

# A Practical Guide to Parametric Drawing in AutoCAD

**Rick Ellis**

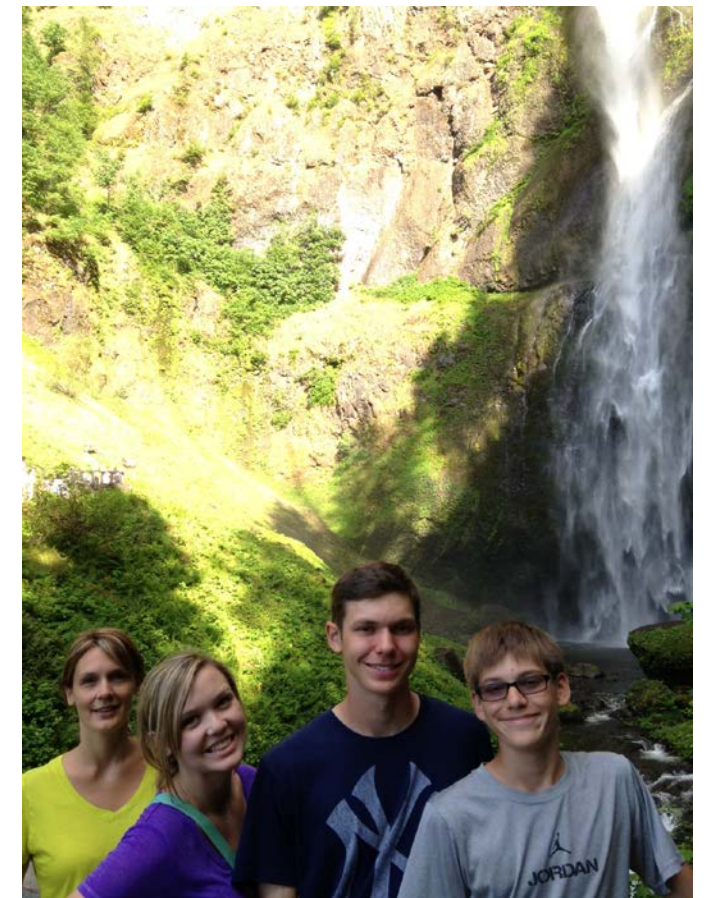
President, CADapult Software Solutions

@theRickEllis

rick@cadapult-software.com

# Who am I...

- Rick Ellis
- Portland, Oregon
- Originally a CAD Manager and Civil Designer
- I've been teaching AutoCAD, Civil 3D, and AutoCAD Map since mid-90's
- Consultant
- Author
- 11<sup>th</sup> year teaching at AU
- Member of the Autodesk University Advisory Council



# Introduction

- Welcome
- Who am I
- Who are you
- Class surveys

# Lab Assistants

- Sam Lucido
  - Civil Designer and CAD Services Manager, Haley and Aldrich
- Tracy Chadwick
  - Coordinator / Instructor, Hutchinson Community College
- Al Whitley
  - Principal, [cadteacher.com](http://cadteacher.com) & AU Advisory Council member

# Key learning objectives

At the end of this class, you will be able to:

- Create geometric relationships between objects by adding constraints
- Define dimensional constraints
- Identify and edit constrained objects
- Use inferred constraints to have AutoCAD automatically define constraints for you

# Agenda

- Overview
- What is parametric drawing?
- Parametric Constraints
- Geometric Constraints
- Dimensional Constraints
- Constraints in Dynamic Blocks
- Constraints to manage annotation?

# What About Questions???

- Lab Assistants are here to help you
- Short time for questions at the end of each topic
- After the session
- Via email [rick@cadapult-software.com](mailto:rick@cadapult-software.com)



**Exercise:**

**Examples of Parametric Drawings**



# Overview

Have you ever wanted to...

- Keep two lines parallel or perpendicular even if you edit one?
- Keep two lines the same length throughout the editing process?
- Maintain any important geometric relationships between objects?
- Edit a dimension and have the object update?

If you answered “Yes” to any of these questions then the answer is Parametric drawing.

# What is parametric drawing?

- The Autodesk Definition: “Feature in AutoCAD that assigns constraints to objects, establishing the distance, location, and orientation of objects with respect to other objects.”
- A feature that allows objects to be related to each other.
- “Sticky” or persistent object snaps.
- Dimensions that drive geometry.

# Parametric Constraints

- Constraints are associations and restrictions applied to 2D geometry.
- AutoCAD uses two types of Parametric Constraints:
  - Geometric Constraints
  - Dimensional Constraints

# Geometric Constraints

- The Autodesk Definition: “Rules that define the geometric relationships of objects (or points of objects) elements and control how an object can change shape or size.”
- “Sticky” Object Snaps. They maintain the geometric relationship between objects rather than setting it once at the time you use the object snap and then allowing it to change in the future.
- Add intelligence to your drawings.
- Allow you to think more about modeling and less about drafting.

# Types of Geometric Constraints

- Coincident
- Co-linear
- Perpendicular
- Parallel
- Horizontal
- Vertical
- Tangent
- Concentric
- Equal
- Symmetric
- Smooth
- Fixed

# Geometric Constraints

Objects	Constraint Points
Line	Endpoints, Midpoint
Arc	Center, Endpoints, Midpoint
Spline	Endpoints
Ellipse, Circle	Center
Polyline	Endpoints, midpoints of line and arc, center of arc
Block, Xref, Text, Mtext, Attribute, Table	Insertion point

# Adding Constraints Automatically

- Auto-Constrain
- Inferred Constraints

# Tips when creating Geometric Constraints

- When applying constraints between two entities AutoCAD modifies the second entity selected, leaving the first entity unmodified.
- If you convert an object that has constraints to a polyline the constraints are lost.
- If you explode a polyline that has constraints the constraints are lost.
- If you copy an object with constraints the constraints are copied if all the objects involved in the constraint are copied.



**Exercise:**

# **Working with Geometric Constraints**

# Dimensional Constraints

- The Autodesk Definition: “Parametric dimensions that control the size, angle, or position of geometry relative to the drawing or other objects. When dimensions are changed, the object resizes.”
- You type the value into a dimension and the object updates.
- Can include equations.
- Can even reference other objects. For example, line 1 is twice the length of line 2.

# Types of Dimensional Constraints

- Aligned
- Horizontal
- Vertical
- Radial
- Diameter
- Angular

# Dimensional Constraints

- Can constrain the following properties:
  - Distances between objects, or between points on objects
  - Angles between objects, or between points on objects
  - Sizes of arcs and circles
- Two different kinds of dimensional constraints
  - Dynamic
  - Annotational

# Dimensional Constraints

- Dynamic
  - Maintain the same size regardless of zoom level
  - Can easily be turned on or off globally in the drawing
  - Display using a fixed, predefined dimension style
  - Position the textual information automatically, and provide triangle grips with which you can change the value of a dimensional constraint
  - Do not display when the drawing is plotted
  - Can be converted to Annotational Constraints using the Properties Palette

# Dimensional Constraints

- Annotational
  - Change their size when zooming in or out
  - Display individually with layers
  - Display using the current dimension style
  - Provide grip capabilities that are similar to those on dimensions
  - Display when the drawing is plotted
  - Can be converted to Dynamic Constraints using the Properties Palette

# Tips when creating Dimensional Constraints

- When applying dimensional constraints AutoCAD modifies the constrained geometry to satisfy the new constraint.
- If you convert an object that has constraints to a ployline the constraints are lost.
- If you explode a polyline that has constraints the constraints are lost.
- If you copy an object with dimensional constraints the constraints are copied.
- Dimensional constraints can contain equations.

**Exercise:**

# **Working with Dimensional Constraints**



# Constraints in Dynamic Blocks

- Both geometric and dimensional constraints can be used in dynamic blocks.
- Constraint Parameters combine the features of a dimensional constraint and a block parameter.
- Add constraints to blocks in the block editor using the commands on the Block Editor tab of the Ribbon.

**Exercise:**

# **Working with Constraints in Dynamic Blocks**

# Things to Remember

- Geometric Constraints are like “Sticky” Object Snaps.
- The second object is the one changed.
- Dimensional Constraints let you edit objects by changing the dimension value.



# Don't forget Class Surveys

- Your class feedback is critical. Fill out a **class survey** now.
- Use the AU mobile app or fill out a class survey online.
- Give feedback after each session.
- AU speakers will get feedback in real-time.
- **Your feedback results in better classes and a better AU experience.**



# Still Have Questions???

- After the session
- Via email [rick@cadapult-software.com](mailto:rick@cadapult-software.com)



Thank you for your time and attention!

Rick Ellis

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