SMARTNESS KNOCKING AT GIS'S DOOR

Advanced editing via smart-layers

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CHANGE THE ASPECT

We live the golden age of smart applications now, the smartness takes place in all areas of our life. According to our perception the smartness should enter to the Geographical Information Systems as well. We made a discovery at a little segment of the GIS software were the intelligence can be useful, this part was the Editing. If we look around in different geoinformatics software, we have to perceive that the layer settings - like creating, switching between layers - needs a lot of attention and time as well. Till now this activity was an inductive task, so we made a layer by define that it will be point, line or area. After we chose a layer make some editing inside it.

Think about that – a geoinformatics software could find out what kind of geometry are we editing – in a deductive way. The application can perceive that, this feature cannot be a point, because we put down more points, or the last point equivalent with the initial one, maybe that's a polygon. We are going to show a way which could ease and change the habit of editing via two mental innovations.

Let's assume the opening of a new project in GIS software, afterwards defining each necessary layers, a point layer for houses, a line type layer for rivers and finally a polygon layer for forests. Imagine that the software puts the layers into baskets or groups according to its geometry type, like in Figure 1. In each group the GIS application should set the firstly created layer to "Smart", and this smartness is changeable between the groups by hand.
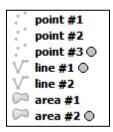

FIGURE 1: THE GREY CIRCLES REFER TO SMARTNESS ON TABLE OF CONTENT (LAYER PANEL)

It was the first innovation what we are writing about, but it can't live without the other one, which can be seen in Figure 2. The pushed mouse buttons and the coordinates take part in the deductive interpretation of geometry.

TABLE 1: WE RE-REGULATED THE ROLES OF BUTTONS TO VIVIFY THIS INTERPRETATION WITH THE ATTENUATION OF LEFT BUTTON'S DOMINANCE

Click	Open Object	Save Object
1.	line point	POINT
2.	line point	LINE (with 2 point)
3.	line point	LINE (with 3 point)
4.	line point	LINE (with 4 point) POLYGON (triangle)

So we open and continue the geometries (objects) with the left, and save or finish them with the right button of the mouse. For example the edition of a point on the map needs only a right click, while a line with two points needs first a left and after a right click on another cursor position of course. The third case is the polygon, where we need at first three left clicks, and finally a right click on the position of the first line point. It's simple. The SmartEdit intelligence uses the first and last points to decide the geometry between lines and polygons. If they are identical it is a polygon, otherwise it's a line.

PUT THE THINGS TOGETHER, EDIT IN SMARTEDIT

With the outlined methods the editing will be much easier than in all existing GIS applications.

(a)   (b)

FIGURE 2: THERE ARE ONLY TWO ICONS ON THE EDITOR PANEL

With first icon we can change to editor mode, thereby the combination of left and right clicks on the palette reads the Smart settings from the table of content and pairs them together to register. For example if we sat the third point layer to Smart, then a pushed right button on the palette saves a point to the third point layer. The pairing happens the same way between the other geometric primitives (line, polygon).

At this point we must suppress the word of sceptics by a specification. Till now the technology cannot distinguish the difference between polygons and closed lines, like contour lines. To solve this problem we created the second icon of Figure 2, which make contour lines on toggled case (b), and polygons else (a).

TEST OF EFFICIENCY

We used a sample map (Figure 3) to test the SmartEdit conception next to other GIS software, and then we composed a comparison in a table from the quantity and distribution of used buttons.
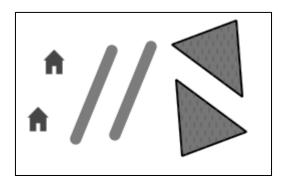

FIGURE 3: SUBJECT OF DIGITIZING, TWO HOUSES (POINT), TWO RIVERS (LINE) AND TWO FORESTS (POLYGON)

In the sample area each type of geometry represents oneself with the most basic possibility, like a polygon with 3 points. The quantities of each type the same as well – two points, lines, polygons. With these settings we minimalized the contingent distortion of the result. We didn't care about the track length of mouse because it is function of too much parameter (size of raster, place of panels etc.).

RIGHT	RIGHT	LEFT, RIGHT	LEFT, RIGHT	LEFT, LEFT, LEFT, RIGHT	LEFT, LEFT, LEFT, RIGHT
house below	house above	left river	right river	forest above	forest below

FIGURE 4: THE MOUSE BUTTON SERIES OF SAMPLE MAP DIGITIZING BY SMARTEDIT

To the interpretation of Table 2 we have to mention the insider information that the light gray rows stores the geometries really object-orientated in tables. The GIS software specification can be seen at the end of paper (Appendix).

TABLE 2: NOTICE THE EQUABLE USING OF MOUSE BUTTONS WITH SMARTEDIT

	Left	Right	All	Left/Right
QGIS 2.0.1	26	4	30	6.50
GeoMedia Professional 6.1	22	4	26	5.50
ArcMap 10	26	2	28	13.00
AutoCAD Map 2013	28	4	32	7.00
MicroStation V8i	20	2	22	10.00
SmartEdit	**8**	**6**	**14**	**1.33**

ASPECT IN TIME

TABLE 3: THE SUM OF TIMES WERE CALCULATED FROM THE KEYSTROKE-LEVEL MODEL (KLM) [1]

ArcMap 10	
Editor (1)	M,P,B
Start Editing (2)	M,B
Create features, House (3)	M,P,B
Editing of houses (5)	M,P,B,M,P,B
Create features, Rivers (6)	M,P,B
Editing of left river (8)	M,P,B,M,P,B
Right click (9)	M,B
Finish sketch (10)	P,B
Editing of right river (12)	M,P,B,M,P,B
Right click (13)	M,B
Finish sketch (14)	P,B
Create features, Forest (15)	M,P,B
Editing of forest above (18)	M,P,B,M,P,B,M,P,B
Right click (19)	M,B
Finish sketch (20)	P,B
Editing if forest below (23)	M,P,B,M,P,B,M,P,B
Right click (24)	M,B
Finish sketch (25)	P,B
Editor (26)	M,P,B
Stop editing (27)	M,B
Yes (28)	M,P,B
Operations:	**24M,22P,28B**
Sum of time [s] :	**58.6**

SmartEdit	
Editing of houses (2)	M,P,B,M,P,B
Editing of left river (4)	M,P,B,M,P,B
Editing of right river (6)	M,P,B,M,P,B
Editing of forest above (10)	M,P,B,M,P,B,M,P,B,M,P,B
Editing of forest below (14)	M,P,B,M,P,B,M,P,B,M,P,B
Operations:	**14M,14P,14B**
Sum of time [s] :	**35.0**

According to the comparison (Table 3) we finish 40% faster if we edit with SmartEdit.

HCI GOALS TO SUMMARY

The theory of Human-Computer Interaction (HCI) proves the advantages of SmartEdit.
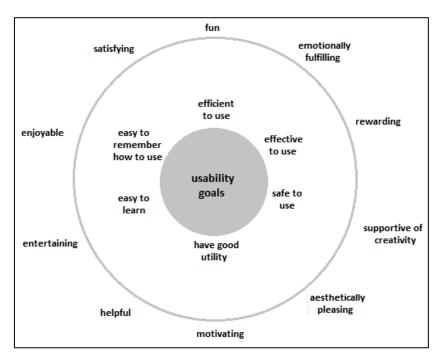

FIGURE 5: THE FACTORS OF SUCCESS IN HCI [2]

Start with the most important, is SmartEdit effective? As we shown, we are able to reach the end faster in editing. In addition the route of mouse is less as well (because of unnecessary operations), so we save energy too. Don't forget that, our conception liberates a hand, which can be used to other tasks, like navigate the map or correct mistakes. The SmartEdit sets free the operator from some mental tasks during the digitizing, thus the free brain capacity can be took advantage of at other territory. Furthermore we made a description about how to use SmartEdit with touchpad, it's able to edit with only tapping. [3]

Another important aspect is that the usage of the system have to be logic and easily memorable. The conception bears this constraint as well, because it is easy to remember: open/continue object – left, save object – right button. It satisfies the Nelson rule, which says that a system is easy-learning if can be learn in ten minutes. [2]

The applications of the geoinformatics market sometimes need too much operation for changing layers, switching into edit mode and then off, to save edited geometries, however the SmartEdit ease the worker from this stuffs, and the operation becomes more enjoyable, changing to a more draw-like act, a creative activity, to a pleasure.

REFERENCES

[1] D. Kieras, "Using the Keystroke-Level Model to Estimate Execution Times," 1993.

[2] Preece, Roger and Sharp, Interaction Design: Beyond Human-Computer Interaction, TBS, 2007.

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APPENDIX

We drew up the following conditions under digitizing:

- Change layer only, if every referring elements were digitized
- We defined forward the three layers (house, river, forest)
- Don't save attribute data
- Start the edit with selected layer
- Use keyboard only in necessary case
- Ease the edition if it's possible (suppress attributes pop-up windows)
- Deem the save of edits to the last phase
- We use the right mouse button if it doesn't take surplus clicks

Software specifications under digitizing:

- QGIS: Settings/Options/Digitizing/Suppress attributes pop-up windows after each created feature
- GeoMedia: Tools/Options/Placement and Editing/Display properties dialog for new features
- AutoCAD Map 2013: Edit in Classic mode in three layer
- MicroStation V8i: Use Active point and SmartLine

To register the pushed buttons we used MousoTron 9.1.