Descartes says that an object's *vicinity* consists of bodies in “immediate contact with it” [Descartes, 233]. An object’s *true* motion is a change in its vicinity.

On the other hand, Newton does not think an object's *true* motion is a relational concept. Newton defines *absolute space* as space that is not defined in “reference to anything external” and characterizes it as “homogenous” and “immovable” [Newton, 64]. Then, he defines the *absolute place* of an object to be the part of absolute space that the body occupies. Absolute motion, or true motion, is then a change of position of a body from “one absolute place to another” [Newton, 65].

An object in a world where nothing else exists would not have a vicinity because there would be no thing that is in immediate contact with it. Thus, an object could not change vicinity, and so the object could not undergo *true* motion according to Descartes’ conception. Since *true* motion is not a relational concept for Newton, whether or not the object could move is not a function of the existence of other objects. Thus, a single object could move under Newton’s conception.

Newton’s bucket example can be broken down into 3 stages. In the first stage, a bucket is attached to a cord and the cord is wound up until it is “twisted tight” and then released [Newton, 68]. In this stage, the water is still and the vicinity of the water is the part of the bucket that is in contact with the water. Since the bucket moves quickly but the water remains still in this stage, the water can be said, in relation to the bucket, to have a high level of relative motion. In the second stage, with the passage of some time, the water begins to turn along with the bucket, but not at the same speed yet. It begins to assume a “concave shape” [Newton 68]. In this case, the absolute motion of the water is higher than in stage one, but the relative motion (relative to the bucket) is lower. In the third stage, the water and bucket are moving at the same speed, and the water’s concavity increases from stage 2. The absolute motion of the water is higher than in stages one and two, but the water is at rest relative to the bucket.

The rise of the water to form the concave shape indicates that it is receding from the axis of its circular motion. Descartes’ second law of nature states that “any body moving in a circle always tends to move away from the centre of the circle which it describes” [Descartes, 241]. Newton agrees with this law and says that it explains the phenomenon of the water receding. However, this phenomenon, as described earlier, corresponds with an increase in the absolute motion and a decrease in the relative motion of the water. It follows that the motion described in Descartes’ law corresponds to absolute motion, rather than relative motion. This undermines Descartes’ view that the *true* motion of an object is its motion relative to its vicinity.

To evade this criticism, Descartes might focus on the *vicinity* of the water in Newton’s example. He would probably agree that the bucket is in the *vicinity* of the water but might contend that the air on top of the water is also in the *vicinity* of the water since it is in immediate contact with it. While Newton claims that the water is relatively at rest in stage three, Descartes may argue that this is not correct because the air particles that are in the vicinity of the water are changing. Relative to the air particles, the increase in the concavity of the water corresponds to an increase in the relative motion of the water. He might then conclude that it is his definition of *true* motion that corresponds to the water receding from its axis of circular motion.

References

1. René, Descartes. “Part 2.”. In *Principles of Philosophy*, 1644
2. Newton, Isaac. *De Gravitatione*, 1687