

Regional population structures at a glance

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Population ageing is the major demographic challenge for humanity. Since population structures evolve rather slowly and predictably, the demographic, economic, environmental and social problems of ageing have been anticipated and discussed for many decades¹. Yet in the prime focus of these discussions has always been elderly population, with elderly people often defined as those older than a threshold—eg, 65 years or age at retirement—or with a certain number of estimated remaining years of life². Such a focus is quite reasonable and understandable, but not entirely correct. Ageing is not exclusively about the size of elderly population or its proportion in a population; ageing is a function of the whole age distribution of a population. Therefore, to understand ageing better, we need to focus on the evolution of the whole population age structure, not just the elderly part of it.

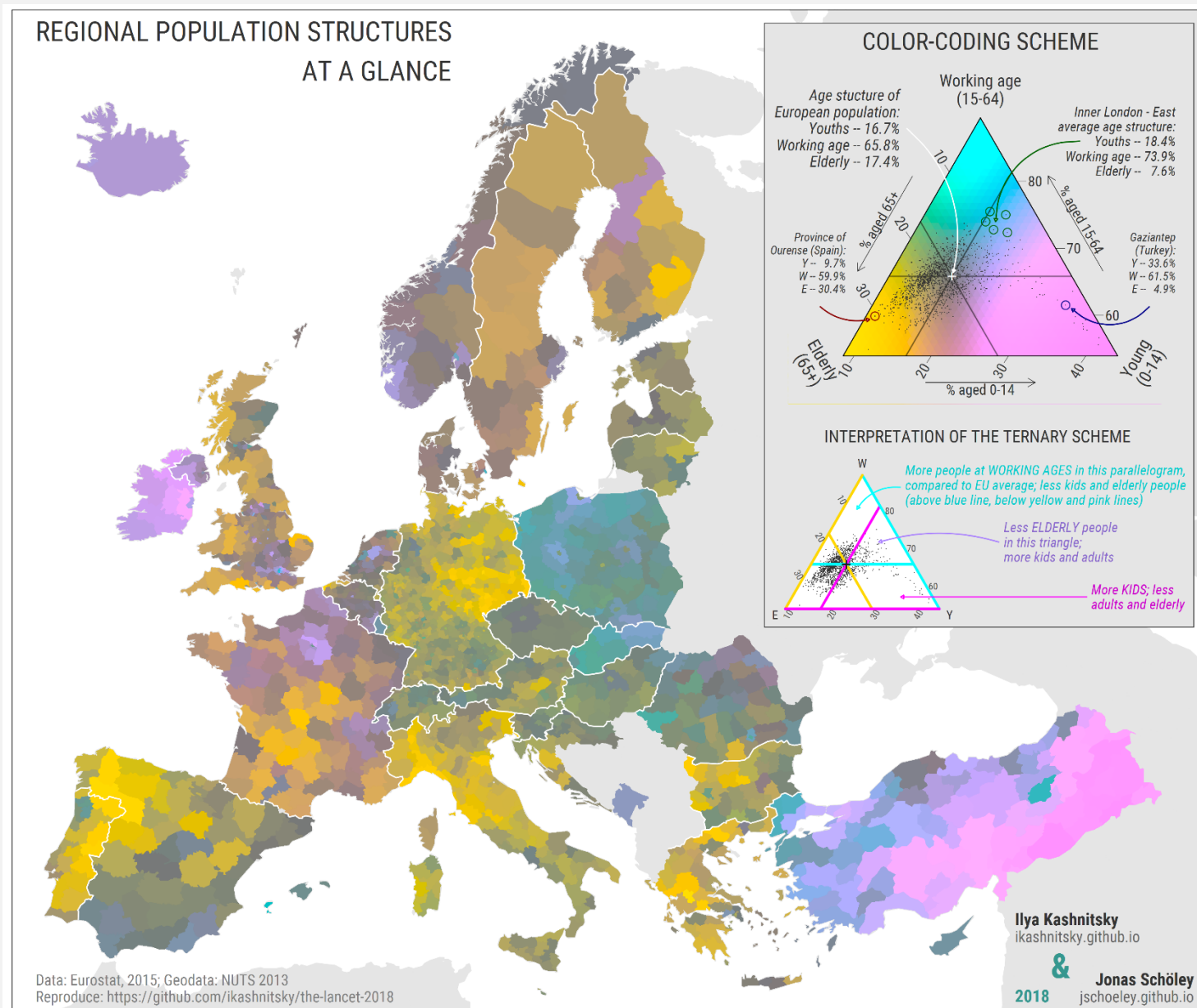


Figure: Colour-coded map of population structures in European NUTS-3 regions in 2015. Each NUTS-3 region's population composition is uniquely colour coded. Colours show direction and magnitude of deviations from the center point, which represents the average age-composition of European population and has a dark grey colouring. Hue component of a colour encodes the direction of deviation: towards yellow – more elderly population (65+); cyan – more people at working ages (15-64); magenta – more kids (0-14). Chroma and lightness components signify the distance from the center ranging from desaturated and dark colours near the center to vivid and bright colours at the corners. The smaller schematic ternary plot at the bottom of the legend explains how to interpret the six different regions in the ternary colour key. We provide R code to fully reproduce this map¹¹.

We offer a novel approach to visually investigate the diverse picture of population ageing in the present-day Europe. To map the whole population age structures rather than any single summary measure of ageing, we used *ternary colour coding*—a technique that maximizes the amount of information conveyed by colours. With this approach, each element of in a three-dimensional array of compositional data is represented with a unique colour. The use of colour mixtures to encode multiple data dimensions in a single attribute has been proposed by various authors. To our knowledge, ternary colour coding was first used in the context of map design by Olson³. Later the approach has been used to map election results in a three-party system⁴, labor force composition by sector⁵, soil textures⁶, composition of arctic sea-ice coverage⁷, and cause-of-death compositions⁸. We used colour coding to explore the differences in populations structures across Europe and provide the tools that we developed⁹ to streamline its use with R¹⁰.

The diverse picture of colour-coded age structure of European regions (figure) indicates varying stages of population ageing across Europe. The process of population ageing is not happening uniformly in all parts of Europe¹² and regions differ quite a lot: eastern Europe is still undergoing demographic dividend, southern European regions are forming a cluster of lowest-low fertility, the baby boomers are ageing in western Europe, urban regions are attracting young professionals and forcing out young parents, and peripheral rural regions are losing their youths forever. Colour coding allows to map all regional population structures in Europe simultaneously. This map is not meant to easily inform the reader of the exact population structure in a specific region, rather, it provides a highly detailed snapshot of all the regional population structures, facilitating comparisons between them. One limitation of the approach is that the maps are not easily interpreted and usable by those who are colour blind; however, our generalised function that mixes colours⁹ makes it easy to change colours by rotating the colourspace, thus

enabling those who are colour blind to use this setting more readily.

In the figure, we can clearly see large-scale and small-scale regional differences in population structures. At the macro level, the distinctions between Eastern, Western, and Southern Europe are evident. Eastern Turkey is the only example of a society that is still at the early stages of demographic transition. At the country level, the center-periphery contrasts are prominent. We can easily spot all capital regions and major urban areas that have a large working-age population, and their surrounding areas where families with kids tend to settle (ie, the suburbs of Paris). The population of the remote periphery ages at an accelerated pace because of out-migration of young individuals. Country borders are highly important because they often demarcate territories with different demographic histories (ie, Germany–Poland border). The map also reveals the signs of recent dramatic changes in population structures. For example, Spain received a tremendous inflow of international migrants in 2000s¹³, eastern Germany experienced a draining effect of out-migration coupled with a drop in fertility levels in the last decades¹⁴, and Poland has had a massive labour out-migration because of European Union integration and more labour migrants moved from major Polish cities¹⁵. This map is a snapshot of European population at the regional level, and it tells numerous demographic stories.

Ternary colour coding is a useful and intuitive way of displaying three-component compositions at once. We strongly propose a wider use of the presented approach.

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LINKS

Free PDF: <https://osf.io/zac5x/>

Map PNG: <https://osf.io/cqbnv/>

Map PDF: <https://osf.io/e24nx/>

PhD project (Ilya Kashnitsky): <https://osf.io/d4hjj/>

Tricoloure R package: <https://github.com/jschoeley/tricoloure>

Replicate the map: <https://github.com/ikashnitsky/the-lancet-2018>