Editing

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Editing in Easy Trace

Data extraction from raster materials (vectorizing of maps, charts, plans, etc., as well as imagery decoding) is a sequence of automatic and manual operations. Those altering vector data are editing.

Editing is usually understood as a purely manual work but it is not true for Easy Trace. Manual operations are inevitable of course but automatic utilities are charged with the lion's share of the task.

We would like to outline the role and place of editing in data processing before detail description of these operations.

Vectorizing

This is where you act as demiurge indeed: you create vector data, and will have exactly what you have done. At that, manual and semiautomatic vectorizing is intuitively obvious but automatic generation of vector data requires a knack of envision. It is not so simple but worth trying as makes vectorizing several times faster.

And what has editing to do with it? Just a minute!

Automatic vectorizing in Easy Trace is subdivided into a series of steps. Roughly, it consists of tracing, breakup joining, and optimization of line form. One of the reasons to introduce such subdivision was the necessity of data backfitting between operations, that means manual editing.

Small interference of the operator between work of utilities notably facilitates final editing. You have cut off a «hook» - and line fragments will be sewed together across the gap and help to restore other lines. A «hump» brushed off with Eraser means that you will not have to move individual vertices after line form optimization. And so on.

> *Unlike typical GIS instruments, our editing tools can treat intermediate results of vectorizing - «raw» vector lines. As a rule, these are «dense» lines generated by automatic vectorizing. There is no sense to edit such lines in the ordinary way because of the great number of vertices. Easy Trace has special tools for this purpose.*
>
> *Use of «dense» lines provides a great gain in efficiency. Such lines require only quick and rough editing for shape improvement because they bring a lot of superfluous information. Strike with Eraser and Camber Editor several times at an early stage of vectorizing and the result will be better and quicker than at careful final editing.*

Thus, one of key objects of editing in ET is correction of intermediate data at automatic vectorizing.

Editing

Unlike editing at vectorizing (when we correct the shape of lines extracted from the image), editing proper implies change of already existing vector objects.

It is insignificantly if the data are newly-generated or old (for example, imported from ACAD for updating). You must only know, what to do with them and how to do it quickly.

«What to do» means correction of shape, connections, and generation of derivative objects.

«To do it quickly» requires the skill to use utilities at any opportunity. Actually, utilities are automatic editors that make numerous data alterations (tens of thousands sometimes) within several seconds.

Positioning of line ends, forming of common boundaries and nodes, polygon assembling and other operations should be done with the help of utilities.

Even at use of manual tools, it is necessary to give preference to ones that change the shape of object (or several objects at once). Shift of individual vertices is the least desirable option.

All in all, the operator should be lazy and smart enough to turn over most laborious operations to the computer.

Do not try to work instead of your computer! It is faster then you and never tired!

Toolkit

It is better to speak about «means of editing» in Easy Trace as specialized editing tools constitute only a small part of them.

Individual cycles of editing generally correspond to the ancient formula: «I came, I saw, I conquered». Let us consider it closely though:

«***Came***» - it is easy to open a vectorized map of course but… One should review 300 – 400 screen-large fragments to control a 40 x 40 cm map. It is wishful not to get lost at that and to avoid repeated check of fragments.

Hence, the first mean of editing: *Inspector* – organizer of methodical data review. What next?

«***Saw***» - well, what do we want to see? Vector data that ideally correspond to the image are of low information value – just a nice picture!

We must see line skeletons to control exactness of tracing, nodes and vertices – to check connectedness, transparent polygon filling helps to control completeness of vectorizing, etc.

Hence, the second mean: *View modes* – help to check «health» of data like radiography or tomography. Let's go on!

«***Conquered***» - this is the time to use editing tools at last. Is it all? No, one more step:

«***Checked***» - not after every operation of course but not once as well, and in different ways. Editing without utilities of *Topology* group is nonsense, something like driving with closed eyes.

As a result:

Means of editing in ET are represented by a set of mechanisms, approaches, and tools for data control and modification.

Utilities for topology control and correction are discussed in an individual chapter, just as special utilities for automatic vectorizing. View modes are considered together with the program shell, and this chapter describes the portion of the set attributed to *Edit* me.

Conventionally, elements of our toolkit may be classified as follows:

- *Editors* - means to change geometry, connectedness and properties of vector objects. These are *Editors* proper, specialized tools (such as *Eraser*, *Camber Editor*), and some utilities of course. Many of these utilities also mark the sites that require attention of the operator.
- *Selectors* - means to select objects basing on a set of their properties as well as marks in the sites that require attention of the operator. These are *Group Editor*, bookmarks, and utilities that generate such marks (e.g., *Topology Check-Up*).
- *Generators* - means to create derivative objects. These are *Band Polygons* and *Decorators* tools, the utility for polygonal coverage forming, and all tracing tools.
- *Navigators* - means to shift the working window towards marks or marked objects. The group also includes the *Inspector* tool provided for regular review of the project field.

Object selection

Any object modification starts with selection. It is necessary to specify unambiguously what object or a group of objects will be affected by editing before you do something.

Selection looks like a simple operation but there may be several thousands of objects in one map sheet, and many of them will be corrected several times.

As selection in itself changes nothing in vector data, we tried to combine this unproductive operation with impact on the selected object when possible and thus to avoid tens of thousands of unneeded clicks.

For example, object deletion requires one click instead of usual two (selection + deletion). Contour contraction / expansion, deletion of vertices, line cutting, forming of band polygons and design elements operate in the same way.

Another accelerating method is transfer of the current object from one tool to another. It is enough to do anything with the object, and the next tool receives it as on the conveyer belt without additional actions of the operator.

Object marking is also an implicit way of selection provided for most utilities. If the object is marked, you need not search it for editing but just move to it. It means that shift of the working window, zoom, and object selection come to one click.

Let us summarize. There are several ways of object selection in ET:

- ***pointing*** - direct selection of the object with *Editor*, *Group Editor*, *Camber Editor*, or *Eraser* tool. *Group Editor* allows selection of several objects at once;
- ***inheritance*** - the last created or selected object automatically becomes current when you take any *Editor*;
- ***transfer*** -appropriate objects automatically become current in turn when you apply navigation means. Navigation is provided for objects marked with *Group Editor*, any objects attributed to the _ERRORS_ or _CORRECTIONS_ vector layers, and special objects - *error marks* and *correction marks*. At mark-to-mark navigation, the program selects the mark first and the related object becomes current after mark deletion;
- ***criteria*** - *Group Editor* can select objects meeting the user-specified set of criteria.

Some tools alter objects without their explicit selection. Selected objects (called also *highlighted* or *current*) are distinguished by the way of their representation, which may be specified on the *Project -> Project Properties -> View* page. It is either a user-selected contrast color or dot line together with representation of the insertion point or all vertices.

The *Layers* bar shows the layer of the selected object. The same is true for a group of objects if they belong to the same layer. If highlighted objects belong to different layers the bar will be empty.

Object transfer to another layer

Attribution of vector objects to different layers for subsequent processing follows automatic vectorizing. For example, it is convenient to separate index, intermediate, and supplementary contour lines or linear rivers and polygonal lakes, etc.

Thus, change of layer the object belongs to is a rather frequent operation after automatic vectorizing.

To change the layer of the current object or a group of objects, just open the list of layers in the *Layers* bar and specify the desirable one.

It is convenient to use the *Group Editor* for mass attribution of vectorized objects to different layers.

Selection of vector layer may be simplified and accelerated with the help of the «S»hot key – *Cyclic layer changing*. To use the key, switch off or freeze all layers except the source and target ones.

There may be several target layers at vector data attribution. In that case, the «S» key should be pressed repeatedly after object selection until the desirable target layer becomes current.

There may be «frozen» layers in the project. They are protected from object alterations and marked by the snowflake. It is impossible to attribute their objects to other layers. Similarly, you can not attribute an object to a frozen layer until you «unfreeze» it, i.e. switch off the snowflake mark.

Further still, the entire group of objects becomes unavailable for editing if it comprises an object attributed to a frozen layer. In that case, you may either exclude the object from the group or unfreeze the layer. The latter operation does not discard selection of objects.

Freezing of the layer does not prevent objects from being selected as it may be necessary for review of their attributive data and other properties.

Keyboard commands

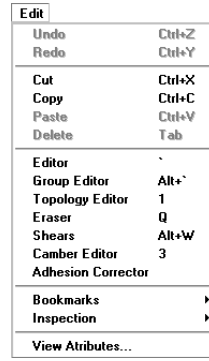
There are some keyboard commands that change geometry or property of vector objects. The commands are available irrespective of the selected editing tool - they act «over its head». The following commands belong to this group:

- ***Change the current layer*** - attribution of selected objects to the selected layer. To change the current layuer, select the new one from the layer list or use the hot key S (*Cyclic layer changing*);
- ***Tab (Delete)*** - deletes all selected objects;
- ***F2 (Edit attributes)*** - opens the dialog box for attribute input and editing;
- ***D (Close / Unclose)*** - closes/uncloses selected polylines;
- ***X (Reverse polyline)*** - changes sequence order of vertices in selected lines.

Some other hot keys may be also useful at editing although they do not alter objects. These keys shift the working window, change the current tool, help to select view modes, etc.

Edit Menu

Edit Menu. Commands for vector data editing



Most editing means of the program are grouped in the special *Edit* menu although there are a lot of operations that may be done by tracers (closing, dissection, polygon splitting), utilities (positioning of line ends, forming of common boundaries and vertices, change of object type), and special tools (shift-widening, object design, elevation data input).

Commands in the menu are divided into several groups. The first two commands allow you to refuse from alterations you have done (*Undo*) or return what you have refused from (*Redo*).

The next group comprises a usual set of *Copy*, *Paste*, *Cut* and *Del* commands intended for vector data.

Editors and other tools of the third group provide the core set of operations for changing of vector objects. Most of the tools may process several objects at once.

The fourth group comprises tools that change chaotic data processing into regular and methodical work.

The last command allows you to control and edit attributes of all objects ascribed to the current vector layer.

Undo command

One of Easy Trace Pro advantages is the possibility to cancel almost any action (including operations with images). For vector, the «depth» of *Undo* operation is extremely big.

You may even refuse from an unsuccessful import of vector data from another project (for example, if you see an error of coordinate transformation).

Big depth of Undo allows you to select a small test area and estimate there how a series of operations will affect vector data. The series may be run several times to optimize parameters of applied utilities before you process the entire project field.

Parameter selection for Line Form Optimization utility may serve as an example. Different materials require different combinations of approximation precision and filtering length, and it is much easier to select them by the trial-and-error method.

Topology correction gives another example. This operation is compulsory for all projects, but incorrectly selected parameters of the utility may cause side effects that become obvious after several tens of subsequent operations. If that is the case, it is easier to Undo all changes than to fish the errors out.

Corresponding lines of the menu and screen tips inform you, which operation will be canceled by *Undo* (or restored by *Redo*) command.

The *Undo* command has some limitations. It does not affect:

- changes made in structure of attributive data tables;
- deletion or adding of project layers, both vector and raster ones. It means that information from deleted layers is irreversibly lost;
- alterations of project layers (renaming, change of representation way, layer doubling, etc.);
- editing of line types, fillings, text styles, and block set of the project.

Hot key of the command is *Ctrl+Z*.

 Redo command

The command restores all changes previously canceled by *Undo*. Remember that *Redo* becomes inaccessible if any vector or raster operation was executed after *Undo*.

Hot key of the command is *Ctrl+Y*.

Copy command

The command copies selected vector objects into the clipboard. The copied objects can be inserted with the *Paste* command into any point of the current or another loaded project.

Coordinates of inserted objects remain unchanged. That is why the *Copy – Paste* pair of commands may be used for joining of adjacent projects into a single coverage.

Hot key of the command is *Ctrl+C*.

Cut command

Unlike the *Copy* command, this one deletes selected vector objects from the project. As for the rest, the commands are similar.

Hot key of the command is *Ctrl+X*.

Paste command

The command inserts into the current project vector objects placed to the clipboard by the *Copy* and *Cut* commands. The objects retain their coordinates that enables you to use the *Copy – Paste* or the *Cut – Paste* pair of commands at integration of data from different projects.

The program automatically selects inserted objects with *Group Editor* in the *Move* mode. It helps to change their position if necessary.

Hot key of the command is *Ctrl+V*.

Delete command

The command deletes selected vector objects without saving them to the clipboard. It works «over the head» of any vector tool.

Hot key of the command is *Tab*.

We selected this key (instead of usual *Del*) as it is more convenient for blind pressing with the left hand.

Tools - Editors 

Main editing functions in Easy Trace PRO are assigned to three tools – *Editor of vector entities (Editor)*, *Group Editor*, and *Topology Editor*.

As the tool name indicates, *Editor of vector entities* deals with individual objects. It can change any property of any object – but affects only one object at once (with the exception of snap operation with common vertex or node forming).

Group Editor is intended for selection and alteration of several objects at once. At that, you may just click objects to include them into selection or specify a set of selection criteria. Selected objects may be altered by *Group Editor* directly or delivered to another tool.

Topology Editor generates and corrects topological connections between objects attributed to any number of vector layers. It means that the tool can create, delete, and move nodes and common vertices belonging to several objects simultaneously. On the other hand, it can not break connection of objects without deletion of common vertices or nodes – this is a task for Editor of vector entities.

Editor of vector entities (Editor) 

Editor is the main tool that enables you to change individual objects. The set of available editing operations depends on the type of selected object. Actually, a series of editors intended for different types of vector data is hidden in the shell of the tool.

Hot key of the command is «~» (in most keyboards it is located below *Esc*).

To select an object for editing (i.e., to make the object current), point it with the cursor. If the object had been selected before you «took» the tool, it becomes current automatically.

Parameter bar appears after object selection, depends on its type and resembles the *Parameter* bar of the corresponding tool – generator. That is quite reasonable - there is no sense to show *Diameter* field (for example) at text object editing.

Some parameters in the bar (e.g., number of vertices in the current polyline or if the object has attributes) are shown for information only. Other parameters (such as layer, attributes, size, type, rotation angle, etc.) are editable.

Thus, non-geometrical properties of objects may be changed in the *Parameter* bar of *Editor* or after the tool has provided access to object attributes.

To move any point object in the editing mode, click its insertion point with the mouse left button. *Editor* captures the object in the *Move* mode and you have only to click the button once again in the new position of the object. Right click or *Esc* breaks the operation and returns the object to its initial place.

The following operations are provided for polyline vertices:

- ***movement*** - click the vertex with the mouse left button, and it will start moving similar to relocation of a point object;
- ***addition*** - click a point in the line with the mouse left button to create a vertex, then position it more exactly and click the button again to complete the operation;
- ***deletion*** - click the vertex with the mouse right button.

ATTENTION! Editor of vector entities deals with only one (current) object. It adds, moves, and deletes vertices of this object only, even through the vertices belong to several objects at once.

Apply Topology Editor to move a vertex or insertion point belonging to several objects.

Other functions of *Editor* are accessible through its submenu that appears when you click the right button somewhere in the project field (avoid clicking on the current line though or you may delete a vertex).

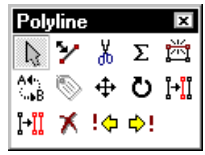
The submenu contains icons of commands applicable to the current object. The largest set is provided for editing of polylines. For point objects, it contains only commands for object type transformation, rotation, work with attributes, and deletion. Other properties of point objects may be changed in the *Parameter* bar of the tool.

All the icons have screen tips and explanations in the *Status* bar.

To execute a command, click its icon in the submenu. Frequently used commands of the set can be connected with hot keys and thus executed without opening the submenu.

Commands included in Editor submenu

Additional menu available at polyline editing



- Vertex editing in polyline / 3D polyline
- Edit edge
- Split polyline / subtract polygon
- Join two polylines (polygons)
- Close / unclose polyline
- Reverse polyline (change direction)
- Edit attributes
- Move object
- Rotate object
- Duplicate polyline to another layer
- Copy polyline to its own layer
- Delete object
- Move to previous / next object

Click the button in the right upper corner of the bar or press *Esc* to close submenu without execution of any command:

Vertex editing in polyline / 3D polyline

It is the most frequent mode that allows editing of polyline geometry. The following operations are provided:

- ***delete the vertex*** - click it with the mouse right button;
- ***move the vertex*** - click the vertex with the left mouse button, and it will move together with the cursor till the second click. Right click or *Esc* to release the vertex without changing its initial position;
- ***add the vertex*** - click a point in the line with the left mouse button, position the new vertex more exactly, and click again.

Move object

The selected line is surrounded by a frame and the cursor (when near the line) changes its shape for the symbol of the icon. Hold down the left mouse button inside the frame and drag the line. You may also move the object with the help of the of the cursor control keys - one pixel displacement per stroke. The larger is the scale, the more precise is the movement.

Edit edge

This button controls capture of polyline segments: when it is pressed, left click on the current line does not generate a new vertex but seizes the line segment for subsequent relocation.

 Split polyline / subtract polygon

The cursor appears as scissors with the hot-spot at the upper end. The tool has two modes. When in ***splitting mode***, it splits the polyline in two in the point you have clicked. When in ***short segment removing mode***, the tool also splits the polyline in two, but removes the short part. *Shift* key switches between the modes. Removing mode is indicated by red color of the cursor.

If a polygon is selected for editing, and the user points inside another polygon crossing the selected one, then this second polygon will be subtracted from the first one.

If you point the boundary of any polygon, it will turn into two unclosed lines (first vertex – specified point and specified point – last vertex).

Hot key of the command is W (by default)

 Join two polylines (polygons)

The summation symbol near the cursor indicates this mode. Click a point (not far from the end) in the line you want to join to the current one, and the lines will be united.

The mode remains selected and you may continue line joining. This function together with the «C» hot key (move to first / last vertex of the current line) may be useful for quick line forming out of fragments generated by automatic tracing.

Hold *Shift* key down to build a smooth curve between the polylines you want to combine into one. ***Smooth joining mode*** is indicated by the wave symbol near the cursor.

ATTENTION! Smooth joining is provided for processing of automatic tracing results BEFORE OPTIMIZATION OF LINE FORM because Easy Trace forms the uniting arc as a «dense» line – one vertex per one pixel of the image.

Superfluous vertices generated at command execution AFTER LINE FORM OPTIMIZATION may be deleted by the Camber Editor tool or Topology Optimization utility.

To join a new pair of polylines, hold the *Ctrl* key down and select a new line to become current. Editor returns in the *Join Polyline*s mode when you release the button.

If a polygon is selected for editing and the user points another polygon adjoining or crossing the selected one, then both polygons will be combined.

If the lines you want to join belong to different layers, the resulting line will be ascribed to the layer of the first selected (current) object.

Hot key of the command is *E* (by default).

 Close / Unclose polyline

There are two variants of this operation – the line may be closed directly or via segments of other lines:

- If at least one end of the current unclosed line is free, the command builds a segment between the first and the last vertex of this line (or deletes this segment if the line is closed). Closure will be arcuate if you hold the *Shift* button down.
- If both ends of the current line are snapped to other lines, and segments of these lines (and of other lines snapped to them) can form a closing line, the closure will be done in this way. At that, the program observes the principle of «minimal polygon» - the resultant contour does not comprise any other. The program uses segments of polylines belonging to all visible layers for this operation.

Hot key of the command is *D* (by default).

 Duplicate polyline to another layer

This command opens the *Select Layer for Duplicating* dialog box. Select the layer you want the current line to be duplicated (copied) to. You may copy the line to its own layer and to several layers at once but copying to frozen and switched off layers is impossible.

Attributes of the line (if any) will be copied as well on condition that attribute tables of the target layer(s) have fields corresponding in name and type to fields in the table of the source layer.

 Copy polyline to its own layer

It may be reasonable to use placing of duplicates instead of vectorizing if there are a lot of identical objects in the project. The *Move* mode will be started automatically after copying.

 Reverse polyline (change direction)

This command places vertices of the current line in a reverse order: the first vertex becomes the endpoint and vice versa. Order of vertices is rather often in use to specify:

- polyline direction (river current);
- representation method (cliff hatching should be to the right of directional line);
- multiplicity (outer boundary / hole in the polygon).

ET has three special view modes that facilitate line direction control and correct polyline representation in case of complex line type:

- ***thematic attribute-depending displaying (Alt+D);***
- ***custom line type***;
- ***line direction (F9)***.

Hot key of the command is *X* (by default).

Edit attributes

The command is accessible for vector objects of the type and layer linked to an attribute table. It opens the *Object Attributes* dialog box.

Hot key of the command is *F2* (by default).

Delete object

The command deletes the current vector object. In case of error mark deletion, the object this mark was related to becomes selected automatically.

Hot key of the command is *Tab* (by default).

Optionally, the program may ask your confirmation at attempt to delete a polyline longer than the user-specified number of vertices. Open the *Project -> Properties -> View and Editing -> Options* page to switch on/off this option and to specify the critical vertex number.

Rotate object

This command enables rotating of the current object around its first vertex (for polylines) or insertion point (for other objects). To fix a new orientation of the object, just click the mouse left button at desired position.

If a polyline is selected for editing, you may change the center of rotation. To do it, specify any desired point holding the *Shift* key down, and the point becomes a new rotation center. If the specified point is situated near a vertex or a segment of a polyline, it automatically snaps to the line.

Rotation angle is displayed in the *Status* bar.

Convert

This command allows you to change the type of the current object. For example, a circle may be turned into a polyline, and a block may be substituted for a point (and vice versa). The command opens the dialog box of the *Object Conversion* utility. See description of this utility for more details.

Select current vertex (3D polyline)

Every vertex of the 3D polyline may have some attributes (height, a sign of belonging to a surface, etc.) as well as arbitrary attributive data (a DB record). When in this mode, you may edit vertex attributes. Click the vertex with the mouse left button, and then edit values in the corresponding fields of the *Parameter* bar.

 Select previous /  next vertex (3D polyline)

The command changes the current vertex. Next or previous vertex becomes current.

 Move to previous /  next mark

ET has an integrated mean for quick navigation (positioning of the working window) between marks. These may be auxiliary objects generated by utilities at sites where manual editing is required (error marks and correction marks), vector objects attributed to the _ERRORS_ and _CORRECTIONS_ layers, or arbitrary vector objects marked with the help of *Group Editor*.

Presence of marks or objects attributed to the above-named layers in the project as well as start of the *Marked Object Navigation* view mode causes appearance of two additional buttons in the *Editor* submenu – *Move to previous / next mark (marked object)*.

After move to an error or correction mark, it becomes the current object of *Editor* and description of the situation appears in the *Status* bar. *Delete (Tab)* command removes the mark while the object related to this mark becomes current.

After move to an object marked with *Group Editor*, this object becomes current immediately.

Hot keys of the command are *V и F* (by default).