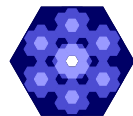




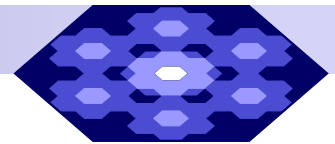
Inner structure of functional regions: relationships between proto-centres

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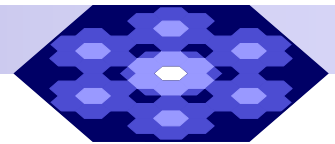


Concept of a Functional Region

- *Based on the heterogeneity of geographic space (horizontal flows of people, goods, energy, information...)*

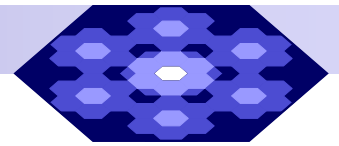
- *A functional region should aim to maximize:*
 - 1) *internal cohesiveness*
 - 2) *external separation*

- *Correctly delineated functional regions can serve as a powerful planning tool:*
 - *assessment of regional disparities*
 - *labour market policies*
 - *distribution of subsidies*
 - *public transport planning, etc...*



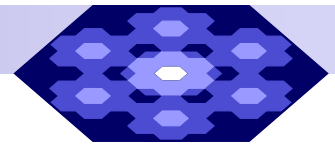
Inner Structure of a Functional Region: basic theory

- *J. Von Thünen, W. Christaller, A. Lösch, W. Isard:
- conceptualised simple inner structure of a functional region
(centre-hinterland-periphery)*
- *P. Haggett:
- identifies a crucial role of direction, orientation, pattern of
interaction flows as well as an existence of several centres at
different hierarchical levels*
- *Based on these inner characteristics, various types of functional
regions can be identified:*
 - *functional urban regions*
 - *daily urban systems*
 - *travel-to-work areas*
 - *local labour market areas*



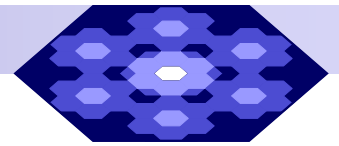
Centres of a Functional Region

- *The centre is the key trait in the inner structure of a functional region*
- *Existence of at least 1 centre (instances of a region with no core are possible but very scarce)*
- *Existence of several cores implies four types of relationships based on incident interaction:*
 - *1) indifference*
 - *2) cooperation*
 - *3) complementarity*
 - *4) competition*



Centres of a Functional Region: method

- *Data basis: daily travel-to-work flows (2001 census)*
- *Output: 160 functional regions delineated using the CURDS measure*
- *Same source provided also so called „**proto-centres**“ as a result of the first step of the multi-stage regionalisation algorithm*



Definition of Proto-centres

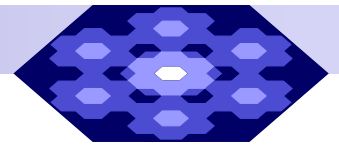
- *In order to qualify as a proto-centre, a BSU has to fulfil two limiting conditions:*

1) the labour function of a proto-centre

$$\frac{\sum_j T_{ji}}{\sum_j T_{ij}} > 0.8$$

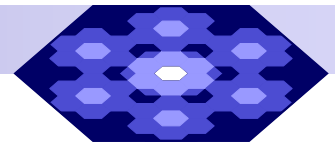
2) residence-based self-containment of a municipality

$$\frac{T_{ii}}{\sum_j T_{ij}} > 0.5$$



Definition of Proto-centres

- *Both conditions are very modest – the municipalities that fulfil them cannot be denoted as centres but rather proto-centres*
- *667 proto-centres have met both restricting conditions*
- *The analysis comprises all municipalities fulfilling these conditions for two reasons:*
 - 1) *this set has been tested in the first step of the regionalisation algorithm*
 - 2) *larger number of proto-centres enables us to capture better the inner structure of a region according to distribution and intensity of commuting flows*



Hierarchy of Proto-centres

- *Hierarchy of proto-centres has been determined by the number of jobs which is the sum of all in-commuting flows into municipality i plus employed residents in i .*

$$\sum_k T_{ki}$$

- *Four hierarchical levels have been identified*

Tab. 1: Hierarchy of centres and proto-centres of functional regions in the Czech Republic according to the number of jobs

Hierarchical level	No. of jobs	No. of (proto-)centres
1	100,000 and more	3
2	30,000 – 99,999	12
3	10,000 – 29,999	52
4	Less than 10,000	600

Source: own processing

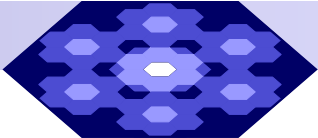
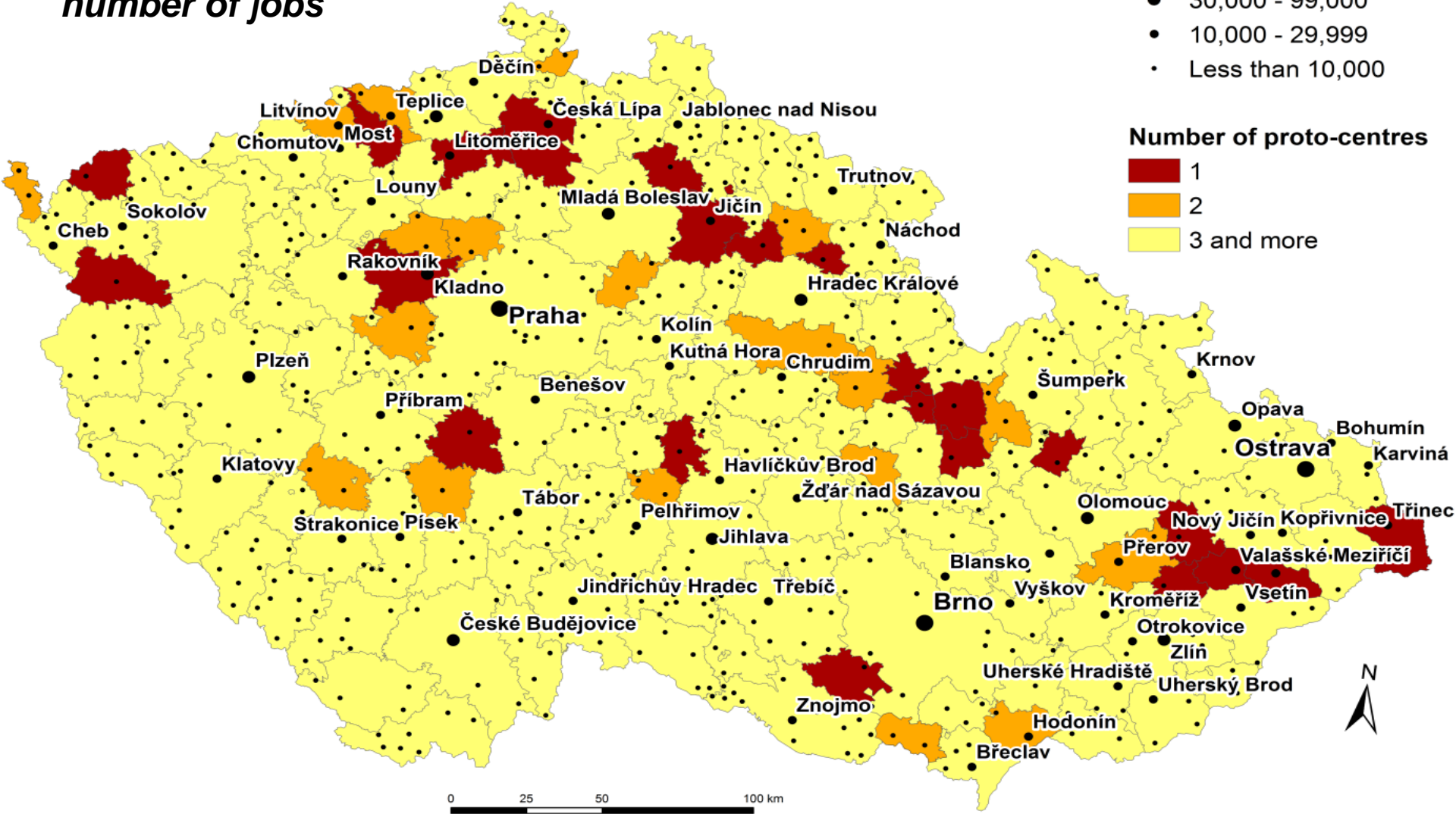
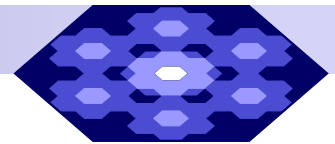


Fig. 1: Hierarchy of proto-centres according to the number of jobs

- Number of jobs**
- 100,000 and more
 - 30,000 - 99,000
 - 10,000 - 29,999
 - Less than 10,000
- Number of proto-centres**
- 1
 - 2
 - 3 and more





Relationships between Proto-centres

- *To assess relationships between proto-centres of functional regions several steps have been taken:*
- *1) the CURDS measure has been calculated for all pairs within each functional region*
- *2) maximum and minimum values for the CURDS measure have identified the strongest and the weakest flow*
- *3) a filter has been used to rule out flows not meeting the relevance criterion*
 - *statistical evaluation of the set of the CURDS measure*
 - *the critical threshold has been set to 0.1*
 - *the number of flows was reduced from 1,942 to 1,132 flows*
- *In order to compare individual intensities, the flows have been relativized according to the strongest flows recorded in the Czech Republic (which was considered as 100 %)*

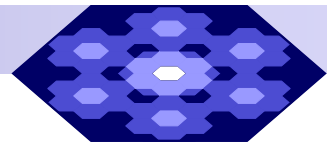
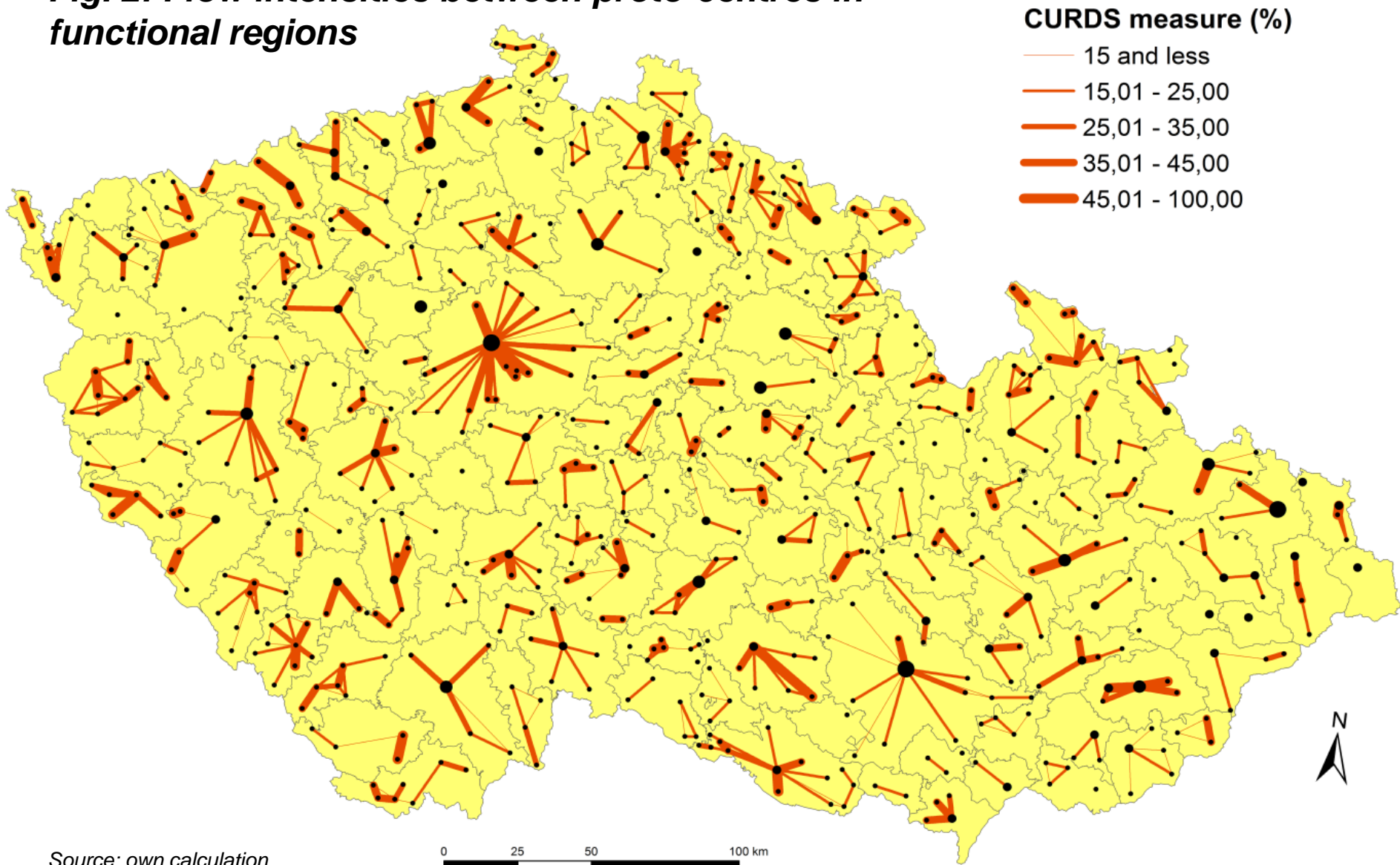
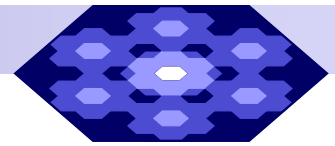


Fig. 2: Flow intensities between proto-centres in functional regions



Source: own calculation

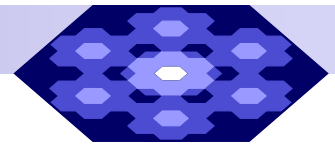


Relationships between Proto-centres: evaluation

- Final identification of the relationship type between proto-centres has been based on:
 - 1) the values of the CURDS measure between a pair of proto-centres
 - 2) their hierarchical level
- The CURDS measure has been decomposed into two parts, one for direction ij , and one for the opposite direction ji :

$$\left[\frac{T_{ij}}{\sum_k T_{ik}} + \frac{T_{ij}}{\sum_k T_{kj}} + \frac{T_{ji}}{\sum_k T_{jk}} + \frac{T_{ji}}{\sum_k T_{ki}} \right]; \text{ let } X = \frac{T_{ij}}{\sum_k T_{ik}} + \frac{T_{ij}}{\sum_k T_{kj}}, Y = \frac{T_{ji}}{\sum_k T_{jk}} + \frac{T_{ji}}{\sum_k T_{ki}}.$$

- Variables X and Y provide relativized data for both directions of interactions between two proto-centres and are used to sort the relationships into types

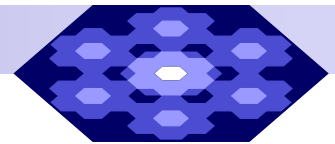


Relationships between Proto-centres: evaluation

- *If both values of variables X, Y are lower than 0.1 it means that the relationship between two proto-centres is **indifferent***
- *The **cooperation** is determined on symmetric relationship between proto-centres*
- *In order to identify this relationship values X and Y have to be numerically close:
- as an absolute comparison is not possible, the numerical distance between proto-centres has been expressed by an average proportional deviation from mean values of X and Y:*

$$P = \frac{\left| X - \frac{(X + Y)}{2} \right|}{\frac{(X + Y)}{2}}$$

where *P* is the average deviation of *X* value from mean values for *X* and *Y*



Relationships between Proto-centres: evaluation

- *The cooperative relationship is determined by the level of 0.25*
- *In the next step the hierarchical relationship between two proto-centres has been assessed and cooperative relationships between proto-centres of the same and different levels identified*
- *The same has been done for **complementary** relationships*

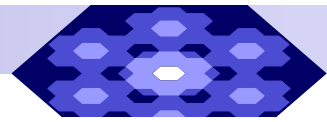
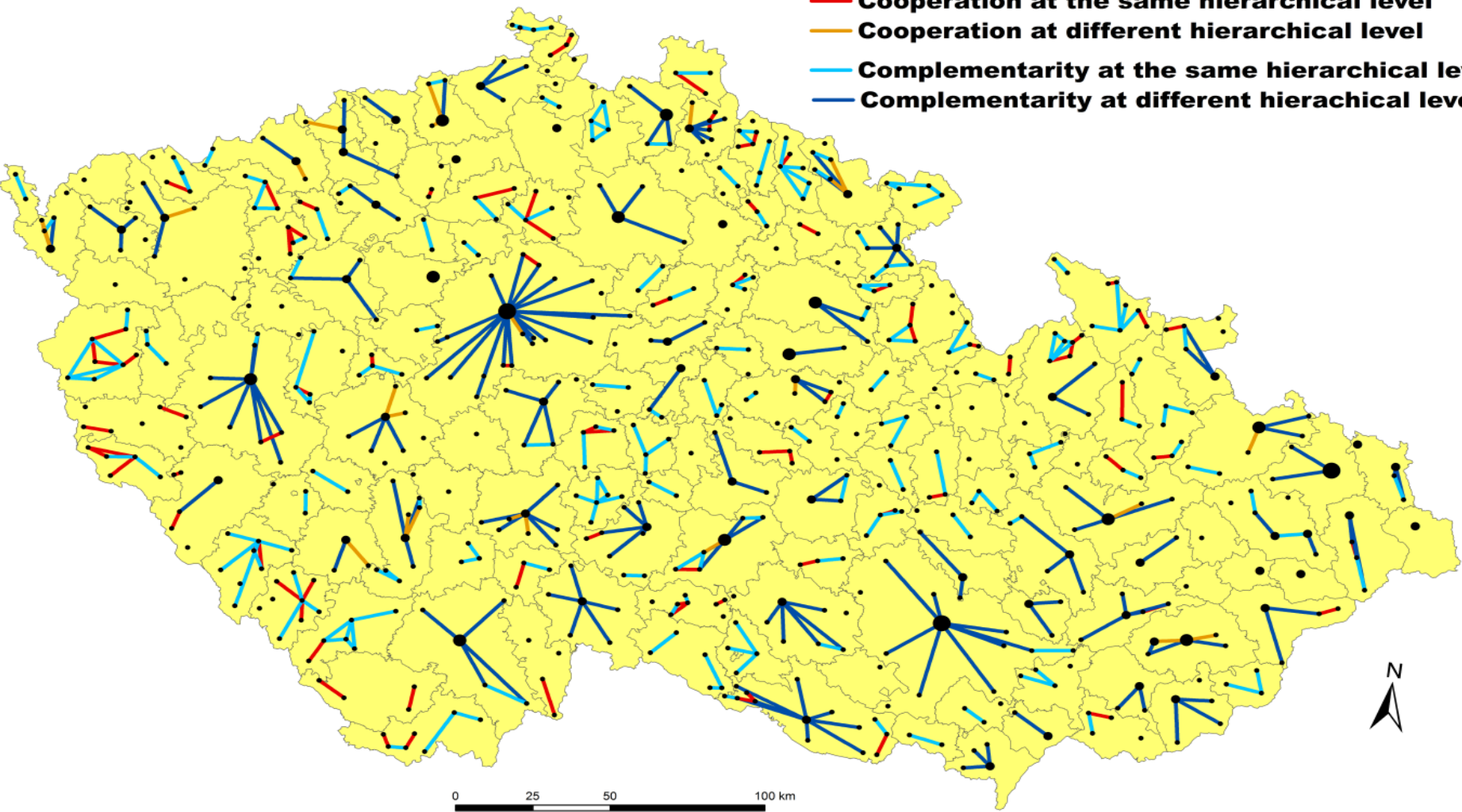


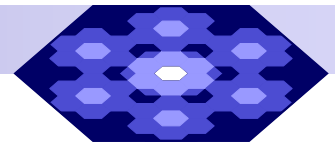
Fig. 3: Typology of relationships between proto-centres in functional regions

Relationships

- **Cooperation at the same hierarchical level**
- **Cooperation at different hierarchical level**
- **Complementarity at the same hierarchical level**
- **Complementarity at different hierarchical level**

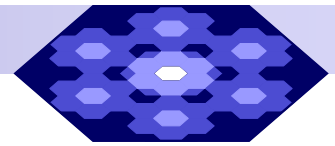


Source: own calculation



Relationships between Proto-centres: results

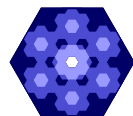
- *The strongest relativized interaction between proto-centres was recorded for the pair Ústí nad Labem and Trmice*
- *The weakest interaction was recorded for the pair Dobříš and Říčany*
- *Limiting values, as have been discussed above, have produced out of 1,942 pairs:*
 - *1,018 cases of indifference*
 - *220 cases of cooperation*
 - *704 cases of complementarity*
- *Out of 220 cooperative relationships 172 (78 %) occurred at the same hierarchical level and 48 (22 %) at different hierarchical levels.*
- *The cooperation is more frequent if the hierarchical level of proto-centres is equal*



Relationships between Proto-centres: results

- *Out of 704 complementary relationship 356 (51 %) occurred at the same hierarchical level and 348 (49 %) at different hierarchical levels*
- *The former case regarded particularly the relationships between proto-centres at lower hierarchical levels*

Thanks for your attention



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