



## **3D Object Representations**



- What makes a good 3D object representation?
  - Intuitive specification
  - Guaranteed continuity
  - Guaranteed validity
  - Efficient rendering
  - Efficient boolean operations
  - Accurate
  - Concise
  - Structure



































## **Equivalence of Representations**



- Thesis:
  - Each fundamental representation has enough expressive power to model the shape of any geometric object
  - It is possible to perform all geometric operations with any fundamental representation!
- Analogous to Turing-Equivalence:
  - All computers today are turing-equivalent, but we still have many different processors



## **3D Reps for Computer Graphics**



<ul> <li>Different pro</li> </ul>	perties for diffe	erent applications
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Property	Editing	Display
Intuitive specification	Yes	No
Guaranteed continuity	Yes	No
Guaranteed validity	Yes	No
Efficient boolean operations	Yes	No
Efficient rendering	Yes	Yes
Accurate	Yes	Yes
Concise	?	?
Structure	Yes	Yes

3D Reps for Analysis & Retrieval						
Different properties for different applications						
Property	Editing	Display	Analysis	Retrieval		
Intuitive specification	Yes	No	No	No		
Guaranteed continuity	Yes	No	No	No		
Guaranteed validity	Yes	No	No	No		
Efficient boolean operations	Yes	No	No	No		
Efficient rendering	Yes	Yes	No	No		
Accurate	Yes	Yes	?	?		
Concise	?	?	?	Yes		
Structure	Yes	Yes	Yes	Yes		

















## Summary



- Many possible 3D object representations
  - Most are "turing equivalent"
  - Different reps are more efficient for different tasks
- Shape analysis & retrieval
  - Not same requirements as modeling and rendering
  - We will study several different reps in this course