

Urban Expansion of Sendai , as a Type of Urban Development

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Urban Expansion of Sendai, as a Type of Urban Development

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Introduction – *The geographical meanings of the complex factor and the geographical analysis by the factor*

There are simple and complex factors in geography. Simple factor has only one meaning, while complex one contains multiple geographical meanings. The latter is composed of several simple factors not only geographical but also such in other sciences, but what those complex factors mean are not merely the collection of the meanings of the several simple factors.

Therefore, the author expects that in geographical analysis it is better to use a complex factor as a key than to use several simple factors, especially in the analysis of the complex phenomena in urban regions. But usually the meaning of a complex factor is not so clear and sharp, and the result of the areal analysis by means of such a factor often becomes indefinable and its geographical interpretation very difficult.

I. Some examples of the areal analysis by means of some complex factors

The author has tried the areal analysis by a series of some complex factors in Sendai City as an example of an urban region. Land value, shopping street, amount of municipal tax and appraisal-value of realty are a series of complex factors used by the author.

a) *The first analysis by means of land value.*⁽¹⁾ We could define clearly the central business district and the residential area in Sendai, and recognize the eastward expansion of the former district and the concentric expansion of the latter area.

The author points out the following three facts from the eastward expansion. The motive power of the activity of Sendai transmits from the feudal army to the railway station. While the new army located in the castle after the Meiji Era, had not much economic power to urban development, similarly even in the case of U.S. army corps which took over the same place after the Pacific War, the corps had not a strong influence to the development of the city.

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(1) Ken-ichi Tanabe: Changes of the distribution of land value and its meaning—on the example at Sendai. *Ann. Tohoku Geogr. Ass.*, Vol. 4 (1951) No. 1, pp. 1-4.

The outer expansion of the residential area was distorted by the railway running along the eastern side of Sendai, and was interrupted by the high land on its western side. On the other hand, the low hills on its north and northwestern side did not disturb the expansion.

The land value in the old shopping streets surrounded by the residential area gradually diminishes its disparity from the value in the surrounding residential area, and increases the inequality compared to the land value in the central shopping street. Namely, it is distinguished that the peripheral shopping streets have decayed.

b) *The second analysis by means of shopping street.*⁽²⁾ It is clear that the variety of shops in shopping street changes from central area to peripheral area. According to our field survey, seven types are classified in the central shopping street, and five types in the shopping streets within the residential area.

The seven types of central shopping streets are represented as the irregular mozaic pattern of the areal differentiation of central business district. The five types of the peripheral shopping streets are arranged in accordance with the distances from the urban centre. The pattern of the types of shopping streets in urban area has no relation to the forms of road nets in its area.

c) *The third analysis by means of the amount of municipal tax.*⁽³⁾ From the analysis, the central business district and its outer marginal area are clearly divided, and the shopping streets in residential area are not distinguished from its surrounding areas. It is seen that the areas where the higher municipal-tax-payers live are scattered all over the residential area, and there is no areal distinction between the living sections of the lower municipal-tax-payers and that of the higher tax-payers. These areas mingle together.

The road system and road-nets and the hills in the northern part of Sendai show little influence to the distribution of these areas. Generally speaking, the

(2) Ken-ichi Tanabe, Reiko Fujimoto: A study of the shopping streets in urban area. Read at 8th Ann. Meeting, Tohoku Geogr. Ass. (1951).

Reiko Fujimoto: The shopping street; as an element of city structure in north Japan — its type, its pattern and its arrangement. Sci. Rep. Tohoku Univ., 7th Ser. (Geogr.) No. 6 (1957), pp. 1-41.

Ken-ichi Tanabe: Yonezawa and its subordinate towns— as the upper structure of the land utilization of the Yonezawa Basin—from the view point of the structure of a region. Sci. Rep. Tohoku Univ., 7th Ser. (Geogr.) No. 6 (1957), pp. 1-41.

(3) Ken-ichi Tanabe: The inner structure of Sendai from the view point of the areal distribution of the amount of the municipal tax. Ann. Tohoku Geogr. Ass., Vol. 5 (1952) No. 1, pp. 1-5.

(4) Ken-ichi Tanabe: The inner structure of Sendai City from the view point of the areal distribution of the appraisalment of realty. Read at the 11th Ann. Meeting, Tohoku Geogr. Ass., (1952)

houses of higher tax-payers become fewer to the east of railway.

d) *The fourth analysis by means of the value of the appraisement of realty.*⁽⁴⁾ The areal distribution of the appraisement-value of realty coincides with that of the classified tax-payers. The appraisement of the value of realty is fixed to their site for respective house and house-lot, while tax-payers are fluid. Therefore the coincidence mentioned above means that the people live in houses well ballanced to their income, because they do not always own the houses they live in.

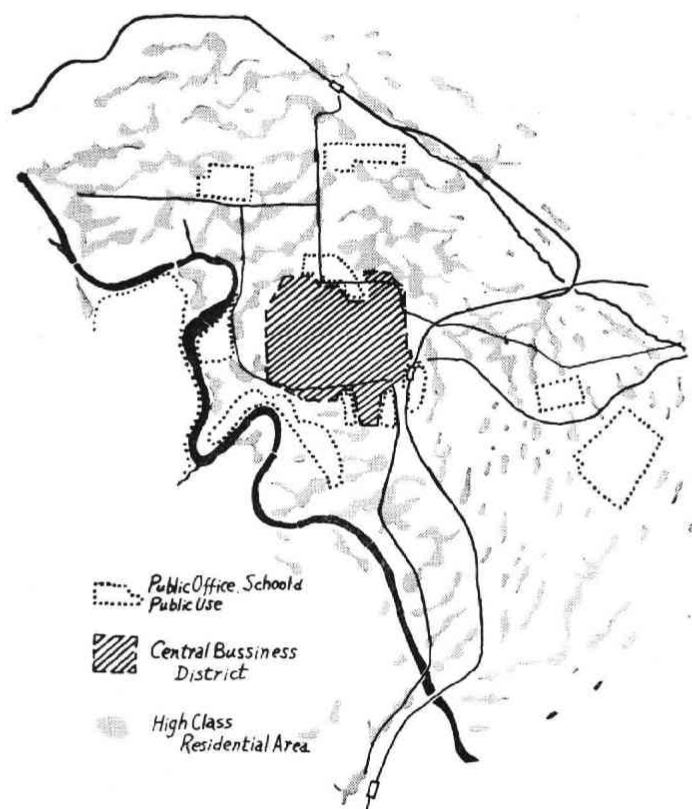


Fig. 1. Circular structure of Sendai.

e) *The combined result of the four analyses.*

The author prepared a structural map of Sendai City as is shown in Fig. 1. It shows a concentric circular pattern like the annual rings of trees within broad residential area. The pattern does not show much influences from the road system and the topography. It is very interesting that the high class residential areas lived by higher-tax-payers with more expensive houses and house-lots, are distributed in the nodulous-concentric-circular pattern.

However, the author could not interpret these phenomena by the analyses using the four complex factors. Although this pattern is somewhat similar to the distribution of the residential areas with high land-value studied by H. Hoyt⁽⁵⁾, it is impossible to explain the case of Sendai simply as the outer movement of higher residential area — as he said. The author thinks that the annular structure suggests the successional expansion of residential areas, in which the high residential areas grew at the outer margin of residential zone are combined into the newer residential zone during the general expansion of the city. Therefore it is necessary to analyse the chronological development of the formation of the structure.

II. *Time and areal analyses by means of a complex factor "House-lot"*

Using the land registers of Sendai City from 1888 to 1953, the author has studied the alterations of the land-classification, the partitions of house-lots and the transfers of the ownerships of house-lots within each piece of land located at the cross points of the 100 m² mesh covering the map of the city.

The result of the study clearly shows an increase of house-lots by the alterations of the land-classification, mostly from arable land to house-lot, although it is not necessary that houses are usually built immediately, but more generally the partitions of house-lots comes after the alterations. By partition a house-lot is divided into smaller lots and then the small lots are traded. A person who wants to build his house purchases a piece of land thus divided, and a house is built soon. Therefore, the alterations of the land-classification and the partitions of house-lots mean the increase of house-lots, in other words they are the factors that indicate the expansion of residential areas, and the trade of house-lots is a factor that shows the expansion more immediately. If land owners make it a business to have their land rented without selling the land, there would be few alterations and partitions, fortunately such tendency did not appear in the suburbs of Sendai. So that the complex factors are usable for the analysis of the areal development of Sendai.

The annual changes of the numbers of the alterations of the land-classification, the partitions of house-lots and the trades of house-lots during 66 years are shown in Fig. 2.

There are three stages in the development of house-lots. The first stage (A_1) is from 1907 to 1917, and is that of areal expansion. The second stage (A_2) is from 1922 to 1936, and is subdivided into 1922 to 1932 (P_1) and after 1932 (P_2). The two thirds of the former period (P_1) is that of the increase of the partitions continued from the first A_1 -stage, and the following one third of the former P_1 -

(5) E.G. Ericksen: *Urban Bihavior*. (1954), pp. 262-265.

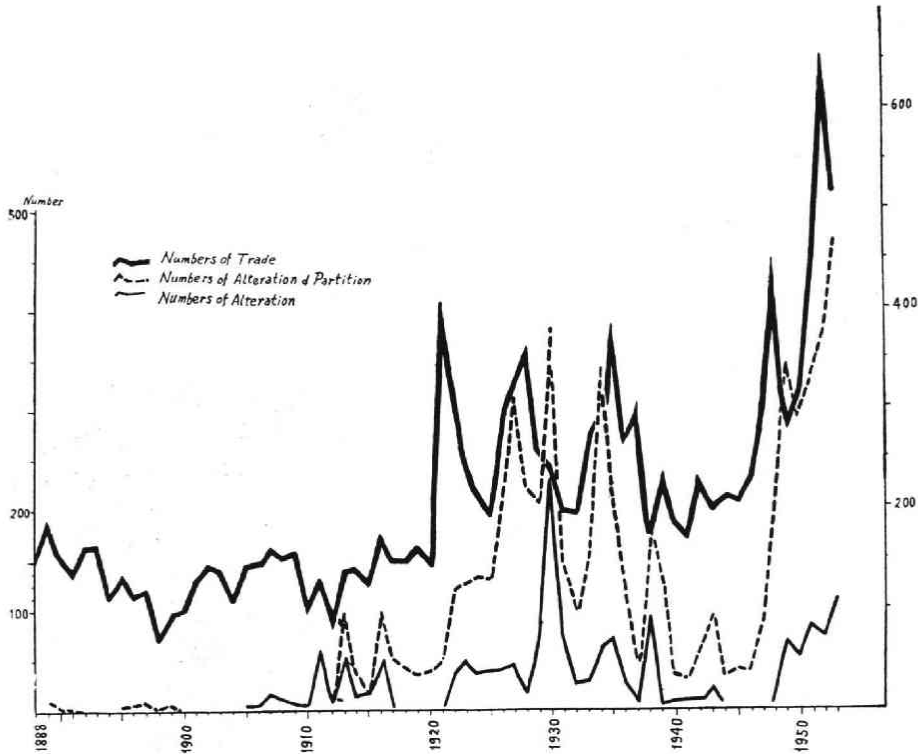


Fig. 2. Annual numbers of trade, alteration and partition

period is that of the areal expansion of housing area. The later half (P_2) of this A_2 -stage is the increasing period of the partitions continued from the previous P_1 -period. The third stage (A_3) began in 1938 and is that of the increasing partitions accompanied by the alterations, and it ended in 1939, the age preceding the beginning of the Pacific War. The fourth stage (A_4) begins in 1947, and is a remarkable period of increasing partitions, though the alterations were rather few. Numerous small house-lots have appeared to the former second A_2 and third A_3 stages.

Concerning the trades of house-lots, the number of trades are few and constant in the T_1 stage before 1920, though the stage contains the first A_1 -house-lots-increasing stage, and in 1921 to 1938 the number increases rapidly. This stage is divided into three periods the early period (T_{2a}) is 1921–1925, the middle (T_{2b}) is 1925–1932 and the late period (T_{2c}) is 1932–1938. In early T_{2a} period the alterations and partitions are not so many, and the middle T_{2b} period is corresponding with the first half of the former period (P_1) of the second stage (A_2). And the



Fig. 3. Areal distribution of partition.

late period (T_{2c}) is corresponding to the latter half of the former period (P_1), the later period (P_2) of the second stage (A_2) and the third stage (A_3). The second stage of the trades of house-lots (T_3) begins from 1947 and is corresponding with the fourth stage of the increase of house-lots (A_4).

That is, a stage of the expansion of the residential areas comes first, and somewhat later comes that of the provision as partition, and the stage of the full

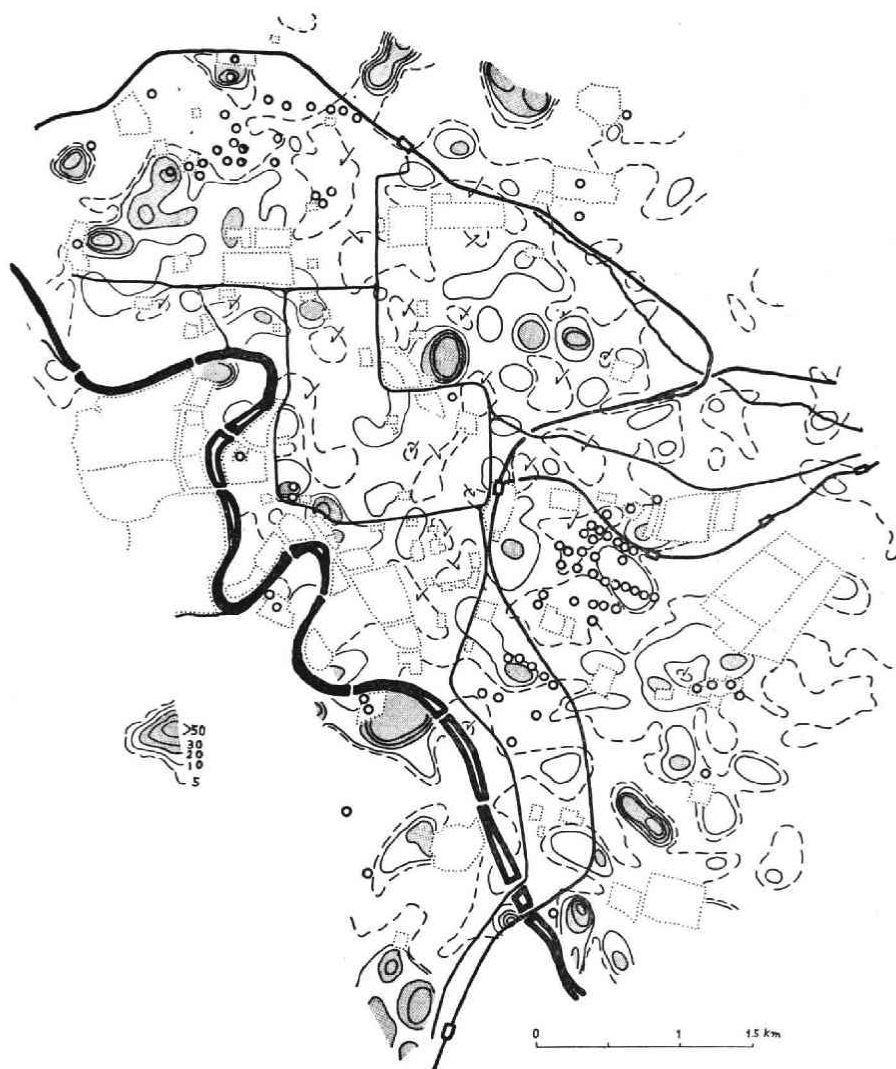


Fig. 4. Areal distribution of trade.

equipment of house-lots for building of house comes last. And these stages come one after another like wave-movement.

Fig. 3 and Fig. 4⁽⁶⁾ show the distribution of the total numbers of the partitions of house-lots including the alterations of the class of land and the total numbers

(6) The mean numbers of the four corners of the above-mentioned 100 m² mesh are written at the centre of the square, and then isopleth lines are drawn.

of the trades of house-lots during 66 years. From Fig. 3, it can be seen that at the central area and at the shopping streets derived from the old merchant streets the numbers of partitions are very few, on the contrary within the residential area the distribution is complicated. The pattern of the distribution hardly coincides with that of the distribution of the amount of the municipal-tax and the value of the appraisement of realty. The relation is inverted in the central business district, while in the areas with numerous partitions within the residential area, high-class residential areas and low-income ones are mingled together.

From the distribution map of the trades (Fig. 4), one can generally see such tendencies. In the central business area, there is quite high percentage of trades of house-lots, and in the residential area the area with many partitions is almost covered by the area with many trades in addition to this coincidence some many-trade-areas are sometimes neighboured by some many-partition-areas.

In order to know the annual average of the number of trades, the cumulative graphs of the numbers in seven divisions are shown in Fig. 5. These seven divisions are taken as examples, of which the two are the central shopping areas in the central business district and one is a traditional shopping area but not central one, and the four are the old and new residential areas in the residential zone, showing these sites in Fig. 6.

The area of No. 1 (Higashi-ichiban-cho) and No. 2 (Chuo-dori) are the neighbouring commercial divisions, but the trends of the graphs are different. That is,

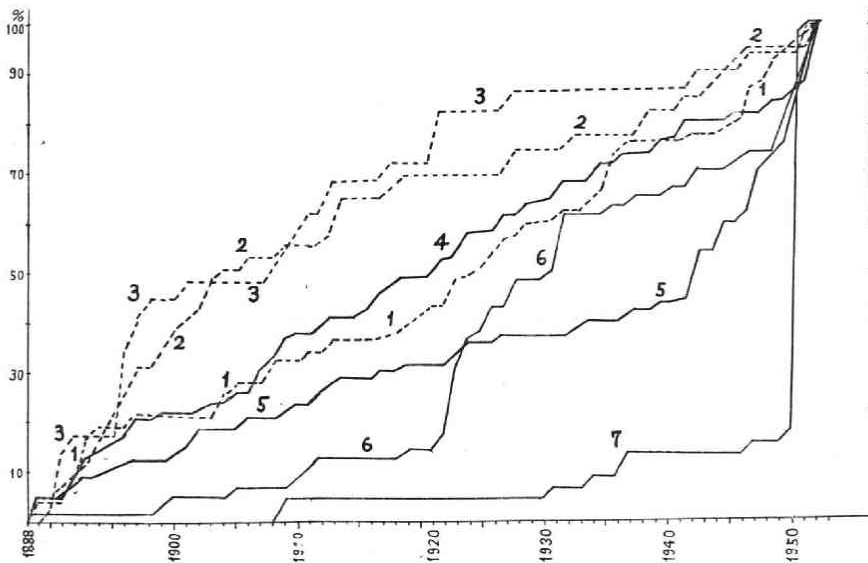


Fig. 5. Cumulative graph of trade of 7 divisions.

in No. 1 the house-lots have been traded steadily every year, while in No. 2 the trades of house-lots are many until 1903 and becomes very few in 1918 to 1938.

The area of No. 3 (Aramachi), which had flourished in the time when Sendai was an castle town, the number of trades was big before 1907 and among 1907 to 1922. No. 2 and No. 3 shopping areas had decayed in 1890 to 1900, and No. 2 has flourished again in the last years. Therefore in the case of commercial area the number of trades indicates its prosperity.

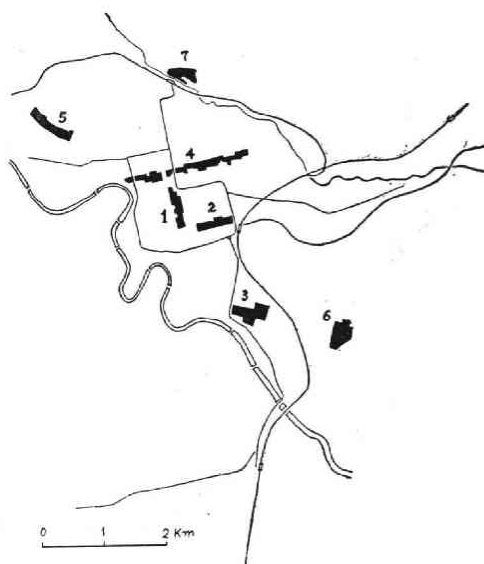


Fig. 6. Index map of 7 divisions.

The trades in residential area shows an inverse relation. When its number increases, it certainly is the period of the development of residential area itself. An example is No. 4 (Kita-ichiban-cho) next to the central business district, which has been a good residential area from old days, and here the division of the trades are few but constant. No. 5 (Hanko-machi) which lies at the northwest marginal part of residential area, the number of trades had grown in 1920–1930 and also after 1942. In No. 6 (Hoshunin-mae-cho) which is the outer margin of the southeastern residential area, the changes took place in 1921–1931 and after 1949. In No. 7 (Sugizoe) which lies at the northern part out of the residential area, there are some in 1930–1939 and much after 1949. As is shown in these four example, the time in which there was a flux of the trades of house-lots is different regionally (functionally and locationally).

The trade of house-lot means two different things — the one is the development of residential area and the other is merely the change of residents, as is shown in Fig. 5. The latter has not so much to do with the development of residential area. For the purpose of this study the author thinks the more of the geographical meanings of the partitions of house-lots.

The author prepared several maps showing the places where there were many partitions. Fig. 7a is the collected map for the years 1924, 1927, and 1930, and Fig. 7b is for the years — 1949, 1951, and 1953.

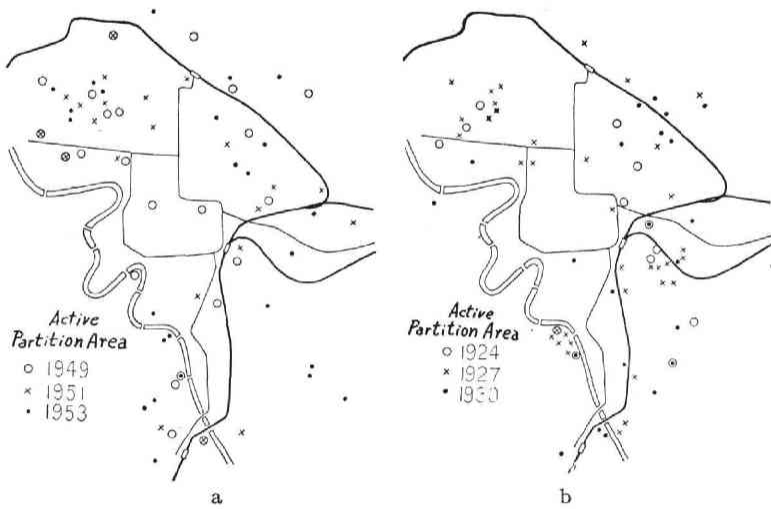


Fig. 7. Distribution on active partition-area.

In 1927 and 1949 when the partitions were many, it is very natural that most of the partitions took place in the marginal zone of urban area. Sometimes, however, such places are also found at the respectable inner part of residential area. When the many-partition-area is moved outward of residential zone, the movement shows the expansion of residential area. But the partitions in the inner part of the zone shows that there was a change towards a more densely populated residential area.

Moreover, the areas with many partitions are different in different years 1924, 1927 and 1930, and it showed little change in 1949, 1951 and 1953.

There are some areas having many partitions along the circular tram-way as is shown in Fig. 3. These areas are the good residential area immediately changed from the area where retainers lived in the feudal age.⁽⁷⁾

Here, there are no period of increased partitions, although few partitions took place constantly, and the total number is fairly big, because the area had already been a residential zone with numerous house-lots. Such state is shown in the case of the trades as an example of the No. 4 division.

It may be seen that the places with many partitions are distributed in the shape of tooth-wheels and the line turns round according to the yearly observation of the places during the former period of the second stage of partitions (1922-

(7) Ken-ichi Tanabe: Development of areal structure of Japanese Cities in the case of the castle towns— as a geographic contribution to the study of urban structure. Sci. Rep. Tohoku Univ., 7th Ser. (Geogr.), No. 8 (1959), pp. 88-105.

1930), and the fourth stage (1949–1953). The turn is to the right in the northern half of the residential area and it is inverse in the southern half.

The tooth-wheel-shaped line marks the outline of urban region, and the projecting points of the line are the expanding parts of urban region. These projecting points do not always grow to the direction of the jut but are formed within a short time. These juts do not always lie along roads but sometimes on the slopes adequate to live. These are the places of low land-value with insufficient traffics and cultural equipment. However, once the partitions of house-lots has started and consequently the trades of lots is done, the land value of the place rises suddenly. Therefore the partitions and the trades at the place and in its neighbourhood are suspended for several years. Thus the many-partition-place transmits from one to another. The direction of these transmission and the many-partition-places are shown in Fig. 8.

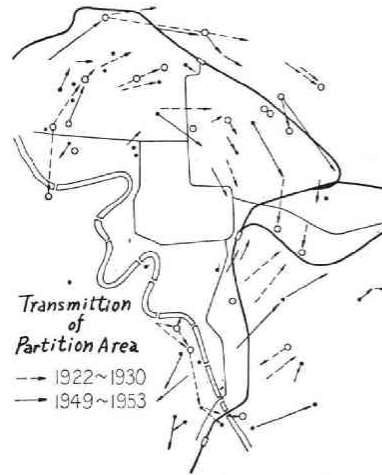


Fig. 8. Transmission of active partition-area.

The nodulous concentric structure which is noticed on Fig. 1 is not comparable to the annual rings of urban expansion but is the route of such transmission.

III *Conclusion* — “*Turbo-cornutus*” Expansion

The author has an idea in which the stagnation of the partitions in the inner zone, and then the periodical transmission of the active site of the partitions at the marginal zone, and then the projecting place at the margin as well as its growing process are comparable to the general outline of the growing process of a top-shell. Therefore the author wants to define this type of the expansion of residential area as “*Turbo-cornutus*” expansion.

Such expansion process has been observed in Sendai, but it may be a general type of urban expansion. The reason is that the expansion of a part of the margin of urban region raises land-value, and the high land-value retards the expansion and these phenomena stimulate the expansion of other places.

In addition the jump of land-value at one part brings about a new expansion to another place, and thus the radial expansion must be a normal type. Indeed, when one observes an urban area in detail, the radial expansion of house-lots

along roads is seen. It is also observed that its elongation sometimes makes a break of several years each. The small difference of the time growing the just along roads can easily be seen by the long-time observation of several roads.

There are radial projections of built-up area along main roads and rail-way. In this case too, there are some short pause.

These two kinds of radial projections are the result of the difference of traffic function, and when the time distance is taken into account, these radial juts along road will entirely disappear.

The growth of these radial juts and the juts of another kind mentioned before take places simultaneously within a small area of suburbs, and there will be some difference of time if one compares rather different parts of the suburbs. The growth of residential area at the margin of urban area as a whole is a vortex-motion.

In conclusion, the development structure is schematized in Fig. 9, showing its resemblance to a shell of "turbo-cornutus".

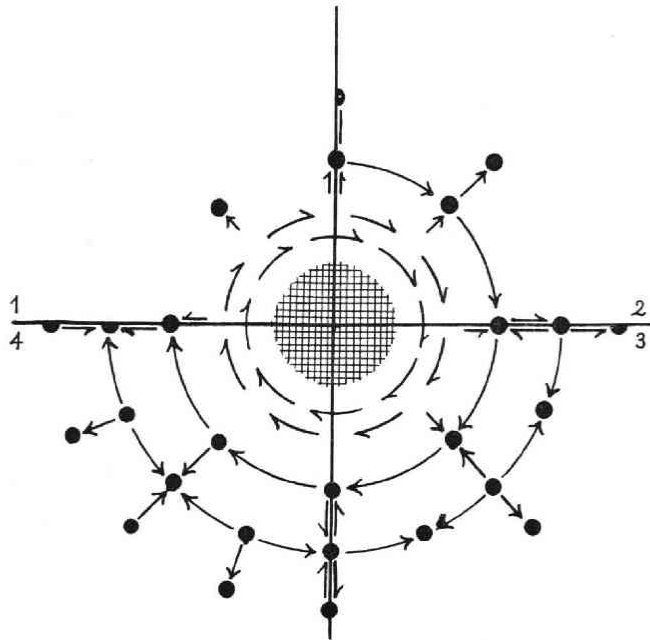


Fig. 9. Schematic structure of Turbo-cornutus expansion.
— a type of urbanization —