Chris Mortensen, *The Impossible Arises: Oscar Reutersvärd and his Contemporaries*, Bloomington: Indiana University Press, 2022, pp. vii + 152, $50.00 (hardback).

The Impossible Arises is an art history and philosophy of impossible pictures, focused especially on the contributions of Oscar Reutersvärd. The book draws on an archive of Reutersvärd's letters and drawings sold to Indiana University by Bruno Ernst. The book is lavishly illustrated, with some drawings reproduced here for the first time. It is a fascinating book, which should be of interest not only to philosophers, but also to anyone interested in the interplay between art and mathematics. The main themes of this book overlap with Part II of Mortensen's book *Inconsistent Geometry* (Mortensen 2010). But as well as taking a more historical perspective on the topic, *The Impossible Arises* eschews the formidable logical and mathematical apparatus of its predecessor, making it accessible to a much broader audience.

After a brief biography of Reutersvärd – he drew his first impossible triangle in 1934, at the age of eighteen while bored in his Latin class, before studying philosophy and art history, becoming a professor of art history and theory at Lund University in Sweden in 1964 – Chapter 1 introduces several examples of Reutersvärd's impossible figures, classifying them into four main types. The four types are impossible triangles, impossible stairways, which always ascend while spiralling back to meet themselves, meanders, which are like the more familiar devil's pitchfork, and Tardis paradoxes, named after Dr Who because they show a larger object squeezed inside a smaller one. Chapter 2 discusses several more illustrations, including four which are difficult to classify into the four types distinguished in Chapter 1. Finally, Chapter 2 concludes with two more biographical details – Reutersvärd's interest in Egyptian mythology, and his impossible pictures featuring on Swedish postage stamps issued in 1982.

The bulk of Chapter 3 is a translation of the preface to Reutersvärd's 1982 book *Omojliga Figurer I Farg* [Impossible Figures in Colour]. The preface is written under the name 'Carlo Bresti', but Mortensen argues convincingly that this is a pseudonym for Reutersvärd himself, and so the preface reflects Reutersvärd's own views of the significance of his work. This is based on the absence of independent evidence for the existence of Bresti, the facts that 'Carlo Bresti' is an anagram for 'Oscar ret i bl', that 'i' is Swedish for 'with' and that 'bl' are the initials of Britt Lundbohm, Reutersvärd's wife and an artist in her own right, and the detailed knowledge the preface displays of

Reutersvärd's life and work. Be that as it may, the preface raises several interesting art historical and philosophical issues about impossible pictures.

The first issue is the connection of Reutersvärd's pictures to non-Euclidean and four-dimensional geometries. Art historically, this is interesting because it helps place Reutersvärd's art in the context of the wider story of the influence of non-Euclidean and four-dimensional geometry on modern art, including on canonical artists such as Malevich and Duchamp, as well as canonical movements such as cubism and futurism (Henderson 2013). Here the preface presents Reutersvärd as succeeding in depicting non-Euclidean or four-dimensional figures where previous artists failed. The preface also suggests that Reutersvärd's figures are counterexamples to a claim he attributes to Reichenbach that impossible, four-dimensional, or non-Euclidean (the preface is not clear about which) pictures cannot be drawn.

But these claims seem to be based on some misconceptions. First, as Mortensen points out in Chapter 4, Reichenbach in fact argues that non-Euclidean geometries are visualisable (Reichenbach 1957, 48–58), and so also drawable. Impossible pictures, on the other hand, do not seem to be on Reichenbach's radar, although Reichenbach does seem implicitly committed to visual imaginability being a guide to possibility, which could explain Reutersvärd's mistake. Second, illustrations of four-dimensional figures such as the hypercube occur in the scientific literature in the late nineteenth and early twentieth century, though their verisimilitude is debatable (Henderson 2013, 107–10). Thirdly, Reutersvärd's figures do not involve the fourth dimension.

Nevertheless, there is a sense in which Reutersvärd's figures are non-Euclidean. For one, all three corners of Reutersvärd's impossible triangle are ninety degrees, but according to Euclidean geometry, their sum should be exactly one hundred and eighty degrees, not two hundred and seventy (Reutersvärd credited this point to his classmate Jan Cornell, who later also showed him the Penroses' article on impossible figures). In Chapter 4, Mortensen elaborates this point by noting that in spherical geometry, a triangle can have three angles of ninety degrees, and that Reutersvärd's triangle does not adhere to Pythagoras' theorem, since the square on the hypotenuse is not the sum of the squares on the other two sides.

Is it necessary that impossible triangles violate the Pythagorean theorem? Some of Reutersvärd's later triangles have sides of three, four and five cubes, as in Figure 1, (drawn after Figure 4.1 of the book), thus satisfying the theorem. Mortensen says that this triangle is "less natural" than the original, but that can be corrected simply by

moving one of the cubes into the foreground, as in Figure 2 here. Although it does satisfy the Pythagorean theorem, this triangle is non-Euclidean in at least one other way. In Euclidean geometry, the lines in a triangle are always coplanar. But although each pair of sides in Figure 2 are coplanar, the entire triangle is not: each pair of sides determines a distinct plane.

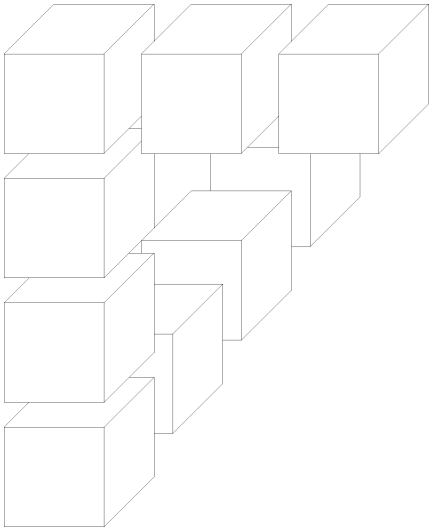

Figure 1

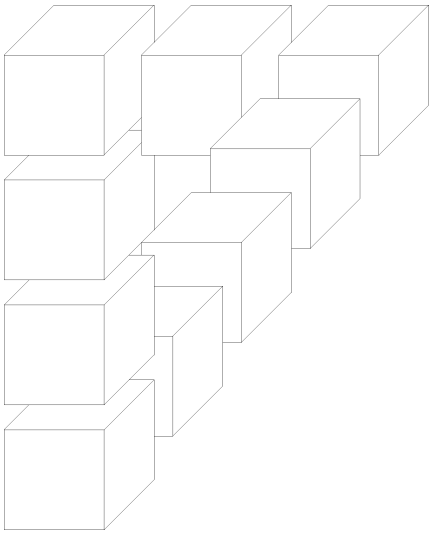

Figure 2

A second issue raised by the preface is the role of perspective. Reutersvärd drew his figures using parallel projection. But Lionel and Roger Penrose, who rediscovered the impossible triangle and stairway independently after inspiration from Escher, used linear perspective. Whereas linear perspective is more prevalent in European art since

the renaissance, parallel projection was prevalent in East Asian art of the same period (Hagen 1986), and the preface makes this connection, emphasising the use of parallel projection in Japan. But parallel projection is also common in the west in architectural and other technical drawings (Willats 1997), and in the face of the testimony of the preface, I would argue that such technical drawing is the more important influence on Reutersvärd's figures. In Chapter 4, Mortensen sides with the preface in arguing that parallel projection is the more realistic method for depicting impossible figures. But I would argue that both methods are realistic in their own way.

There are several other things going on in the preface, and Mortensen helpfully devotes the whole of Chapter 4 to a detailed commentary on it. Chapter 4 concludes with a summary which lists *What Oscar is Right About* (according to Mortensen), as well as *What Oscar is Wrong About* (a much shorter list) and *What Oscar Is Unclear About* (a longer list again). Mortensen agrees with the preface that "Oscar's practice is more akin to science: more akin to artistic research rather than art" (p. 63). I would argue that here Mortensen acquiesces too easily in what, if Reutersvärd is the author of the preface, is false modesty on his part. It is true that Reutersvärd's drawings lack the realistic detail present in many of Escher's works. But if we see Reutersvärd in the context of modern art, as much of the rest of the book suggests we should, this counts for little, as much modern art – Malevich's, for example – is at least as abstract.

Chapter 5 is written by Catherine Speck, an art historian and Mortensen's wife. It consists in a short biography of Reutersvärd, drawing on further material from the Indiana University archive. Reutersvärd was himself a prolific art historian, writing books on Claude Monet and the impressionists. Setting aside impossible figures, he was still an artist in his own right, his other works leaning towards surrealism. His art teachers in Sweden, Michail Katz and Otto Carlsund, were taught by Malevich, and he studied in France with the cubist Fernand Léger, which again helps place his work in the wider context of modern art. He also engaged in "paradoxical knitting", such as ten-figured gloves and four-sleeved jumpers for two, which could be more accurately described as merely impractical rather than truly impossible.

Part II of the book turns to the better-known impossible pictures of Escher and the Penroses. Chapter 5 includes a facsimile of the Penroses' famous paper (Penrose and Penrose 1958), which was inspired by an exhibition of Escher's. Escher's etching *Belvedere*, which includes his impossible cube, was created independently in the same year. The evidence is that Escher and the Penroses rediscovered impossible pictures

independently of Reutersvärd, but unfortunately Escher did not reply to Reutersvärd's first letters (in which Reutersvärd did not press his claim to priority). Chapters 7 and 8 expand on the previously published paper *How Many Impossible Pictures Did Escher Draw?* (Mortensen et al. 2013), and raise two important philosophical questions.

First, Chapter 7 raises the question of whether impossible pictures are correctly described as "illusions", as in, for example, the title of the Penroses' paper. Mortensen argues that impossible pictures aren't illusions, by arguing that there is no disposition to believe the impossible contents of the picture. I would add to this that the question of whether impossible pictures foster illusions is related to the more general question of whether pictures foster illusions, and about the relationship between pictorial and perceptual experience. Few would argue, for example, that a painting of a horse elicits an illusory experience as of a horse. On the other hand, it is very plausible that many pictures do elicit, for example, an illusion as of depth. So insofar as ordinary pictures elicit illusions in this sense, impossible pictures will too.

Rather than illusion, Mortensen urges that we should take impossible pictures to elicit imagination, in analogy with fiction. Mortensen is right to describe our attitude towards the content of impossible pictures as closer to imagination than to belief. But there is still a residual puzzle here, since this is on the face of it in conflict with the role of imagination as a guide to possibility (the same issue arises in connection with imagination and fiction). Chapter 7 also argues for the cogency of impossible content – a point that by now everyone should agree with. And it distinguishes impossibility from paradoxicality, especially as found in semantic paradoxes such as the liar. I also agree with Mortensen that most of Reutersvärd, Escher and the Penroses' pictures are merely impossible, and not paradoxical in this sense. But in this context it would also be interesting to discuss Eschers' *Drawing Hands*, which Mortensen does not classify as impossible, but which has affinities with the no-no paradox.

The second issue concerns the classification of impossible pictures into types. In Chapter 7, Mortensen suggests that there are five basic types of impossible picture – impossible triangles, impossible stairways, devil's pitchforks, impossible cubes (and I suppose other impossible polyhedra), and another kind of impossible staircase which Mortensen credits to Bruno Ernst. This is the same classification given in *How Many Impossible Pictures Did Escher Produce?* (Mortensen et al. 2013, 429), the answer to the title question of which is three types, since Escher did not etch any works based on the pitchfork or Bruno Ernst's staircase. It increases by one the number of types

classified in *Inconsistent Geometry* (Mortensen 2010, 75), which excludes impossible stairways. Moreover, Mortensen neglects to mention here Reutersvärd's *The Squeeze*, or Tardis paradoxes as he calls them in Chapter 1, which brings the total up to six.

Chapter 8 contrasts Mortensen's classification with Escher's own classification of his work into ten themes, focusing on those categories that have some *prima facie* claim to impossibility. Chapter 9 is a discussion of an ignominious episode in which Reutersvärd's claim of priority was disputed by Richard Pybus. Chapter 10 discusses Bruno Ernst, with whom it also includes a brief interview. Chapter 11 lists other contributors to impossible art. Chapter 12 concludes. There is much more to say about this short but fascinating book than can be included in the space of this review. And there is much more to be said about the philosophy, mathematics and art history of impossible pictures then could be said in this short and fascinating book. By bringing to light much fascinating new material on Reutersvärd, and clarifying his relationship with his contemporaries, this book has done much to forward the discussion of the topic of impossible pictures, and I recommend it unreservedly to everyone.

Hagen, Margaret A. 1986. *Varieties of Realism: Geometries of Representational Art*. Cambridge ; New York: Cambridge University Press.

Henderson, Linda Dalrymple. 2013. *The Fourth Dimension and Non-Euclidean Geometry in Modern Art*. Revised. MIT Press.

Mortensen, Chris. 2010. *Inconsistent Geometry*. College Publications.

Mortensen, Chris, Steve Leishman, Peter Quigley, and Theresa Helke. 2013. "How Many Impossible Images Did Escher Produce?" *The British Journal of Aesthetics* 53 (4): 425–41. https://doi.org/10.1093/aesthj/ayt016.

Penrose, L. S., and R. Penrose. 1958. "Impossible Objects: A Special Type of Visual Illusion." *British Journal of Psychology* 49 (1): 31–33. https://doi.org/10.1111/j.2044-8295.1958.tb00634.x.

Reichenbach, Hans. 1957. *The Philosophy of Space and Time*. 1st English Ed. edition. New York: Dover Publications.

Willats, John. 1997. *Art and Representation: New Principles in the Analysis of Pictures*. Princeton, N.J.