Activity Based Indicators of Connections and Access Needs (ABICA)

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Background

This instrument is not an instrument with the purposefulness and instrumentality that this implicitly assumes, but may be applied purposefully in planning as well as in scientific context. Data visualizations have a long history but visualizations and illustrations of interaction patterns and access needs have generally been limited by access to spatial behaviour data and computation capacities.

Visualizations based on interaction data was included as a prominent part of the first metropolitan planning studies in the US (e.g. Chicago Area Transportation Study, CATS; Detroit Metropolitan Area Transportation Study, DMATS; see Tobler, 1987) as well as in studies surrounding the 'Lund school of geography' (e.g. Lenntorp, 1978; Westelius, 1973) such have, however, until the increase in geo-statistical computation capacities and geo-referenced data in the last decade, been a rare event. The improved access to e.g. detailed, spatially referenced datasets, as well as the spread of spatially explicit survey 'tools' such as GPS provides new possibilities for the representation and visualization of spatial interaction patterns. Such may be seen as a supplement to more normative accessibility indicators and may have a huge potential when it comes to communicating findings and engage stakeholders in discussions on criteria for access conditions.

Representative treatments – i.e. visualisations with the purpose of representing and communicating spatial interactions and thus connections and access needs – have been applied in a number of Danish research projects, including 'Byen, Vejen og Landskabet' (Town, Road and Landscape) and 'Danish Centre for Strategic Urban Research'. This section is based on these experiences.

Conceptual framework and theoretical underpinnings

Activity-based indicators and visualizations of connections and access needs do not define accessibility, but assumes that the spatial connections/interactions can be represented and that lessons of access needs and accessibility may be inferred from such representations.

The lack of definition of accessibility is an important contribution from this indicator. Thus, accessibility indicators will often rest on a normative basis or assumed causalities which may not be relevant under all conditions or applicable to all. Representing 'actual' behaviours can supplement and provide a basis for interpretation accessibility and access needs. The openness to interpretation – the fact that the revealed behaviours represented has developed out of multiple underlying causalities – may be seen as a weakness, but also as a strength as the representation can be accepted by stakeholders in the field.

In the Danish examples visualizations of connections and access needs have especially been employed to measure spatial integration at the regional and national scale. Examples include research into developments along the motorway network as an input to a debate on relations between infrastructure design and land use developments; and elaboration of travel patterns in an emerging polycentric metropolitan area as an input to a consensus based strategic planning process for the whole urban entity. The increase and upscaling of spatial dependencies have been documented and illustrated – a process which is extremely relevant for the consideration of accessibility locally as well as regionally.

Even though data access is improving, data is still one of the main concerns for the development of such indicators. As in many other countries there is a long tradition for collecting commuting data in Denmark, and these have been employed to represent interactions and access needs nationally. However, the prominence of commuting in defining the spatial economy has been decreasing for long and studies relating to consumption patterns more generally are highly desirable. Transportation data may in some instances be used to represent interactions and access needs, and tourism datasets may be used at a larger scale, but the main 'future promise' for such studies would be to employ cell phone datasets or loggings based on build-in GPS devices to represent interactions and access needs for large populations.

Operational aspects

Danish visualizations of connections and access needs have based on either the Danish commuter survey (Statistics Denmark, Registerbaseret arbejdsstyrkestatistik, RAS) or the Danish National Travel Survey. The register based account of commuting generally allows the identification of the location of home and work based on other register datasets, while the National Travel Survey have been collecting detailed data on trip origin and destinations since 1997. In both instances origin-destination links may be mapped as 'desirelines' – an approach developed for transportation planning in the US under the heading of 'coordinate method' in the 1940s. The desireline connections as a basic building block allow for the summary of flows or 'desireline traces' as a property of a location; or to map the activity field or catchment of a given place/location.

Visualisations based on desirelines or desireline traces can indicate loads, demand for capacity, as well as spatial patterns of dependency and centrality. Visualisation of activity fields or catchments also indicates patterns of dependency, but takes the starting point of a place or location. Both are of interest in municipal and regional planning and provide basic reality based outlooks to the location of a customer basis, where a population live their lives etc.

Origin-destination datasets from commuter or travel surveys are the minimum requirement for the indicator and are generally not freely available. Exceptions are the US and UK where efforts have been made to make census data available, but in many countries it is necessary to pay to get access to data (e.g. Denmark, Germany, Sweden) and/or there may be restrictions to access (e.g. Netherlands, France), and of course some countries and regions does not have such data at all.

The processing requirements depend on the format of the data available and whether interaction datasets match available spatial datasets (e.g. maps of boroughs, census tracts, wards or similar). In practise survey data and spatial data are not 'in tune' due to timing, updates etc. which then require 'repair' of base datasets before analysis.

Most current PCs are able to handle origin-destination datasets from commuter or travel surveys, but software to process large databases, geo-statistics, and maps are required. Commercial software's, such as ArcGIS, are generally preferred by the practitioners of the field, but open source software (such as R) are becoming increasingly available for spatial analysis and may be able to perform the tasks as well.

Realistically the handling of data and analysis does require some technical expertise, but not to a level where it cannot be included in a general GIS courses. Handling of detailed micro level time-space datasets from e.g. cell phones or GPS will of course increase requirements and require handling outside 'standard software packages'.

Interpretation of results can take place at many levels. The main issue here is that the representation should reflect the intended application, and the representation comes with a declaration of its content.

Relevance for planning practice

The examples relied on in this chapter has been produced in strategic research projects focussing on the spatial development and upscaling processes, as well as in preparations for a common plan for a metropolitan corridor development.

It is our judgement that it is very beneficial when it comes to describing the 'planning context' and especially the dependency or connectedness of the planning unit (municipality) towards other areas.

Strengths and limitations

The main strength of this instrument is that it may be said to represent what people do. On this basis it may gain acceptance and wide application and allow for multiple interpretations.

Experiences with communication to planning practitioners show that the visually appealing image is readily applied in all sorts of communications and presumably creates an interest or awareness around the subject of spatial development conditions. This includes voices that see the map either as representation of 'doom', or that dislike the visual representation because of an implicit image of inescapability or givens. So also the representation is discussed.

An important limitation is the lack of causality or explanations. There are many underlying reasons for the spatial pattern of interactions. Ideally visualisations of connections and access needs should be accompanied with a discussion of why and how this is so – scientifically (general) as well as locally in a given planning context (contextually).

An additional limitation is of course also the visualisations are seductive and great care must be taken towards adequacy and explanation.

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Figures

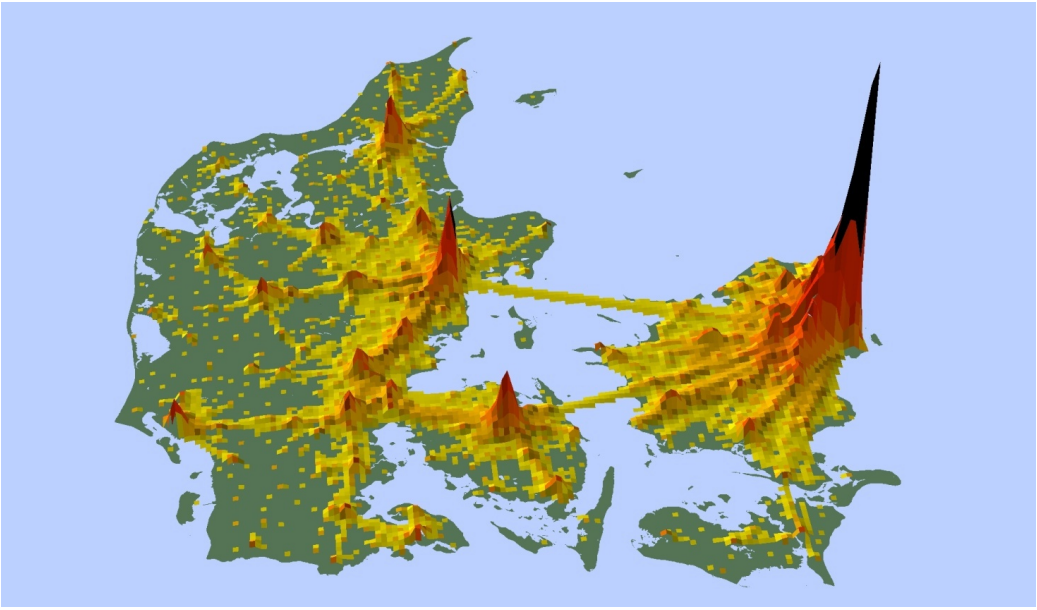

Figure 1 Commuter flow or ‘desireline traces’ drawn from commuting in Denmark. The map is based on origin-destination data for commuting and summarizes the number of commutes passing through any given area. Source: Byen, Vejen og Landskabet (Hovgesen and Nielsen 2005; Miljøministeriet, 2006)

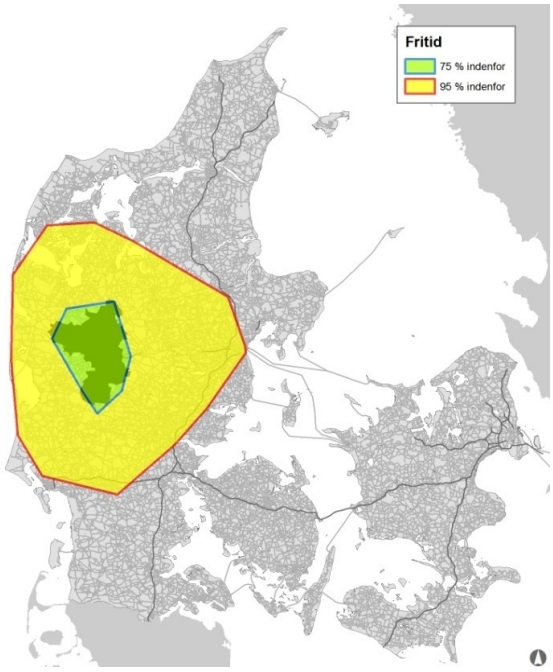

Figure 2 Activity fields for leisure activities. The activity fields are drawn to indicate the areas that contain the 75% and 95% of the activity destinations that are closest to home, out of the total number of activity destinations of the municipal population. Source: Danish Centre for Strategic Urban Research (Nielsen, 2011)