question is presented.

Initially the next-question button says either *No. Next question* or *Yes. Next question*. Clicking this button instead of *Yes* or *No* records that a linkage is lacking, and you move directly on to the next question.

You may click the *Done* button at the point where you have specified all of the linkages of the action printed above the button. This saves you from having to click the *Next question* button repeatedly in answer to additional linkage questions for that action.

Your answer is recorded in the *Record of answers and comments* box at the bottom of the screen. You may click in the box to type remarks of your own, in particular about why actions are linked. The record of answers is structured as follows. The short name of the focal action is printed on a separate line as a heading. The answer to each question about the focal action is printed on an indented line. Each indented line identifies the other action in the question by the other action's short

name. The line then specifies whether or not the other action was linked as a prerequisite to the focal action. The kind of question and the direction of questioning are specified in parentheses.

Click on the *Next question* button. Once again, two action descriptions will be presented, embraced within a question. Continue answering the questions until the program announces that you have reached the end.

Forms of the Elicitation Question

The question that you are asked can be varied by selecting from the **Type of question** pop-up menu. The four options are:

Prerequisite: Does __ require __ or a similar action?

Implication: Does occurrence of __ imply __ or a similar action?

Imminent (or Historical) Causation: Is __ or a similar action a cause of __ in the circumstances that existed?

Counterfactual: Suppose an action like __ does not occur. Can __ occur anyway?

The last two questions reverse the placement of the actions in the boxes, as compared to the first two questions.

The questions are equivalent logically. Answering *Yes* to the first three questions, or *No* to the counterfactual question, indicates that the two actions are linked. Answering *No* to the first three questions, or *Yes* to the counterfactual question, indicates that the two actions are not linked.

Switch among these questions as desired when you are linking two actions. One form of question may seem more lucid than the other forms.

Order of Questions

Under the title *Begin questioning with* are two radio buttons at the left of the screen, *End actions* and *Initial actions*. These control the order in which questions are asked.

If you select *End actions* the program develops questions about a focal action by starting with actions that have the longest strings of prerequisites. This eliminates many questions if the focal action is linked to an action at the end of a prerequisite string. Answering that the focal action requires the action means that the focal action also requires all of the action's prerequisites, so questions about the prerequisites are skipped.

If you select *Initial actions* the program develops questions about a focal action by starting with actions without specified prerequisites. This avoids many questions if the new action is not dependent on any of the actions in a long prerequisite string. Answering that the focal action does not require another action means that the focal action is not dependent on any of the other action's consequences, so questions about the consequent actions are skipped.

In general, it is easier to answer questions involving end actions, and the chances of answering wrong are less.

Changing Answers

If you give a wrong answer and you catch your error while the program still is asking questions about the same focal action, you may start over and re-answer the questions for that focal action. Click the *Redo* button. The program forgets answers you gave regarding the focal action, and re-starts the series of questions regarding the focal action. Your answers about prior focal actions are retained.

You can jettison answers that you gave regarding previous actions, in order to answer questions about those actions again. Open the pop-up menu titled *Unlink Actions*. Select the first action whose linkages you want to change. A red window will pop up asking whether you really want to erase links for the selected action and all of those that follow it. If you click the *OK* button, the model will be returned to the state it was in just before you began considering the action you selected in the menu.

An erroneous link between actions also can be corrected by selecting *Chart* from the **Operations** menu. You can add or delete links graphically with the *Editing* option in the submenu

Using the Thumbnail Chart

The thumbnail chart showing linkages among actions indicates actions by dots rather than by names. You can determine the name and description of a dot's action by pressing the *Control* key and clicking on the dot. The information about the action is presented in a dialog window, which can be removed by clicking *Okay*.

The chart is updated each time you complete elicitation questions for a focal action. The chart also tracks your progress in answering elicitation questions about a focal action by using different colors for dots. Black dots are actions whose relation to the focal action is yet to be determined. A green dot shows the structural position of the action currently being considered in regard to its linkage to the focal action. Yellow dots show actions whose linkage to the focal action is known. The linkage information may be a direct result of your answer to a linkage question, or the information may have been deduced from the logical structure of actions.

After about 175 actions the thumbnail graph is hard to decipher because it has so many points and lines in its limited space. The program continues to work, however.

Chart

The chart is a graph showing relations among actions. Very large charts cause scrollbars to be added to the window so that you can examine all parts of the chart.

A **Function** menu appears in the dark area above the chart. The different functions that are available in the **Function** menu are discussed below.

Reading the Chart

Actions are represented on the chart by their short names. The program may truncate short names to prevent overlapping in a crowded chart. Clicking the mid-point of a truncated name while holding down the *Control* key shows the untruncated name in a dialog, plus the full action description if a description has been provided for the action.

A name may be dragged to a different position. Repositioning lasts until the program redraws the entire chart.

Font styles used to print action names convey information. A plain style is used for concrete actions with conjunctive prerequisites—that is, all prerequisites have to happen before the focal action can happen. Italic shows actions with disjunctive prerequisites—that is, only one prerequisite has to happen before the focal action can happen. Bold is used for generalized actions.

Lines represent relations between actions.

Black lines represent implications. Occurrence of the bottom action implies occurrence of the top action. In other words, the action at the top of a black line is a prerequisite for the action at the bottom, and the bottom action cannot occur until after an occurrence of the top action. Tracing upward along black lines from a focal action reveals the set of actions that have to happen before the focal action can happen. Tracing downward is going "deeper": e.g., someone who engages in an action lower on the diagram is "deeply" involved in the incident.

Magenta lines stand for a commutation relation, in which the bottom action becomes a prerequisite for the top action, after an initial occurrence of the top action. An example of commutation is entering and leaving a room. Entering is required before leaving can occur. But having entered, one must leave before entering again. The two actions commute. An Event Structure Analysis chart would represent this relation by a black line going down from enters-room to represent the requirement of entering before leaving. The chart also would show a magenta line going up from leaves-room to enters-room to represent the requirement of leaving before entering again.

Yellow lines stand for a relation in which a concrete action instantiates a general action. When the concrete action occurs, we can say that the general action has occurred as well. An example of instantiation is a corporate executive parking in the company garage. When this occurs, we can say the executive has gone to work. Parking in the company garage instantiates going to work.

Several procedures impose a dialog window over the chart. You may drag the dialog window to a different position to reveal the chart underneath.

Inspecting Mode

The chart initially appears in *Inspecting* mode, and in this mode you may click an action to highlight its linkages. Actions linked to the clicked action—upward and downward, directly or indirectly—are displayed white-on-black. Click in any blank area to remove highlighting from all actions.

Editing Mode

Having selected *Editing* from the **Function** menu, you can operate directly on the chart to add, delete, or modify an implication. Click on an action and it will be highlighted. Click on a second action, and it, too, will be highlighted. The relation of interest is between these two actions.

A dialog window appears over the chart. A button named *Delete link* is on the dialog window if the two actions already have a black line connecting them. Click this button to remove the link between the actions. When you click the *Delete link* button, the dialog vanishes, and the chart is redrawn without the link.

A button named *Add link* is on the dialog window if a black line does not connect the two actions. Click this button to create a direct link between the actions. The first clicked action will become a prerequisite for the other action, unless the chart implies that the second action must precede the first. After clicking the *Add link* button, the dialog vanishes, and the chart is redrawn with the new link.

Radio buttons labeled *Upper action enables lower action* and *Lower action enables upper action* appear on the dialog. Marking the first of these makes the upper action into a normal prerequisite. Marking the second radio button makes the lower action into a conditional prerequisite for the upper action, as in a commutation relation. A checkbox labeled *Lower action depletes upper action* is on the dialog. An action depletes a prerequisite if it uses up conditions produced by the prerequisite, so the prerequisite must occur a second time in order for the action to occur again. This aspect of the relation between the two actions can be changed by marking or unmarking the checkbox before clicking the *Add link* button, or before clicking the *Keep link* button that is on the dialog when two actions already have a line between them.

Hold down the *Shift* key while clicking the actions if you want to create, or eliminate, commutation between actions. The dialog window will ask if you want to toggle commutation. Answering *okay* adds commutation when the actions do not have commutation initially; answering *okay* removes commutation when they do have a commutative relation currently.

Testing Mode

The diagram looks different than usual after you select *Testing* from the **Function** menu. The name of the first action in the sequence will be printed on a red field. Names of other actions that are possible at that point will be printed on yellow fields. In general:

Red field: This action is occurring currently.

Yellow field: This action could be occurring; its prerequisites are fulfilled.

Aqua field: This action has been accomplished and is not yet depleted by a consequence.

The diagram changes after you click anywhere on the chart, causing the first action to be "done". The red action now is action 2 in the sequence. The first action is printed on an aqua field, indicating that it has happened and no other action has yet made use of its effects. As you continue clicking, you will see

yellow fields appearing as new actions are enabled, and aqua fields disappearing as occurrences of later actions use up the effects of earlier actions.

Keep clicking until the program informs you that you have reached the end of the action sequence. To make actions in the sequence occur automatically, hold down the *Shift* key when you click on the chart.

You probably will be interrupted before you reach the end because some action violates assumptions of the process model. When the program comes to such a case, it superimposes an *Amelioration* dialog on the chart and tells you what's wrong. There are two basic possibilities.

Unprimed

Occurrence of the next action may be impossible because all of its prerequisites are not fulfilled. The program suggests ways of fixing this, which may or may not include all of the following.

Let's call the next action "action X" and the problematic prerequisite "action P". Then P may have been used up recently by some other action Y, and thus P's consequences no longer are available to enable X. In this case the problem could be solved by changing the logical structure so that P isn't a prerequisite for Y. Then Y's occurrence wouldn't use up P, and P still would be available for X after the occurrence of Y. The program will suggest such possibilities if there was an action that used P since the last occurrence of X. The program also will suggest that the problem could be solved just by eliminating P as a prerequisite of X.

Another solution is possible by allowing that P is a prerequisite for Y, but Y does not use up P: then P's effects still would be available to enable X.

Instead of focusing on the model, we might suppose that the record of actions is inaccurate. Maybe there was an occurrence of P after Y, but it didn't get recorded. The program will suggest this possibility if an unfulfilled prerequisite is enabled and possible right before the occurrence of X.

It's possible that the logical structure has to be interpreted in a special way. Maybe P is one of the prerequisites of X but not necessary for P, because X can be enabled by any one of its prerequisites. That is, X is enabled by one of its prerequisites OR another, rather than by the combination of all of them. The program will suggest the possibility of disjunctive prerequisites if X has multiple prerequisites and at least one of them has occurred and not been used up. If X already has been made into an action with disjunctive prerequisites, then the program will list actions that happened recently and suggest that one of these might be another disjunctive prerequisite of X that enables X at the moment.

Possibly an action that depends on X also enables it. For example, suppose someone entered a room (X), then left the room (Q), then entered again. Q depends on X, but Q also enables the second occurrence of X - the two are connected in a commutation loop. When possible, *Ethno* will offer this solution to the problem of X being unprimed. Adopting the solution makes X into an action with disjunctive prerequisites and adds a relation from Q to X which is displayed in magenta.

Unused

Alternatively, the next action (X) may be impossible because it has gone unused since its last occurrence. The program has a number of ways of dealing with this problem, too.

Perhaps X is a prerequisite for one of the actions that occurred since the last occurrence of X. Then X would have been depleted, and it would make sense to do X again. The program will suggest this possibility for any actions that occurred just once since the last occurrence of X.

The program will ask if X can be repeated without regard to whether X was depleted by some other action. If repeatable, X may occur any number of times without another action making use of X's consequences.

You might want to deplete X by adding a new action that makes use of X's products. The program will offer the opportunity to define the new action by entering its short name.

On the other hand, maybe the action record is wrong, and some action that uses X did occur but didn't get recorded. The program will list actions that require X and that are ready to occur just before X is to occur again.

Implementing a Solution

The *Problem* dialog tells you which action is problematic and what kind of problem has occurred. All solutions are listed in a scroll box so you can consider the different options before making a choice. One particular solution is presented below the scroll box, and this is the one that will be implemented if you click the *Adopt this solution* button. However, you can change the implementable solution by clicking the *Go to next solution* button.

A popup menu appears in some of the proposed solutions. It lists all the different actions that can be used with the given solution, and you must select the one you want before clicking the *Adopt this solution* button. (Sometimes there is only one item in the popup menu.)

A text field for entering a short name appears when the program offers the opportunity to add a new action. Type the name of a new action before clicking *Adopt this solution*. The *Problem* dialog will be replaced by the *Relation* dialog (described in the section above on Editing Mode), so you can define the relation between the problem action and the new action.

After you adopt a solution, click the *Done* button. The program reruns the analysis from the beginning of the action sequence to make sure the change doesn't create inconsistencies earlier in the sequence. It stops and waits for you to continue when it reaches the action you fixed.

You may forego all proposed solutions by clicking the *Done* button on the dialog window without clicking the *Adopt this solution* button. This allows you to look at the sequence or the definitions of some actions before making a decision about how to fix the problematic action.

Episode Statistics

A *Completion Dialog* appears when every action in the sequence has been tested successfully. The dialog announces that all actions have been tested, and tells you that action statistics are available on the *Report page*. Clicking the *Cancel* button makes the dialog disappear, leaving the chart as it was at the beginning of testing.

If you use the **Operations** menu to view the *Report page*, you will see the following.

The topmost numerical entry in the table, Number of defined actions, reports how many entries currently are in *Ethno's* Actions menu. The next numerical entry, Number of action occurrences, reports how many lines currently are in the Sequence listing.

A three-column table with a row for each defined action appears below the first two numerical entries. The columns are labeled FREQUENCY, PRIORITY, and ACTION

ACTION is the short name of the action considered on that row. The rows are sorted alphabetically by the actions' short names. Names of generalized actions are tagged with an underline as the first character.

FREQUENCY is the number of times the action appears in the Sequence listing.

PRIORITY is an indicator of an action's salience, of how soon individuals implemented an action once it was feasible. The priority indicator roughly corresponds to the percentage of times the action occurred out of all the times the action was primed and ready to occur. Precisely, the value is the number of times the action happened (N_h), divided by one plus the number of times the action happened, plus the number of times the action was possible but its occurrence was preempted by some other action (N_p), with the overall quotient multiplied by 100 to produce a percentage-like value. In algebraic terms, the priority indicator is the following:

$$100 \cdot N_h / (1 + N_h + N_p).$$

One is added to the denominator to mute values based on small numbers. For example, suppose an action occurred immediately the one time it was possible. In this case, the action occurred 100% of the time that it was possible, but the priority indicator is 50 to reflect the fact that the computation is based on a single instance. On the other hand, suppose an action occurred immediately all nine times that it was possible. Again the action occurred 100% of the time it was possible, but the priority indicator is 90 in this case, reflecting the fact that the computation is based on more instances and therefore is a more dependable indicator of high priority.

The table may be selected by dragging through it, copying with a keystroke command (e.g., Control-C on Windows computers), and pasting into a text file. Then the text file can be imported into a spreadsheet to sort the rows of the table on frequency or on priority. Column entries are separated by tabs to facilitate importing into a spreadsheet.

Experimenting Mode

Selecting *Experimenting* from the **Function** menu produces a change similar to selection of *Testing* mode: actions that are feasible appear on a yellow field. However, no action is shown as occurring (on a red field) because *Ethno* ignores the stored sequence of actions while operating in Testing mode. Instead, you define a sequence of actions by clicking on one action after another.

Clicking on an action causes the action to be displayed on an aqua field, indicating that the action now has been accomplished, and its accomplishments are yet to be depleted by other actions. Clicking also causes actions that are enabled by the accomplished action to be shown on a yellow field, indicating that they could happen now.

Clicking only on yellow entries produces a string of actions that conforms to the rules defined in the model. Thus *Experimenting* mode allows you to see how the model defines a variety of episodes, each consisting of a "grammatical" string of actions.

If a model includes generalizations, then the generalized actions occur when their instantiations are clicked. Clicking generalized actions causes occurrence of the generalized action without causing any instantiation to occur.

Clicking in a blank area resets the chart to its initial state in *Testing* mode.

Clicking on an action alternatively may cause the *Amelioration* dialog to appear. This means that there is something doubtful about occurrence of the action at that point. The dialog indicates why there is a problem and suggests ways that the problem could be fixed, as discussed above under *Testing* mode.

CAUTION: Adopting a solution presented in the *Amelioration* dialog permanently changes the model, the same as in *Testing* mode.

Summarizing Mode

After you select *Summarize* in the **Function** menu, the program finds every network of actions that can be traced back to a single prerequisite, and that flows down to a single consequence, with at least one intervening action. A network of actions of this kind can be interpreted as a single action, and in principle such a network might be summarized by a single action name.

Computations take a noticeable amount of time if a large number of actions are in the model. They culminate in a dialog appearing above the chart.

A scrolling list titled *Summarizable sequences* records each of the networks, using the name of an action or two. Clicking on a line highlights the whole network on the chart.

You can use these results to simplify a model. Select the network that you want to summarize, type a name in the dialog field called *Short name for summary action*, then click the button labeled *Summarize sequence permanently*. The actions in the network are suppressed from view and a single action with the new name takes their place.

CAUTION: save your data with the *Import-Export* option in the Operations menu before summarizing, in case you want to see the detailed actions again.

The dialog window also contains a *Done* button. Click this button to leave the dialog without changing data.

Generalizing Mode

Generalized actions refer to more abstract kinds of agents and actions than concrete actions. A concrete action instantiates a generalized action if occurrence of the concrete action is reason to say that the generalized action occurred as well. For example, the concrete action, "John grounds Tommy," might correspond to the generalized action, "parent disciplines child." An occurrence of "John grounds Tommy" is an instantiation of "parent disciplines child."

The program allows you to formulate a model of generalized actions in parallel with a model of concrete actions. Select the *Generalizing* option in the **Function** menu. This causes a dialog to appear above the chart.

CAUTION: save your data with the *Import-Export* option in the Operations menu before generalizing, in case you want to see the unaugmented model again.

Entering a name in the field titled *Short name for new generalized action* and clicking the *Incorporate new action* button adds a generalized action to the data. The generalized action will be listed in the **Events** menu when you leave the dialog. Each generalized action that you define appears in a popup menu on the right of the dialog window. The popup menu on the left lists all concrete actions in the system. Below each popup menu is a text box that presents the full description for the action selected in

the popup menu above the box. In the case of generalized actions, you can type in the box, allowing you to create or edit descriptions for the generalized action selected in the popup menu above the box.

Instantiations are established by selecting a concrete action in the left popup menu, selecting a generalized action in the right popup menu, and clicking the *Instantiates* button. The button then changes to *Delete link*. The *Instantiates* button appears when you align a concrete action and a generalized action that are unconnected. The *Delete link* button appears when you align a concrete action and a generalized action that are connected by an instantiation relation.

Enter all generalized actions and establish their instantiations. Click the Done button to leave the dialog.

The program sets the time ordering of the generalized actions to the time ordering of their instantiations. But the program does not presume that the logical relations among generalized actions can be computed from the logical relations of the instantiations. Instead, you must link the generalized actions one by one. Define instantiations so that the program knows the time ordering of the generalized actions. Then select the *Link actions* option in the **Operations** menu. The program will present questions about the generalized actions, allowing you to establish which are prerequisites for which.

The chart will show yellow instantiation lines connecting concrete and generalized actions, after the generalized actions have been linked. Generalized actions are displayed in boldface, and the names are printed somewhat lower than concrete actions to reveal instantiating lines.

You can refine linkages in a generalized model by selecting *Testing* in the **Function** menu, and clicking through the actions in the standard way. Generalized actions will happen along with their concrete instantiations. Generalized actions cannot be deleted; instead you must start with the unaugmented model and create a revised set of generalizations.

Print

Select *Print* in the **Function** menu to print the chart on paper. A *Page Setup* dialog will appear, followed by a *Print* dialog. Specifications of paper size, margins, and portrait-versus-landscape must be made on the *Page Setup* dialog rather than on the *Print* dialog. (The *Print* dialog can be used to cancel the print job, and to adjust the printer.)

Ethno formats the chart automatically to fit the printed page. Changing paper size, margins, and portrait-versus-landscape usually changes the formatting of the chart.

Saving the Chart

Here is a kludge to save the chart as a graphic.

Buy Adobe Acrobat and install it, including its virtual printer called Acrobat Distiller. In *Ethno*, with your study loaded, choose *Chart*, then *Print*.

In the **Printer** pull-down menu, select Acrobat Distiller as your printer. Click ok to print; this produces a PDF file.

Load the resulting PDF file and save it as a TIF graphics file.

Load the TIF in your graphics program to modify it (e.g., to change yellow lines to greyscale).

Import-Export

You can create a sequence of actions in a spreadsheet and then import the sequence into *Ethno* for analyses. Once you have analyzed actions, you can save the *Ethno* project by copying and pasting text. The saved text may be reloaded to continue analyses at another time.

Importing Actions

You can import a list of actions consisting of short names, plus optionally: a sentence-long action description, a quote from an archival source (without quotation marks), your own comment, and entries in the eight action-frame categories (agent, act, object, instrument, alignment, setting, product, and beneficiary), in that order. The twelve fields must be separated by tabs. Action frame categories may contain multiple percepts, separated by ", ".

The easiest way to build a sequence for input is with a spreadsheet formatted as follows.

Each line must relate to just one action. The line must begin with the short name of the action. (Any short name longer than 35 characters will produce a warning when you import the sequence.)

Optionally, the short name may be followed by texts for the other fields. However, any field other than the short name may be left blank. Repeated actions must be entered by entering just the short name (optionally with a different source text than the first appearance of the action). Action-frame entries must be prefixed with tags to specify their type. "E: " (cap-E colon space) is the tag for entities; "P: " is the tag for agents (people); "A: " is the tag for acts.

The action frame categories may be easier to use if you include questions in the header row, as follows. *Agent*: Who is responsible for the action? *Act*: What verb describes what is going on? *Object*: Who or what is the focus of action? *Instrument*: What is used to perform the action? *Alignment*: What things get connected, and how? *Setting*: Where does the action occur? *Product*: What emerges from this action that wasn't there before? *Beneficiary*: This action is intended to enable later activity by whom?

The following is an example spreadsheet setup for the actions in the veni-vidi-vici tutorial at

<http://www.indiana.edu/~socpsy/ESA/Tutorial.html>

	A	B	C	D	E	F	G	H	I	J	K	L
					Agent: Who is responsible for the action?	Act: What verb describes the action?	Object: Who or what is the focus of action?	Instrument: What is used to perform the action?	Alignment: How does instrument connect with object?	Setting: Where does the action occur?	Product: What emerges from this action that wasn't there before?	Beneficiary: This action is intended to enable later activity by whom?
1	Short name	Long name	Quote	Comment								
2	I came				P: Caesar	A: transport	P: Caesar, P: Roman army	E: chariots	E: dirt roads	E: Europe	P: Caesar, P: Roman army	P: Caesar
3	I saw				P: Caesar, P: lieutenant	A: reconnoiter	E: defensive structures			E: enemy territory	P: Caesar	P: Caesar
4	I conquered				P: Caesar, P: lieutenant	A: subjugate	P: foreign leader	P: Roman army	P: enemy army	E: enemy territory	P: foreign leader	P: Roman leader

To import the sequence into *Ethno*:

1. Select the spreadsheet cells containing the data, and copy the text to the computer clipboard. For example, to import the actions shown above, select cells A2 through L4, and press the keys for copying.
2. In the *Ethno* program, choose *Import-Export* from the **Operations** pop-up menu.
3. Click the *Clear Text* button to clear the text box on the display.
4. Paste the clipboard text into the text box by pressing keys for pasting.
5. Click the *Import Sequence* button. If the sequence of actions was prepared correctly, it will be replaced by a message reporting that the data were imported successfully.

After importing a sequence in this way, you may select an action in the **Actions** menu to go to the display for that action. The display will show the action's short name, plus its longer description, the source text, and the comment, if these were included. Entities, agents and acts will be properly assigned in the action frame, and the elements will be incorporated into the menus for entities, agents and acts. The sequence may be edited by selecting *Define Sequence* on the **Operations** menu. The actions may be linked by selecting *Link Actions* on the **Operations** menu.

Links between Elements

Elements in the action-frame categories may be linked by two kinds of relations:

- *Generalizations*, indicated by a less-than sign, for instance, robin<bird. Read the less-than sign as “is” or “is a kind of”, as in “a robin is a bird” or “a robin is a kind of bird”.
- *Possessions*, indicated by a vertical pipe, for instance, wing|robin. Read the pipe as “of”, as in “the wing of the robin”.

A typing tag must begin precede each relational structure. The tag specifies the type of the more specific element in the case of generalizations, and the type of the owned element in the case of possessives. Examples: “P: robin<bird” means that robin is a kind of agent; “E: wing|robin” means that wing is a kind of entity.

Generalizations are processed as follows. First, the more specific element is included in the list of elements of the specified type, if not already there. In the case of “P: robin<bird”, robin is included in the list of agents. Second, the lists of entities, agents, and actions are checked to see if the generalization already has been incorporated. If not, the generalization is included in the same list as the specific element. For example, in the case of “P: robin<bird”, bird is included in the list of agents. Third, the generalization is added to the specific element’s list of generalizations, if not already there. For example, bird is incorporated into robin’s list of generalizations.

Two generalization marks in the same line is an error, and the text after the first one will be ignored.

Possessions are processed as follows. First, the text following the type tag is added to the list of elements of the specified type as a delimited element of that type. For example, the entry “E: wing|robin” causes “wing|robin” to be added to the list of entities. Second, the owned element is added to the same list, if not already defined as an entity, agent, or action. In the example, “wing” would be incorporated into the list of entities. Third, the owned element is made into a generalization of the delimited type. For example, “wing” becomes a generalization of “wing|robin”—i.e., the wing of a robin is a kind of wing.

The possessor is not added to the database while processing a possession, but it can be added by chaining entries—e.g., “P: robin, E: wing|robin”. Two possession marks may appear in the same entry, but text after the first mark will not be processed. For example, “E: wing|pet bird|Mary” adds “wing|pet bird|Mary” and “wing” to the database, but not “pet bird|Mary”.

Entries can consist of combinations of generalizations and possessions, such as “E: rim|bicycle wheel<metal object”. In combinations, generalizations are implemented, but the possessions produce no further processing. In the example, “rim|bicycle wheel” is added to the list of entities, if not already there, and so is “metal object” if it is not already in a list; then “metal object” is made into a generalization of “rim|bicycle wheel”. A generalization of “rim|bicycle wheel” to “rim” would not be made. However, both generalizations could be accomplished by chaining entries, as follows: “E: rim|bicycle wheel, E: rim|bicycle wheel<metal object”.

Export an Ethno Project

Ethno used to run as an applet in Internet browsers. In 2014 applets became an impractical method for distributing software, so *Ethno* was converted to an application that you download from the ESA website, and run like other software on your computer. *Ethno*’s history as an applet saddled the program with an involved system for saving and restoring projects since applets could not write files to your computer. Saving a project still involves this special procedure. (Saving directly to a file is on the agenda for future programming.)

Choose *Import-Export* from the **Operations** pop-up menu. The display comes up with the text box filled.

The text in the box is the program's record of your work—the source text describing the episode, your definitions of actions, of linkages between actions, of action compositions in terms of your defined entities, agents and actions, and a record of each of your decisions linking one action to another.

Click the *Select Text* button to select everything in the text box. Press keys to copy the selected text to the computer clipboard. Paste the text into an open document in a text processor, and save the file for future use with an XML suffix - e.g., “myStudy.xml”. A simple text processor (like NoteTab in Windows) is best in order to avoid embedded formatting codes for fonts, margins, etc. CAUTION! *Ethno* formats the output text so that *Ethno* can read it as input text. The export-import procedure will fail if the text gets corrupted while it is in an external file.

XML Record of a Study

Most internet browsers will open and display the XML file for your study. The display provides a visual record of all information involved in your study. Unfortunately the display will not show new lines in the Linking History and in the Narrative, running all the text together. Nicer formatting can be obtained by opening the XML file in a text processor that understands the XML language. For example, Notepad++ can be downloaded free at <http://notepad-plus-plus.org/> for use with Microsoft Windows computers. Notepad++ shows your XML file in a multi-color display, with a readable Linking History and a readable Narrative.

Readable XML files are possible only if you avoid the following characters in the names of actions, acts, entities, and agents, and also in any source text or comments.

& (ampersand, you may use + instead)

% (percent)

... (ellipsis character)

/ (slash)

Import an Ethno Project

Use a text processor to load an XML file that you saved previously. Copy the text to the computer clipboard. In *Ethno*, choose *Import-Export* from the **Operations** pop-up menu. Click the *Clear Text* button to clear the text box on the display. Press keys to paste the clipboard text into the text box. Click the *Restore Study* button. If the exported record of the study was uncorrupted, it will be replaced by a message reporting that the data were imported successfully.

After restoring an analysis in this way, all screens look the same as when you exported the analysis.

(XML files saved prior to July, 2012, must be updated by searching for all instances of "EVENT" and replacing with "ACTION" while using the Match-Case option in the Find-Replace function of your text processor.)

Generalized Models

The first stage of a prerequisite analysis produces a model showing how concrete actions are linked one to another. After you have completed such a model, you can add a generalized model showing how the concrete actions instantiate more general actions (see the Chart section for details). A new entry, *Export abstract*, appears on the **Operations** menu after you have specified generalized actions and linked them. Select this option to export the generalized model alone.

Sometime later when you are working on a different concrete model, you can add the previously-defined generalized model. Import the generalized model as usual, except click the *Append Study* button as the last step. You then will be able to instantiate the generalized actions with the different concrete actions in your later study, as described in the Chart section.

Report page

The text box on this page shows various kinds of information produced by the program. Click inside the box, select what you want to keep, and copy and paste to a text document in another program. For example, to keep all of the box contents: click inside the box, and use the standard keys to select all, and copy (Ctrl-A and Ctrl-C on a Windows computer).

CAUTION: you must copy information from this box before exiting *Ethno*, or else the information will be lost. *Ethno* does NOT save the information in this box when you export a project.

Possible contents of the box are the following.

The first line always records the current date and time.

Some lines may provide information about errors that occurred while reading actions or restoring projects, or while printing the chart.

Results of association analyses are printed in the box—see the section above on “Associations”.

Episode statistics are printed in the box—see the description above in “Episode Statistics”, within the “Chart” section.