

Philosophical and formal analysis of qualitative spatial logics — SUMMARY FOR GENERAL PUBLIC

What is geometry? For millenia people thought that what we now call Euclidean geometry was the only one possible. This led Immanuel Kant, one of the most famous philosophers of all time, to state that Euclidean geometry is so fundamental that it is in some sense hard-wired in our minds. Kant tackled one of the most fundamental philosophical questions, namely the problem of the origin of human knowledge. He claimed that at least certain knowledge of the real world is independent of human experience and this he refers to as *a priori*. For him, (Euclidean) geometry is an example of a priori knowledge, which nevertheless extends our knowledge about the world (i.e. is synthetic, to use his terminology). Kant claims that the properties of the external world as we perceive it are not independent from us; in fact we perceive reality through the categories imposed by our intellect. Geometry for Kant is a science of space and for him space and time are forms of the intellect and do not belong to the external world. This is the famous "Copernican revolution in philosophy". However, nineteenth century shattered all that. With the emergence of non-Euclidean geometry, people started to raise doubts about the *necessary* character of Euclidean geometry, which underlied Kant's schema. Bertrand Russell, arguably one of the most famous public intellectuals of the previous century, a forefather of modern formal logic, initially attempted to save some parts of Kant's schema. In order to do that, he used the results of nineteenth-century mathematicians and divided geometry into qualitative and non-qualitative (where the notion of distance is used). He claimed the former to be Kant's a priori knowledge. Soon afterwards, however, he abandoned the idea of defending Kant, yet his conviction that the qualitative geometry is somehow distinguished, and primary, remained. The end of the twentieth century showed a development of qualitative spatial reasoning (QSR) paradigm within the logical analysis of geometry. This approach abandons points as primitive notions in geometry and instead uses the notion of a region (after all, it is argued, regions are in some sense ontologically primary for us: in everyday spatial reasoning tasks we refer to regions, e.g. this cup of tea resting on this table, rather than points, which are nothing more than a mathematical convention). By the same token, QSR emphasises the importance of qualitative notions in geometry (i.e. one region being a part of the other). It is suprising but these two worlds never met: Russell was not actively involved in the work on the foundations of geometry after the second world war, which was a time when Tarski developed first logical systems with geometric interpretation, spurring further research in the area; notwithstanding, QSR researchers were mostly practically-minded and did not go beyond Whitehead or Leśniewski in search for their ancestry. Our research bridges these two worlds: we wish to investigate the philosophical underpinnings of qualitative spatial, or geometrical, logics in the context of Russell's work and to formally analyse in more detail certain examples of such logics, dealing with the so-called affine geometry (one of the geometries distinguished by Russell as qualitative). Russell's views on geometry have not been the subject of a more comprehensive analysis so far. We wish to explore Russell's ideas on the nature of geometry, looking for new sources that can shed light on the origin of his approach but also analysing his better-known publications in that respect, to obtain a fuller picture of the evolution of his ideas. On the other hand, affine spatial logics are underexplored when compared to other branches of QSR. We wish to extend our previous results on such logics to dimensions greater than 2. Hence, both parts of the proposed research deal with important research problems and their combination adds a third value: bridging philosophical and formal investigations.