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Current standards for high school mathematics call for students to recognize a linear function as one in which uniform changes in the input variable correspond to uniform changes in the output variable (e.g., CCSSM.HSF-LE.A.1). We investigated teachers' and students' understanding of this notion of linearity by recording their work on a task that calls for a graph of the relationship between two quantities that vary nonlinearly with time, but that are linearly related to each other. Video interviews with students working on this task revealed ways of thinking about graphing and covariation that, by turns, helped and hindered them in discovering the invariant linear relationship between the two quantities. We argue that explicit attention to these ways of thinking in the preparation of secondary mathematics teachers may better equip them to help students learn to analyze quantitative relationships and recognize linear functions in context. (Received September 26, 2017)