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Representation of Regional Space Based on Spatial Relation

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If GIS is to be more cooperative for people in making spatial decisions, it is essential that man's space grasping and reference ability should be formally and mathematically modeled so that it can be processed with computer. And this module should be applied to GIS. This means extension of function of GIS's space analysis module so as to make it similar to man's space grasping and reference ability.

This paper presents one method of dividing man's spatial activities into representable parts and on this basis, getting the overall spatial representation from the elemental spatial relations.

1. Congnition Process for Geographical Space

Most activities of man are done in the geographical space and presupposes the awareness for space.

Cognition of space means having a vivid understanding of how the objects necessary for achieving the purpose of activities are distributed in a certain geographical area and how they are co-related.

Based on the cognition of space, man decides the route and means of movement and changes his position in the space.

Man's movement in the geographical space constantly changes the relationship between man and the objects in the space. Spatial relations are the relations between the geographical objects; man's *movement* in reality changes the relationship between the positions of him and the objects.

It is very important for representing the space to determine the direction of movement in the geographical and abstract space reflected in man's brain.

Daily commuting or travelling by train to the destination is done by confirming exact positions, that is, based on certain space coordinates. However, those exact space coordinates are not always essential.

People usually make movements based on the the relative position relations – space relations mainly (See Fig.).

Consider a person's movement from Point A to Point B. Now, we have additional information that A is in the northern vicinity of C.

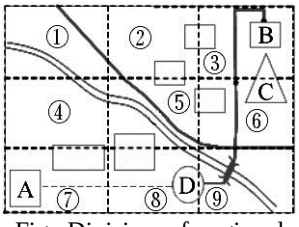

Fig. Division of regional space
A－D are points, ①－⑨ are subspaces

Even though the exact coordinate of B is not known, as he already has a clear image of the geographical area, he moves to B based on the space reference methods in the relationship between himself, B and other objects.

This can be analyzed through the following elemental procedure:

First, as the exact coordinate of B is unknown, the man should find out which district B is in.

Next, he sets the primary goal of getting to C and moves to the place.

Moving to C requires that A is set as the starting point and D is set as the reaching point. D is set as the reaching point here and is nearest to C. With this simple route in mind, the person moves to D using the transportation, e.g. subway.

The next step of space activity is the movement from D to C. This movement is also done only after confirming the route of movement that includes bridges, flyover at the crossroad, left turn etc. Through these movements, the man gets to C.

The last step of space activity is to find B which is in the vicinity of C. This is done by cognition of the four directions of C, i.e., utilization of the directional spatial relations and actual movement to B.

From these things, it is clear that cognition and utilization of spatial relations are actually done based on spatial relations like the topological coherence of points and lines, neighborhood topology of objects and directions.

Most movements of man and objects are done in the geographical space.

After a certain spatial movement, the existing space relations disappear and a new spatial order is set. Therefore, spatial movement of several people and objects means the very complicated spatial relations.

Movement of man and object depend on cognition and direct or indirect utilization of spatial relations.

Cognition and utilization of spatial relations are done in the whole course of movement. This can be proved by analyzing the usual speculation, the way the neighboring space is represented and the way the movement is made.

Representation of the space is done by spatial relations, that is, the relationship between the positions of the objects. This has been used traditionally and will be used in the future, too.

The cognition of space is done by first setting the regional space, and then dividing the space into certain parts and finally finding out the relations between the object, subspaces and man himself.

With this, a new methodology of representing the geographical space as a whole can be proved through the procedure of man's cognition of space.

2. Representation of Space based on Spatial Relations

Representation of a certain area based on the spatial relations between the objects is done through the following procedure.

Step 1 Comfirmation of space range and division of subspaces

First, the range of the area to be investigated should be confirmed. The range may be rectangular, circular or in any other shape. Number of subspaces can be set at random, for example, 9.

Step 2 Establishment of the central subspace and direction relation .

Subspace 5 becomes central subspace among the established subspaces. Confirmation of central subspace is made to reflect the direction relations between the objects more specifically.

Next, the direction is decided. It can be set as top, bottom, left, and right or east, west, south and north. When there are 9 subspaces, there can be 8 directions with the central subspace as the center.

Step 3 Representation of the space

Here, relative position relations of subspaces are considered. This is done to represent the space more vividly based on the spatial relations. Here, the coherence, directions and divisions are represented as much as possible.

After steps 1 to 3, we have the basic information for describing the spatial relations and the position of individual objects.

Step 4 Establishment of frame elements of the space

The frame elements are standards for establishing the relations and position of other geographical objects. For this reason, the frame elements should be set first and the relations between these elements and other geographical objects should be explained based on them. The frame should be set with objects whose positions are easy to find, e.g. mountain, river, highway, building, etc.

Step 5 Explanation of position relations between the objects

Spatial relations between the subspaces and the frame elements do not normally change compared with other spatial relations. Therefore, once they are established, they can be used to find the position of other objects.

The spatial relations between the subspaces, frame elements, and geographical objects established as mentioned above enable us to cognize the space as a whole.

On this basis, we can tell the position of the bridge.

First, from the inclusion relations of the bridge and the subspace 9, we can say that the bridge is in the subspace.

Second, based on the direction relations between the subspaces 5 and 9, we can say that subspace 9 is to the southwest of subspace 5.

Third, based on the vicinity relations between the bridge and object D, we can say that the bridge is in the vicinity of D.

In conclusion, we can qualitatively represent the general image of the space with the information “The bridge is in the southwestern corner of the regional space and is in the vicinity of object D.”

Conclusion

With subspaces, geographical space and spatial relations can be represented more specifically and they can give answers to many questions about space that arise in the reality.

References

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