# Kurzbeschreibung / Short Description

The goal of this project is to provide visual intuition and feeling for the underlying mathematical language that helps describe physical phenomena. I will conceptualize a virtual display based on the following question:

Can moving around on a circle be seen as moving along a straight line?

The question will be visualized by creating and modifying a few animations that exemplifies the relationship between periodic and uniform circular motion. By using the Socratic Dialogue in conjunction with the animations, a process of exploration can be created as the person–the presenter of the display–attempting to communicate the solution of the question can do so by methodically refining the question with visual aids. This then allows the audience interacting with the animations to be led along to the solution by illuminating subtleties in the question.
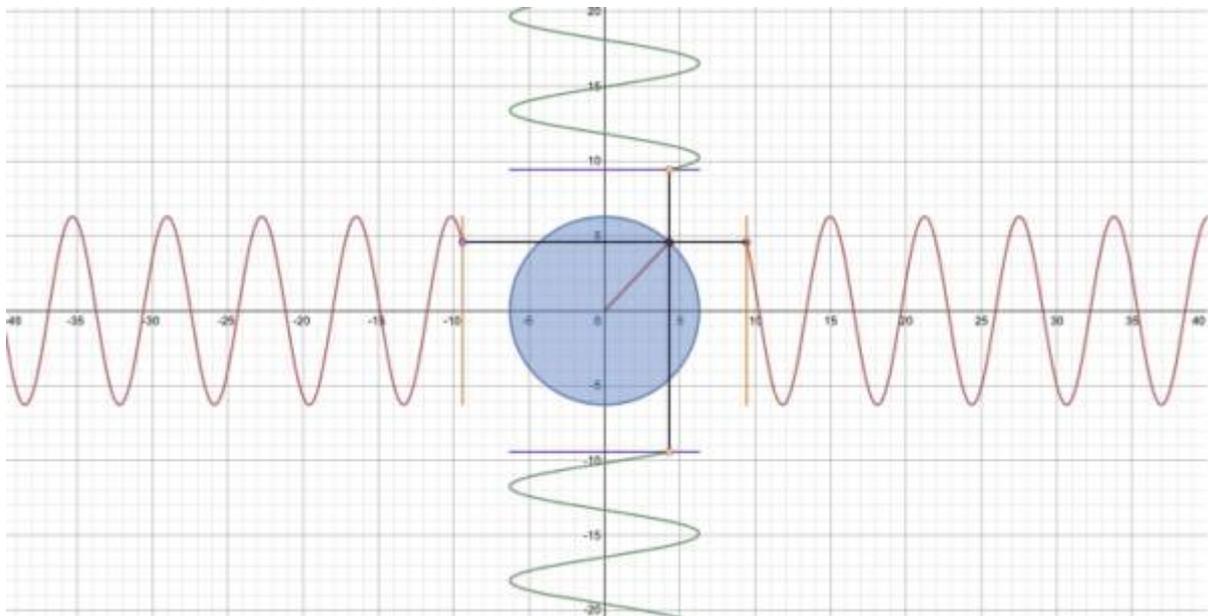
Theorie / Theory
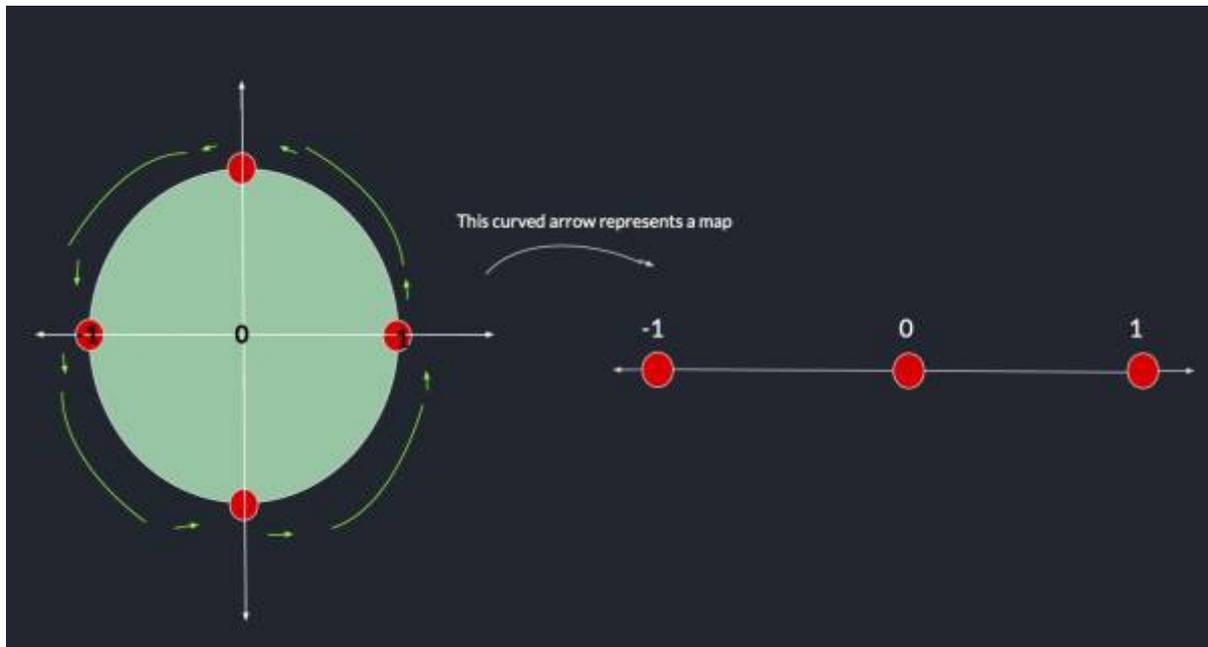
The question of whether the circular motion of an object can be seen as a form of motion on object on a straight line requires the introduction of a couple of concepts. The first concept is that of <u>periodic motion</u>, which enables circular motion to be represented as motion on a straight line. Periodic motion is defined as a type of motion that <u>repeats in regular intervals of time</u>. These regular intervals are specifically unvarying, uniform, and consistent spacings of time, which is called a <u>period</u>. As an object (like the <u>red point</u> in the diagram above) moves in a circular path, it will repeat its movement after a particular interval of time, i.e. after some amount of time it will come back to where it started and then it will continue to move in its circular path. Therefore, we can create a relationship in the form of a mathematical <u>map</u> that is called a <u>projection</u> that takes the two-dimensional circular motion and places it onto the one-dimensional periodic motion, i.e. moving on a straight line back-and-forth between the two endpoints (an interval) that define the straight line. This second concept of a <u>projection</u> is one we see in everyday life with light shining upon an object resting on the floor and then the object casts a shadow of itself onto the floor. This shadow is a two-dimensional version of the original three-dimensional object. The same can be said about an object moving in a circle to then be moving on a straight line–we are merely creating a shadow of the circular motion.

For further information please see:
Physics for Everyone - Book 1 - Physical Bodies by L. D. Landau, A. I. Kitaigorodsky
The Physics of Waves by Howard Georgi

Bauplan / Blueprint

- **Material / List of Material**
    - Pencil
    - Paper
    - Computer with Internet Access
    - Graphing calculator software called Desmos
    - Literature & video resources on mathematics, physics, and philosophy
- **Aufbau / Construction**
    - Sketches were drawn on paper and then played with Desmos software to attempt to animate the drawn ideas
    - Rather than repeating work, look through Desmos community to find out that a few

demonstrations of the drawn ideas already exist
  - Input the appropriate geometrical equations and then use basic animation features to display the motion of a point in circular and periodic motion
    - [Animation 1](#) using Desmos (found on Desmos community–credits to the original creator–using for educational purposes)
    - [Animation 2](#) using Desmos (found on Desmos community–credits to the original creator–using for educational purposes)
    - [Animation 3](#) using Desmos (found on Desmos community–credits to the original creator–using for educational purposes)
  - [Animation 4](#) that was built by Russell Georgi using html5 canvas a script-language to do browser-animations (credits to the original creator–using for educational purposes)

Fazit / Conclusion

- ## Anmerkungen / Remarks
  - The verbal communication between the presenter and the audience is integral in enabling the audience to be able to build a sense of curiosity and eventual understanding of both the question and its solution.
- ## Probleme / Problems
  - This is quite an abstract idea and visualization. Requires a lot of preparation with the methodology of Socratic dialogue, along with the understanding of the question being explored. Since this is an abstract idea, attempting to make it concrete was challenging.
- ## Verbesserungen für nächste Version / Improvements for next version
  - In order to make the abstract idea more concrete, one can construct physical experimental demonstrations of physical phenomena like a pendulum and a oscillatory motion of a vibrating plate that can demonstrate how the abstract idea connects various different physical phenomena.

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