were found to perform better on phoneme deletion and addition tasks when tested 5 months rather than 2 months after beginning learning to read[3]. In another study, carried out in an underdeveloped area of a Southern European country, we have shown that subjects who had learned to read at adult age performed considerably better than illiterates of comparable social background on similar tasks[4]. This result has since been confirmed and extended for two fresh groups of subjects. Learning to read is, however, not the only answer to phonetic competence, and we have found recently that a training procedure similar to that of Bradley and Bryant[1] can accelerate acquisition of phonetic analysis in 5-yr-old pre-readers[5]. In our opinion, a more satisfactory formulation is that the link between the ability to analyse speech into phonetic segments and reading acquisition is a part-whole one; acquiring the complete skill implies that the component capacities have been acquired and acquiring independently some of the component capacities can facilitate acquisition of the whole skill.

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BRYANT AND BRADLEY REPLY—In our paper we established that 4- and 5-yr-old children detect rhyme and alliteration before they begin to learn to read. This shows that some phonological awareness precedes reading, which rules out the possibility that all such awareness is the result of learning to read. The fact that our measures of this early awareness were related to later success in reading and that training in rhyme and alliteration improved reading appears to show that the skill has an effect on learning to read. Bertelson and colleagues suggest that we have not excluded the possibility that the cause-effect relationships go the opposite way and that the experience of learning to read improves children's awareness of the constituent sounds in words. We agree that we have not excluded this possibility—we did not intend to or claim to, and we think it likely that the causal links operate in this direction also.

There are some tests of phonological awareness which have proved more difficult than ours. One, used by Bertelson and his colleagues, is the elision task where a child has to work out what a particular word would sound like if a phoneme in it were removed. Children do not manage this task at all well until some time after they have begun to read[1]. The fact that there is such a large gap in the ages when children can manage our task and theirs suggests that the two tasks test different levels of phonological awareness, and that one level may precede and cause reading while the other may follow and be the result of learning to read. The possibility of different levels of the skill in question has not been raised before. We entertain the hypothesis that the basic difference between our easy test and the difficult one of Bertelson is that in ours the child has only to be aware of part of a word's sounds—the part that rhymes or that begins the word—while their test involves awareness and manipulation of all the word's sounds. We intend to test this hypothesis.

We thank Bertelson, Morais, Alegria and Content for several very lively and cordial conversations which ended in a substantial measure of agreement between them and us. These exchanges helped us to formulate our idea that some forms of phonological awareness precede reading while others follow it.

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Archaeomagnetism, Santorini volcanic eruptions and fired destruction levels on Crete

IN their study of the magnetic properties of the Minoan pyroclastic deposits of Santorini and the fired destruction levels on Crete, Downey and Tarling[1] conclude that there was a time gap of several years or longer between the Plinian phase and the later phases of the eruption. They further propose that the Plinian eruption was contemporaneous with the destruction levels in central Crete, whereas the overlying base surge and pyroclastic flow deposits were contemporaneous with the destruction levels in eastern Crete. The geological and volcanological evidence, however, supports a single eruption with no time gap. I now suggest that their archeomagnetic data should be interpreted in other ways more consistent with the other evidence.

The Minoan pyroclastic deposits are typical of those produced by many major explosive eruptions associated with caldera formation. An initial Plinian air-fall pumice deposit mantles the island and is covered by a complex sequence of base surge, pyroclastic flow and reworked volcanoclastic deposits[2]. Similar sequences are known throughout the world[3,4]. Large historical eruptions comparable in magnitude, style and geology include Vesuvius (AD 79), Katmai (1912), Tambora (1815) and Krakatoa (1883). All these eruptions produced a sequence of pyroclastic deposits, comparable with Santorini in periods of a few hours to a few days with Plinian and subsequent flow deposits often generated on the same day. Evidence indicates that large explosive eruptions associated with caldera formation are very short in duration and are not characterized by substantial time gaps.

Geological observations on Santorini[2] provide convincing evidence of a single short eruption. The Plinian pumice deposit forms a continuous sheet with a smooth upper surface across all the islands of Santorini. A prominent ash band (5–10 cm thick) occurs ~20–40 cm below the top surface of the Plinian deposit and can be traced around the entire caldera wall. The ash band thickens towards the north where, in the Oia region, it can be traced into a base surge horizon up to 1 m thick. This ash band demonstrates that base surge activity began before the Plinian phase was completed. There is no evidence of any erosion of the upper surface of the Plinian deposit and gullies or other disconformities are not observed. Major gullies, several metres thick, were cut through the Mt St Helens deposits within weeks of the 18 May 1982 eruption. There is no evidence of any features attributable to the rapid erosion of unconsolidated pyroclastic materials within the major part of the Minoan sequence. Channellized sheets of fluvial deposits are observed within the uppermost parts of the ignimbrites[2], but these are stratigraphically well above the horizons where the differences in magnetic properties are recorded. The Plinian deposit preserved its uneroded surface, because it was immediately buried by base surge deposits. A gap of many years cannot be reconciled with this evidence.

A major time gap should be obvious in the stratigraphy of the ash layer preserved in deep-sea cores[5]. In distal areas, east of Crete, the ash layer occurs as a single normally graded deposit. Two events, separated by many years or more, should produce two normally graded layers. In more proximal regions, the deep-sea ash layer is more complicated due to slumping into the Cretan basin[5], but is also inconsistent with the time gap hypothesis. For example, the turbiditic layers are mixtures of ash from all the eruption phases, showing that slumping occurred after the ash layers had been deposited.

The geological evidence and volcanological arguments suggest that an alternative explanation of the magnetic data is required. One possibility arises from the emplacement temperatures deduced from the magnetic data. Downey and Tarling estimate temperatures in the range 300–400 °C for the base surge and massive upper deposits in Thera quarry. The deposits at Thera quarry are 40 m thick and would, therefore, have taken a con-