

# Cinderella.2

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What exactly is Cinderella? Cinderella is a software for doing geometry on the computer, and it is designed to be both mathematically robust and easy to use. Platforms supported: Unix / Linux, Windows, Mac OS X, JAVA, XP Tablet PC... The creators were Jurgen Richter-Gebert, Ulrich H Kortenkamp. Cinderella.1 released 1999, Cinderella.2 in 2006

## Program Parts

- Dynamic Geometry
- CindyLab, an environment for doing interactive physical experiments
- CindyScript, a high-level programming language that allows for fast, flexible and freely programmable scenarios
- Each part can be used standalone or together

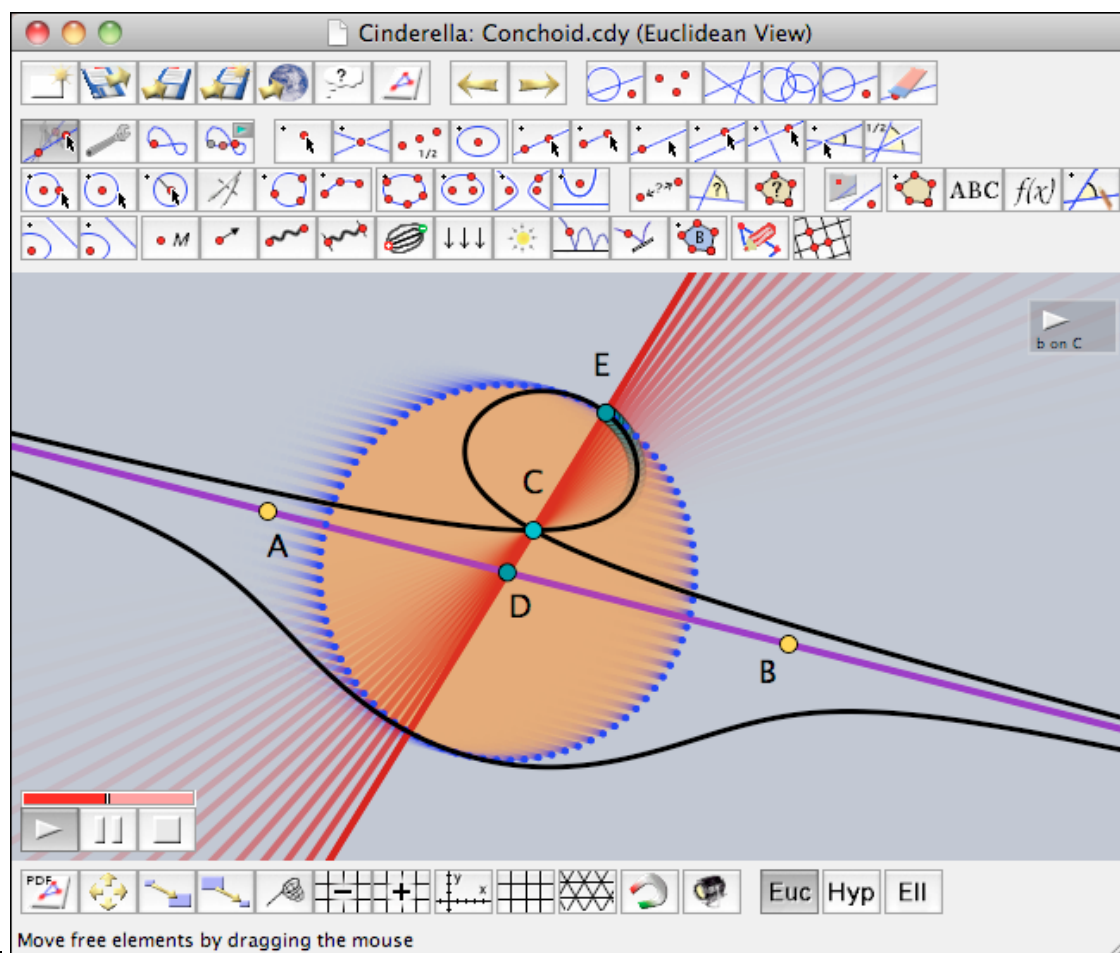


Figure 1: A

## Why is Cinderella special?

- Mouse-driven- simple or complex constructions
- Built-in automatic proving facilities-reports non trivial facts that might occur
- Simultaneous manipulation and construction in different views- Euclidean, spherical, hyperbolic
- Native Support” for non-Euclidean geometries- switch between Euclidean, hyperbolic, and elliptic
- Based on mathematical theory: built on math foundation, reliable and consistent

## More Features?

- has advanced facilities for geometric loci: complete real branches of the loci and not only parts of them are drawn
- is ”Internet-aware”: The entire program is written in Java; Student exercises and animations can be created in this way-dont need a player or reader to see them unlike mathematica, arrghh!
- produces high-quality printouts: You can generate camera-ready PostScript or PDF files of your drawings (yay for Latex, lol!)

## What and how can you construct?

- Simple translations or reflections
- For ex. Mobius Strip and other topologies
- Fractals-construct so-called ”iterated function systems.”
- CindyScript: functional language that allows powerful high-level programming
- Supports Audio Output
- Built-in formula renderer that supports the TeX formula description language
- Image rendering/transformation: possible to create custom images with self created content
- Supports pen-driven devices: convert hand drawn tablet/whiteboard drawings into constructions

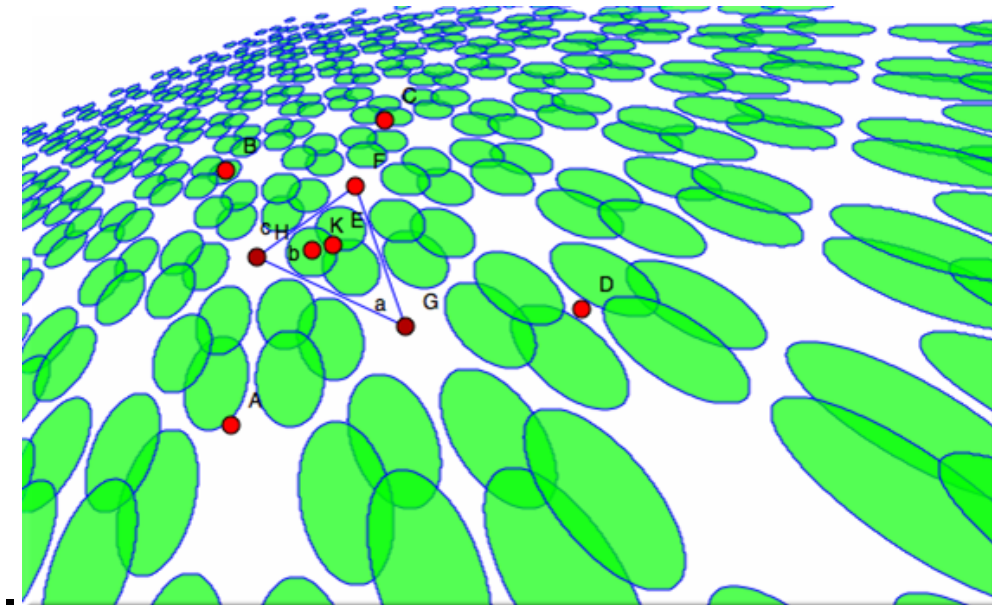


Figure 2:

## Cindy Lab

- CindyLab constructs physical simulations based on a mass-particle/forces paradigm.
- Draw an experiment and start the simulation.
- The combination of physics simulation with geometry or with the programming environment opens the possibility of surprising insights and amazing interactive simulations.

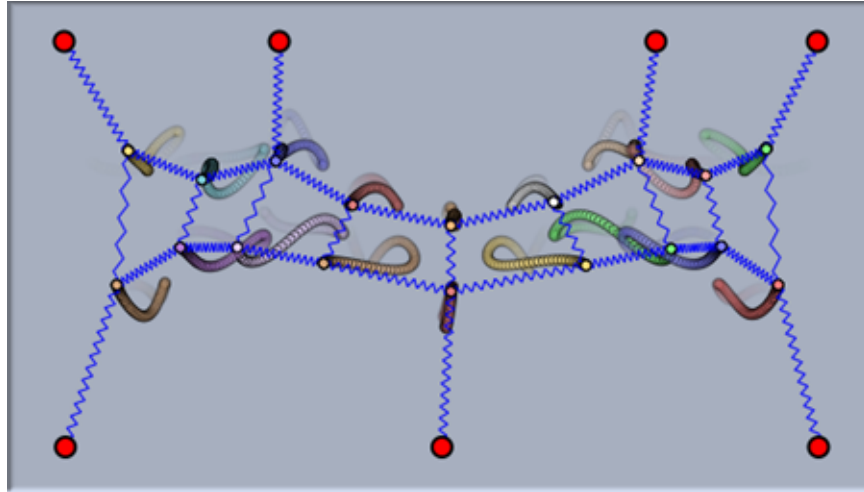


Figure 3:

## Dynamic Geometry

- Pure Euclidean (and non-Euclidean) geometry via physics (ex. Optics) to computational kinematics and CAD.
- Exact drawings/ Geometric calculator
- Communicate research on internet
- Interactive worksheets/ Exercises
- Projective and Cayley-Klein geometries

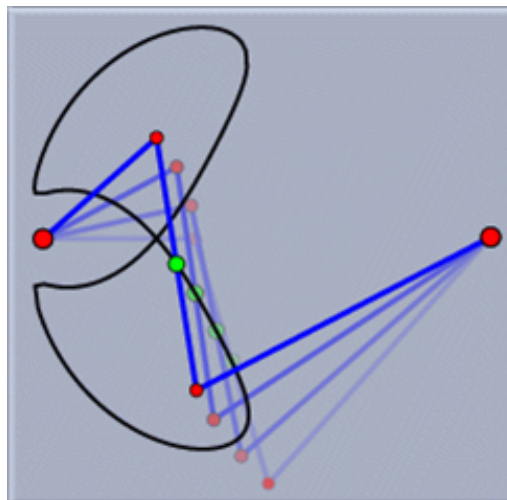


Figure 4:

## Cindy Script Programming • Different Inputs to create graphics

- Graphical output and mouse-driven input (the geometric part), physical simulations can be "outsourced" to the Cindy-Lab simulation engine. Very often, only a few lines of code are needed to achieve the desired behavior. This is in strong contrast to common programming languages, where a substantial part of programming goes into the creation of a graphical mouse-driven user interface.

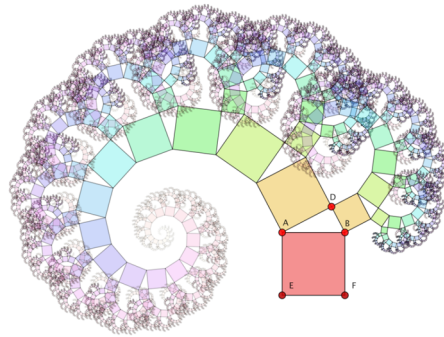


Figure 5: Scripted Pythagoras Tree

## Programmatic Drawing

There is a special class of applications that cannot be covered at all by a classical approach to dynamic geometry. Constructions in dynamic geometry are inherently like unbranched programs, in which all calculations are always performed. It is inherently difficult to include logical decisions or algorithmic behavior in a dynamic geometry program usually resolved by conditionally controlling the visibility behavior of geometric elements by intersection properties (so-called Boolean points). Cinderella.2 offers this, but at the same time, CindyScript provides a much better and more elegant way. CindyScript is a full-featured high-level programming language in which it is easy to implement arbitrary algorithmic behavior. Thus even complicated algorithms can be included on a general level in a dynamic geometry environment. Graphical output can be easily included in such algorithms.

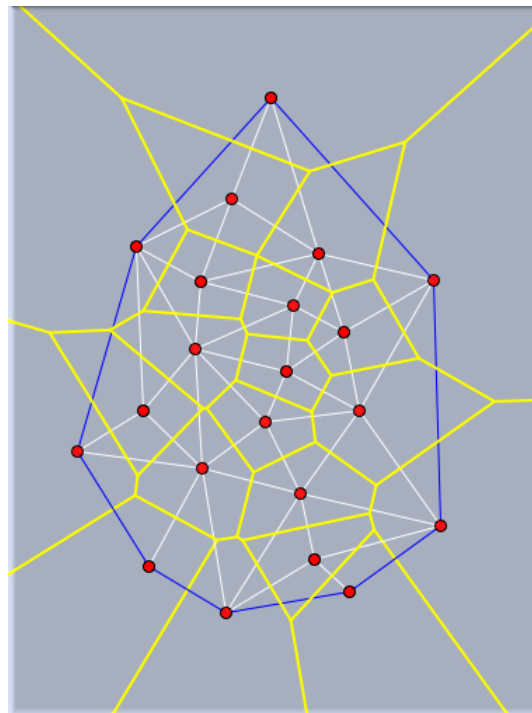


Figure 6:

## Analysis of Mathematical Functions

Easy to generate interactive worksheets that allow for a wide variety of modes of analysis of functions. Functions can also be defined by geometric dependencies of the geometric constructions, which facilitates combining input and analytic parts in one example.

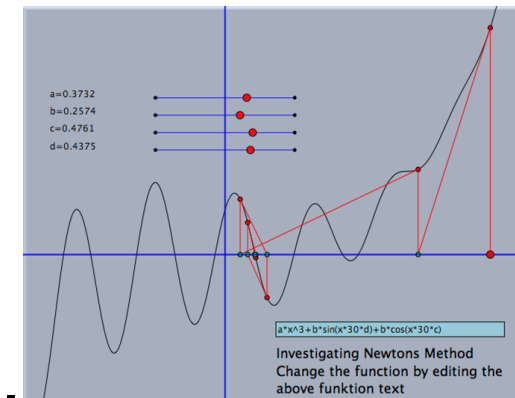


Figure 7: Newton Method Worksheet

## Controlling the Behavior of Constructions

Pick's theorem applies only to polygons whose vertex coordinates are pairs of integers, a restriction that is usually not supported by a dynamic geometry program. However, by adding the following three lines of code one can alter the behavior of the three free points:  $A.xy = \text{round}(A)$ ;  $B.xy = \text{round}(B)$ ;  $C.xy = \text{round}(C)$ ;

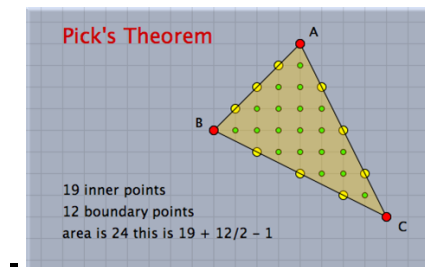


Figure 8:

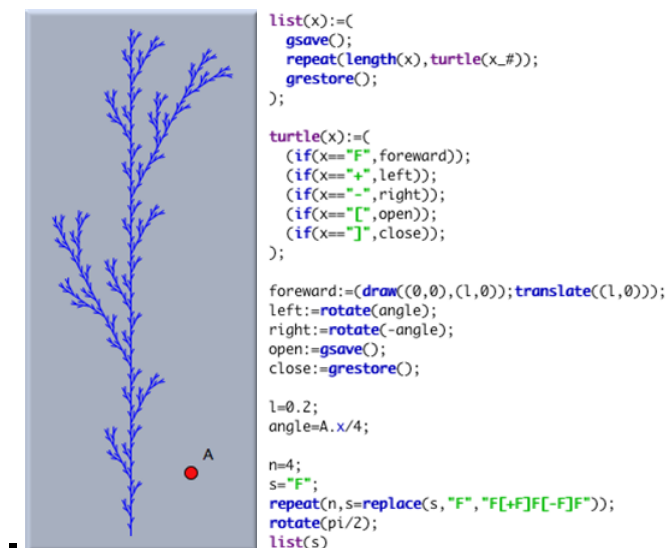


Figure 9:

Although Cinderella is not as commercial as Mathematica, it still seems like a very powerful software worth your time!

If you have any questions, feel free to mail Ulrich Kortencamp at

- [authors@cinderella.de](mailto:authors@cinderella.de)
- <http://cinderella.de/files/HTMLDemos>
- <http://doc.cinderella.de/tiki-index.php>
- <http://www.cinderella.de>
- <http://vimeo.com/3826066>