1 Literature Review

framing the dissertation

theoretical/methodological/empirical

things to review:

- urban morphology literature:
  - what is urban morphology? brief history
  - morphometrics / quant approaches
- different clustering algorithms (see `https://towardsdatascience.com/the-5-clustering-`
- (quantitative) ways of subdividing cities / housing submarkets

1.1 Urban morphology

Urban morphology is the study of the physical form of cities, towns and villages. While the various definitions of urban morphology—Oliveira (2016) cites nine—differ in their details, each considers the elements of which cities are composed, particularly their "urban tissues, streets (and squares), urban plots, [and] buildings" (Oliveira 2016: 2). By providing a descriptive language to talk about the

structure of built environments, urban morphology presents a set of tools to help 'read' urban forms, and thereby understand the effects of differing urban forms on a wide array of social, economic and environmental processes (Kropf 2017:10).

Urban morphology has been associated with (and hence used to understand) many different factors which vary spatially in built environments. A typical application of urban morphology is as a tool to understand the historical development of a town or city, such as Baker's (2009) study of the historical townscape of Hereford. Other applications look at the relationship between urban form and social issues, such as poverty (Vaughan et al 2005) or public health (Sarkar 2013); environmental concerns like heat-energy demand and efficiency (Rode et al 2014); and concerns with both social and environmental components, such as the effect of urban morphology on birdsong loudness and the visibility of green areas (Hao et al 2015).

The foundational works of urban morphology examined the distinct subdivisions of built environments, referred to semi-interchangeably as plots, lots, and urban tissues. While varying somewhat in their definition and usage, these are all generally small areas with homogeneous urban forms which "[combine] to form the larger-scale structure of whole settlements" (Kropf 2017, p. 15).

Urban Morphometrics

Traditional urban morphological research has primarily made use of qualitative methods, using records such as historical and current maps and photographs of the area in question to determine the nature of a settlement's morphology at a given point in time. These methods lend themselves to detailed examinations of the particular historico-geographical context of a given case study settlement, but are labour- and time-intensive

an increasing availability of appropriate data has been accompanied by a proliferation of methods in use, many drawn from data science (and the methodological traditions that precede the term; see Donoho 2017)

in the wake of this array of methodological approaches (?) to quantitative urban morphology and differing terminologies, Fleischmann, Romice, et al. (2020)

sought to establish [proposed?] "a systematic and comprehensive framework to classify urban form characters" (ibid: page number)

1.1.1 Defining the spatial unit

Fundamental to any spatial segmentation (be that according to demography, morphology, or any other character) is the smallest spatial unit used. Dibble et al (2015) define this as the Operational Taxonomic Unit (OTU), borrowing the term used in the biological field of morphometrics to describe the smallest unit used when comparing characteristics in the process of taxonomic classification. In biology, the OTU is almost always the individual organism, but in urban morphology the choice of OTU is less straightforward.

Conzen (1960) used the 'plan-unit' in his seminal study of the urban morphology of Alnwick, Northumberland, identifying 13 major and 49 sub-types.

Fleischmann, Feliciotti, et al. (2020) propose 'morphological tessellation' as a method for deriving a spatial unit for use in urban morphometrics (called the 'morphological cell') from only the building footprints, via Voronoi tessellation

Other studies have sought to somewhat circumvent the problem of determining what constitutes an urban tissue by instead using an arbitrary unit, such as a regular grid.

1.2 Approaches to urban spatial segmentation

Calafiore et al 2021: via Foursquare check-ins + spatially weighted community detection algorithm (borrowed from network science)

1.2.1

1.3 Spatial housing submarkets

While the term is defined and used in various ways such that "no single definition of a housing submarket exists" (Rae 2015), a housing submarket can generally be

considered to be a set of dwellings sharing similar characteristics (Bourassa et al. 1999), often defined with an spatial contiguity constraint such that there are no multi-part spatial housing submarkets; a line can be drawn on the submarket map linking any dwelling to any other within the same submarket without crossing into a different submarket.

Past research has operationalised the concept in a range of ways. Early works used existing divisions: for example Palm (1978) partitioned the San Francisco-Oakland into housing submarkets based on the districts covered by each of the seve nteen Boards of Realtors in the region. Another approach is to make use of convenient existing administrative spatial units, as done by Adair et al. (1996), who determined spatial housing submarkets by amalgamating the existing ward divisions of Belfast into larger groupings with common characteristics.

The turn of the millennium saw the development of a range of quantitative techniques for determining the spatial bounds of housing submarkets, a 'microstructural turn' in housing analysis (Smith and Munro 2013, p. 2) resulting from the increased availability of "large micro-datasets that contain geo-coded details of dwellings, their characteristics and values" (Keskin and Watkins 2017, p. 1447) and a concomitant advancement in the methods available to analyse these data. (maybe add something about this mirroring developments in UMM)

Bourassa et al. (1999) produced one of the first examples of such spatial segmentation, defining spatial housing submarkets in Sydney and Melbourne using both *k*-means and Ward's method for agglomerative clustering.

1.4 Research gaps

maybe: difference when using different spatial units (ie tessellation cells vs H3)

In urban morphology, urban morphometrics is an active area of research

housing spatial submarkets

More generally, there is a need for spatial units which reflect the heterogeneity of (whatever variable) across a city.

Geographical data are often aggregated by administrative units, which themselves are ignored when the data is presented.

The units by which data are aggregated has a significant effect on the values ultimately presented (MAUP)

if the units have no relation to the distribution of a given variable, the variable may be misrepresented when aggregated according to these units.

`https://youtu.be/_T_0FYHn0I0?t=572`

"spatial aggregations to administrative boundaries that ignore the social nature of neighbourhoods" Calafiore et al 2021

from diss proposal:

Housing submarkets are sections of the real estate market which share similar characteristics. When defined spatially, existing spatial units (such as neighbourhoods) are usually employed to represent these submarkets, either individually or through a grouping of neighbourhoods. When this approach is used to analyse the housing market, for example when producing price indices based on these spatial units, the end result can misrepresent the nature of the underlying property market(s) being studied. For example, if an administrative neighbourhood contains properties of significantly varying prices, the mean price index for the area will be unrepresentative of the properties in the area it seeks to represent.

Because urban morphology is held to be related to many diverse spatially varying factors/processes [examples/citations], morphologically-derived spatial units may offer improvements over administrative units for a variety of different variables

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