Most ancient authorities on the matter of sound believed that its pitch depended on its speed,¹ a notion that modern readers, educated in the idea of sound as vibration, quite easily dismiss as entirely mistaken: as we all know, the velocity with which sound propagates in a given medium (and at a given temperature) is fixed, so pitch and speed are entirely unrelated. Or are they not? After all, propagation is not the only way of conceiving speed in sound. At the level of the particle, it seems clear that faster oscillation means faster moving molecules, other factors being kept equal. So, does pitch depend on speed, in the end? Yet greater volume also increases particle velocity, since a movement within a larger amplitude means completing a longer course within the same time span (as defined by the frequency). As a result of this double connection of speed to both pitch and volume, particle velocity is usually not mentioned at all in modern accounts of sound. However, it may be fruitful to bear those relations in mind before accessing, and perhaps too rashly frowning upon, ancient sources, which hardly ever make clear, when ascribing properties of sound to speed, what exactly it is whose speed they have in mind.

In any case ancient acoustics, even where it defined sound as a sequence of impacts and pitch as their density in time and thus came remarkably close to the modern notion of frequency,² apparently never considered explicitly the fact that (particles of) air, after contributing to the propagation of sound by displacing their neighbour(s), would return much to their original position, a

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¹ There is good reason to believe that the theory originated with Archytas (Huffman 2005, 138–40), though speed is mentioned in a musical context in connection with Lasus and Hippasus (Theon 49.7–12).

² The most evolved version of this concept appears in [Eucl.] Sect. can. 1 (cf. Barker 1989, 192 n. 2) and Pr. 19.39, but with potential precursors possibly even preceding Archytas: Porph. in. Ptol. 107.15–108.21 Düring, convincingly explained in Barker (1989, 35 n. 27). In none of these sources, however, is propagation velocity explicitly ruled out as a factor, so that higher frequency of impacts might also be envisaged, for instance, as resulting from impacts of entities separated by a similar spatial distance but moving at a higher speed (cf. Barker 1989, 95 n. 64).
notion that would have been prerequisite to appreciating fully the nature of longitudinal waves. And the physical models employed in the *Problems* are still a good deal simpler. In the following I will briefly discuss their nature, also in relation to other, mostly Peripatetic, writings, and eventually propose an interpretation of a particularly problematic passage, tentatively attributing to it an especially refined view.

Apart from not acknowledging the nature of oscillation, the ancient accounts are often hampered by confusion between notions that we would distinguish into velocity on the one hand and impulse or pressure on the other (the latter depending on the former as well as the mass of the moving item, potentially divided by the area of impact). Sometimes, starting with Archytas, it is taken for granted that speed and force are directly correlated and therefore might be referred to interchangeably (e.g., βραδέως καὶ ἀσθενῶς); note however that this does not imply that the *amount* of whatever moves in the propagation of sound is conceived of as always being identical—a distinction clearly exposed in Plato’s *Timaeus* (67b–c). The earliest extant account by Archytas is informed by experience with sounding tools such as the bullroarer, where the application of stronger force results both in faster motion and higher pitch. In most cities, any educated citizen was also familiar with the procedure of tuning a lyre, where a higher pitch required higher tension and therefore more force; the tauter strings vibrated more quickly, just as a tauter bow would give a higher sound and project the missile with higher speed and force. Tension and relaxation were apparently also experienced as the factors that govern pitch in the human voice. However, transferring the idea to woodwind instruments was less straightforward: Archytas suggested that the breath slowed down when travelling through a longer section of tube, obviously disregarding the notion that producing bass notes on the aulos required significantly more

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3 Heraclides, in a detailed account of the relation between the vibration of a plucked string and the perceived sound (Porph. *in. Ptol*. 31.7–21 Düring), conceptually translates the string’s continuous oscillatory motion (κινεῖσθαι σειομένην καὶ ἐπὶ τὸν αὐτὸν τόπον ἀνακάμψεις ποιεῖσθαι) into a series of distinct impacts (καθ’ ἑκάστην δὲ πρόσκρουσιν), each apparently carrying the note’s pitch, which are subsequently blurred by the hearing (cf. Barker 1989, 236 n. 119); cf. *Aud.* 803b32–40.

4 For a more systematic discussion of the history of the notions involved, cf. Rocconi (2003) and, with a focus on the dependence of ancient theories on pre-scientific language, Barker (2002); on *Pr*. 11 in particular, see Petrucci (2011).

5 For the common awareness of the analogy between bow and lyre string, cf. *Od.* 21.406–11 and Heraclitus fr. 51 Dk, as well as the fact that both the lyre and the bow were attributes of Apollo.