Comparisons in .NET

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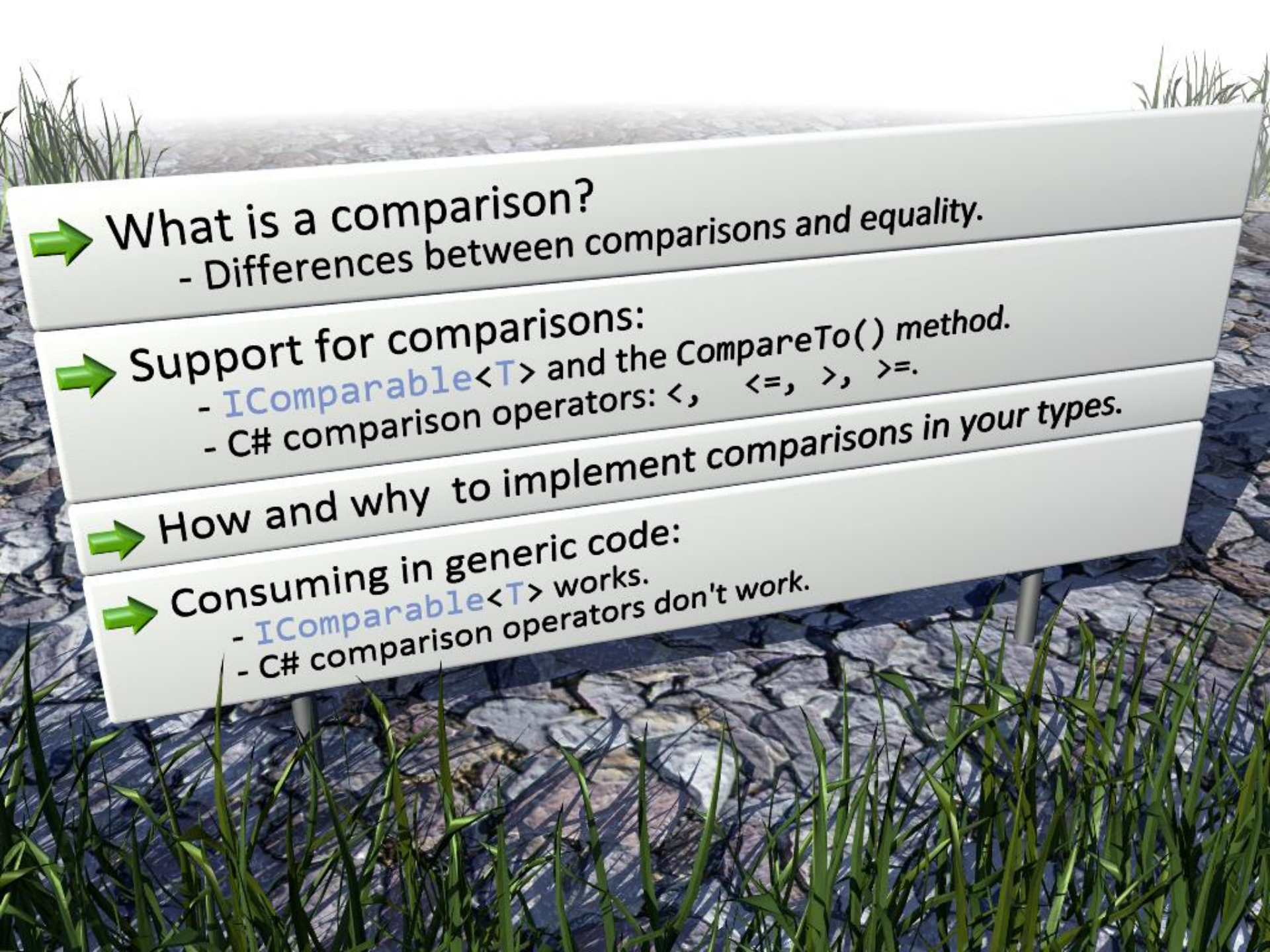

What is a comparison?
- Differences between comparisons and equality.
Support for comparisons:
- IComparable<T> and the CompareTo() method.
- C# comparison operators: <, <=, >, >=.
How and why to implement comparisons in your types.
Consuming in generic code:
- IComparable<T> works.
- C# comparison operators don't work.

What is a Comparison

Comparison: Way of ordering objects

```
if (3 < 4) {
```

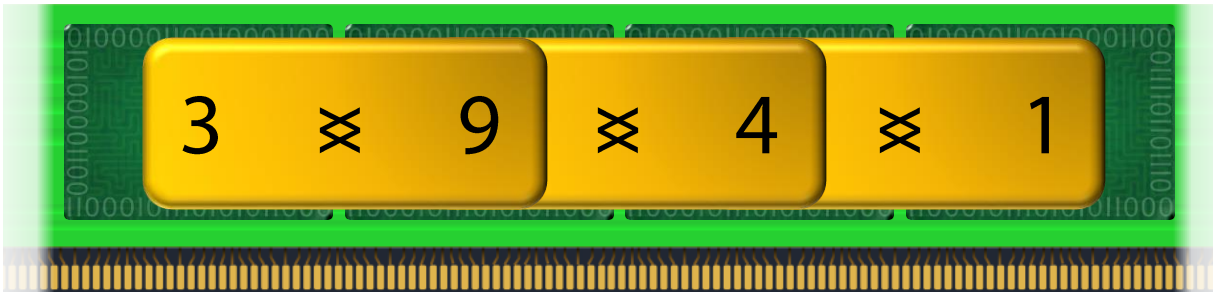
`true`

because 3 comes before 4

Comparing and Sorting

Sorting: Important application of comparing

If you can compare…
… you can sort!



Collections often need to do this
(Sort their elements)

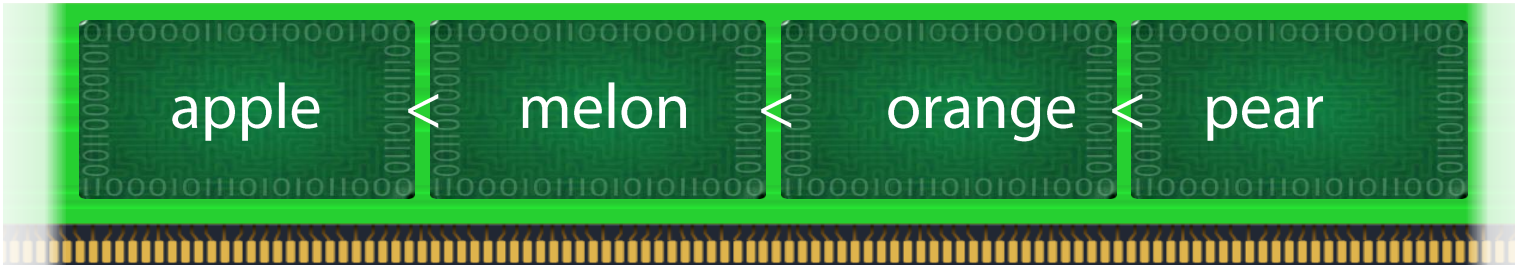
Comparisons and Equality

If the comparison says…	Then equality says..
`x = y`	`Equal`
`x > y`	`Not equal`
`x < y`	

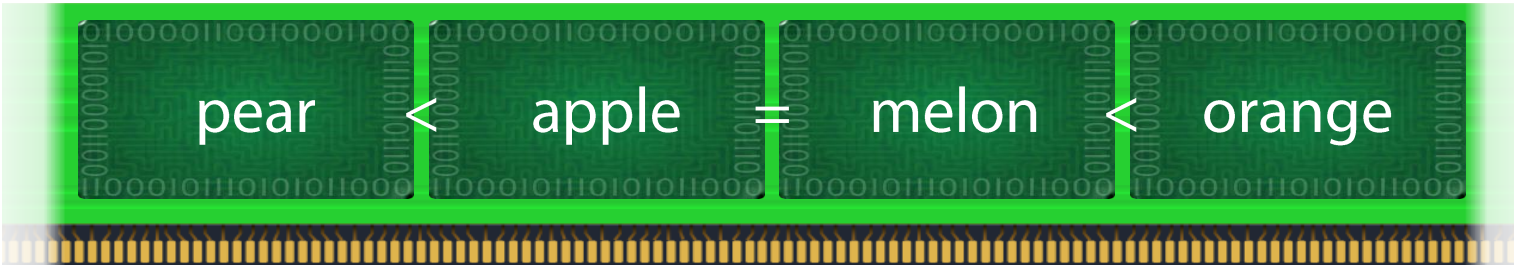
'Natural' and 'Plugged-In' Comparisons

Eg. For strings…

Natural comparison: Alphabetical



A 'plugged-in' comparison: Compare by string length

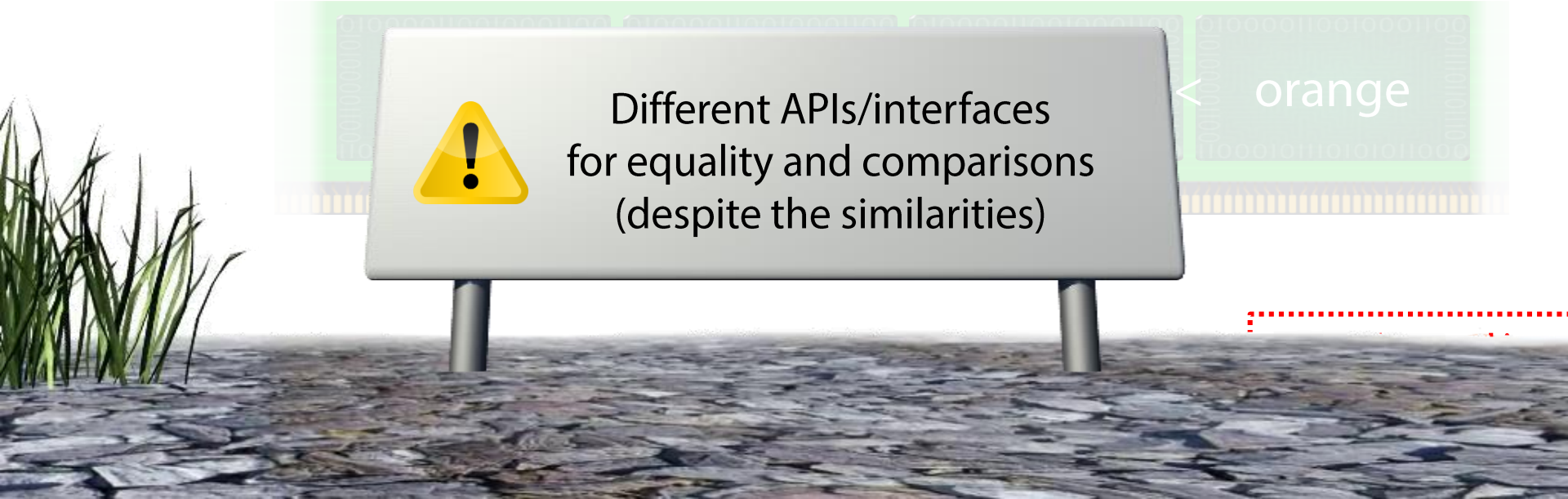


Different APIs

Eg. For strings…

Natural comparison: Alphabetical

A 'plugged-in' comparison: Compare by string length



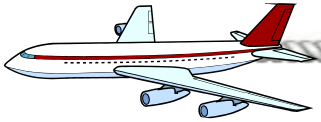
Equality vs Comparisons in .NET

	Equality	Comparisons
"Natural"	`object.Equals()` (and other methods)	 No support in `System.object`
	`IEquatable<T>` 	`IComparable` `IComparable<T>` 
	==, != operators	>, <, >=, <= operators
"Plugged-in"	`IEqualityComparer<T>` 	`IComparer<T>` 

object Doesn't Support Comparisons

Equality	Comparisons
`object.Equals()` (and other methods)	✗ No support in `System.object`

Equality makes sense for **all** types



Comparisons **don't** make sense for many types

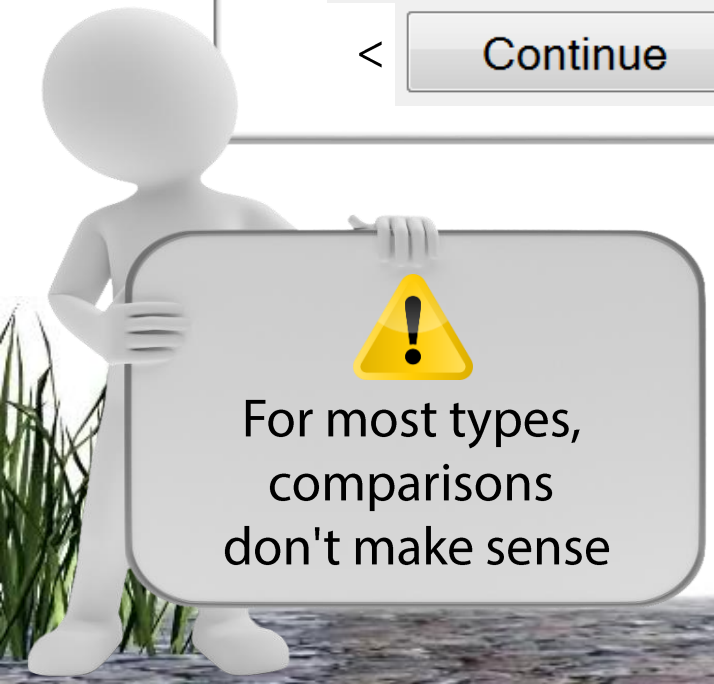
Comparisons

Is 3 < 4 ?

This question makes sense

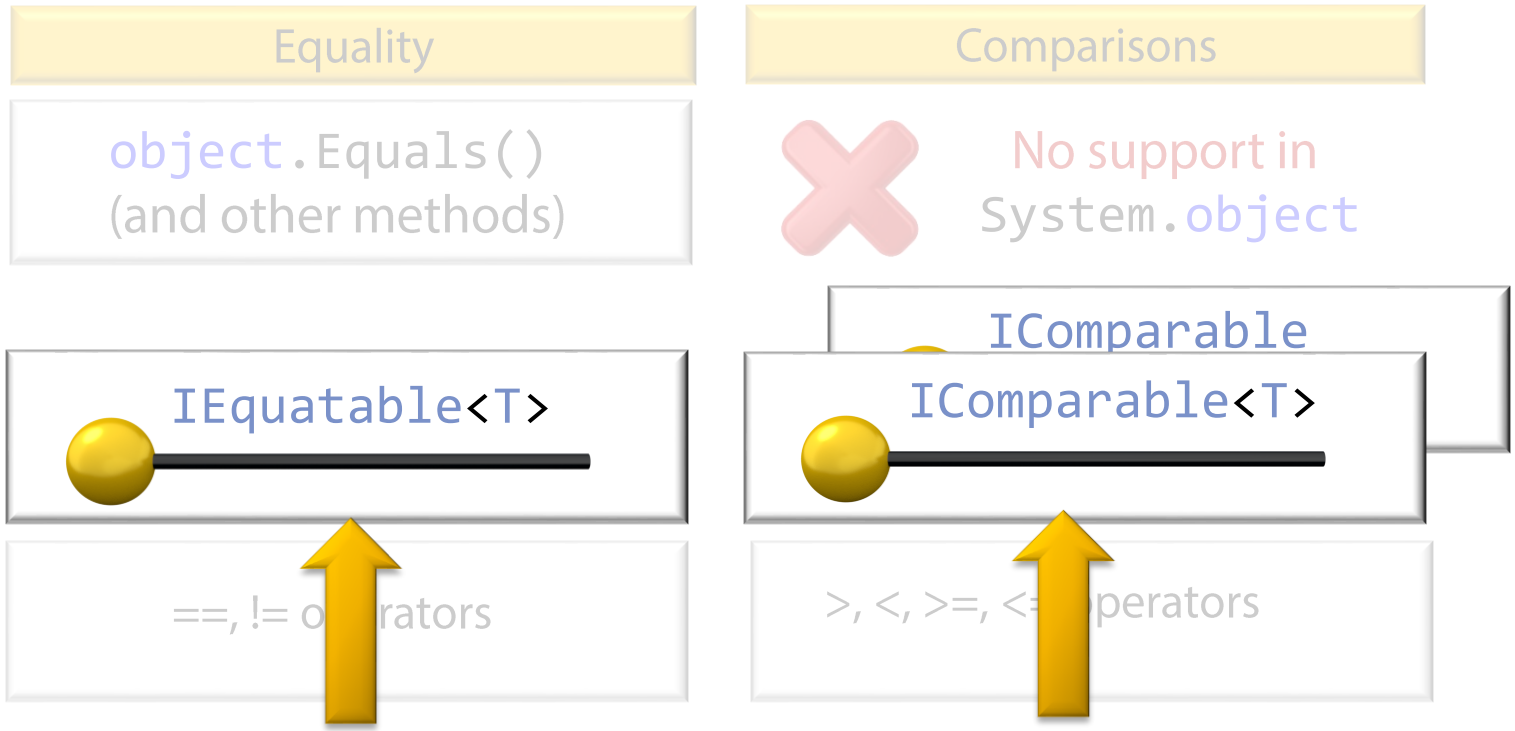
Is OK < Continue ?

This question is nonsense



For most types, comparisons don't make sense

Equality vs Comparisons in .NET



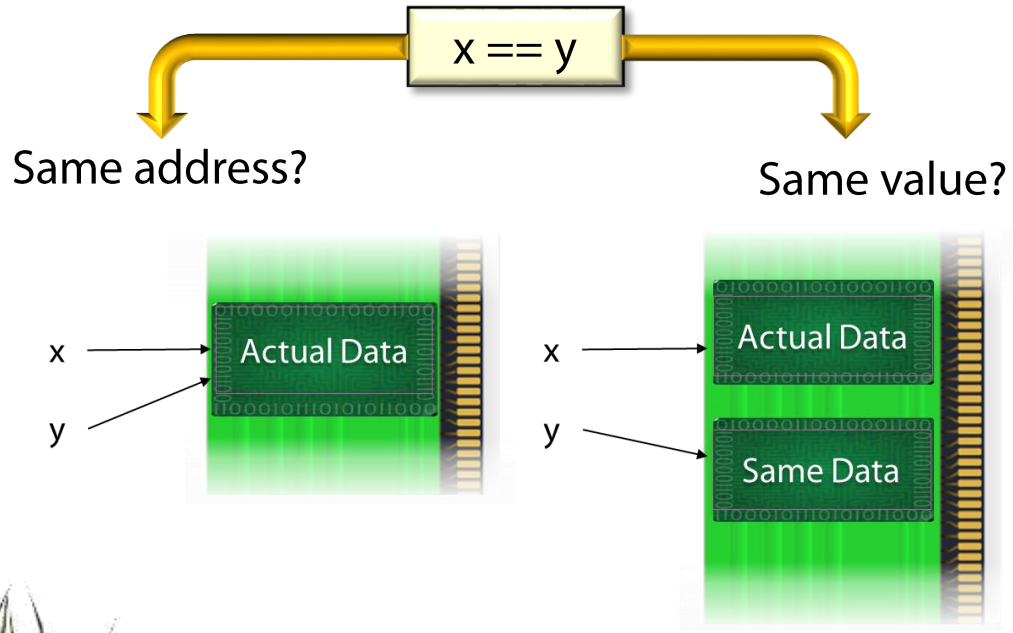
Supplement to
`System.object` methods

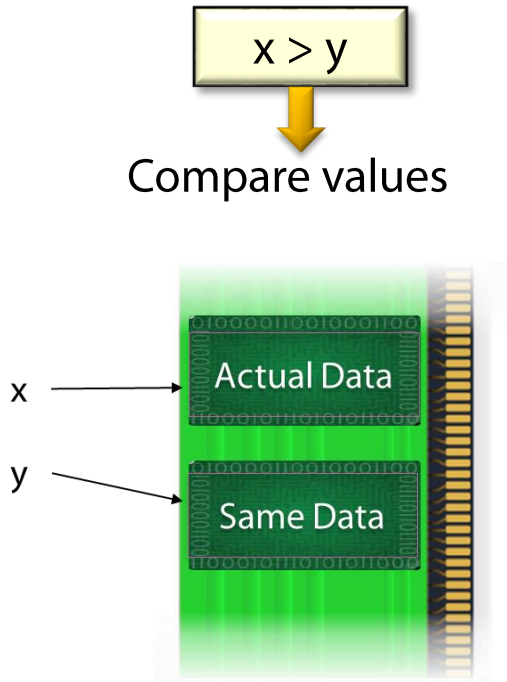
The way that a type declares
it knows how to compare instances

Comparisons are Value Only

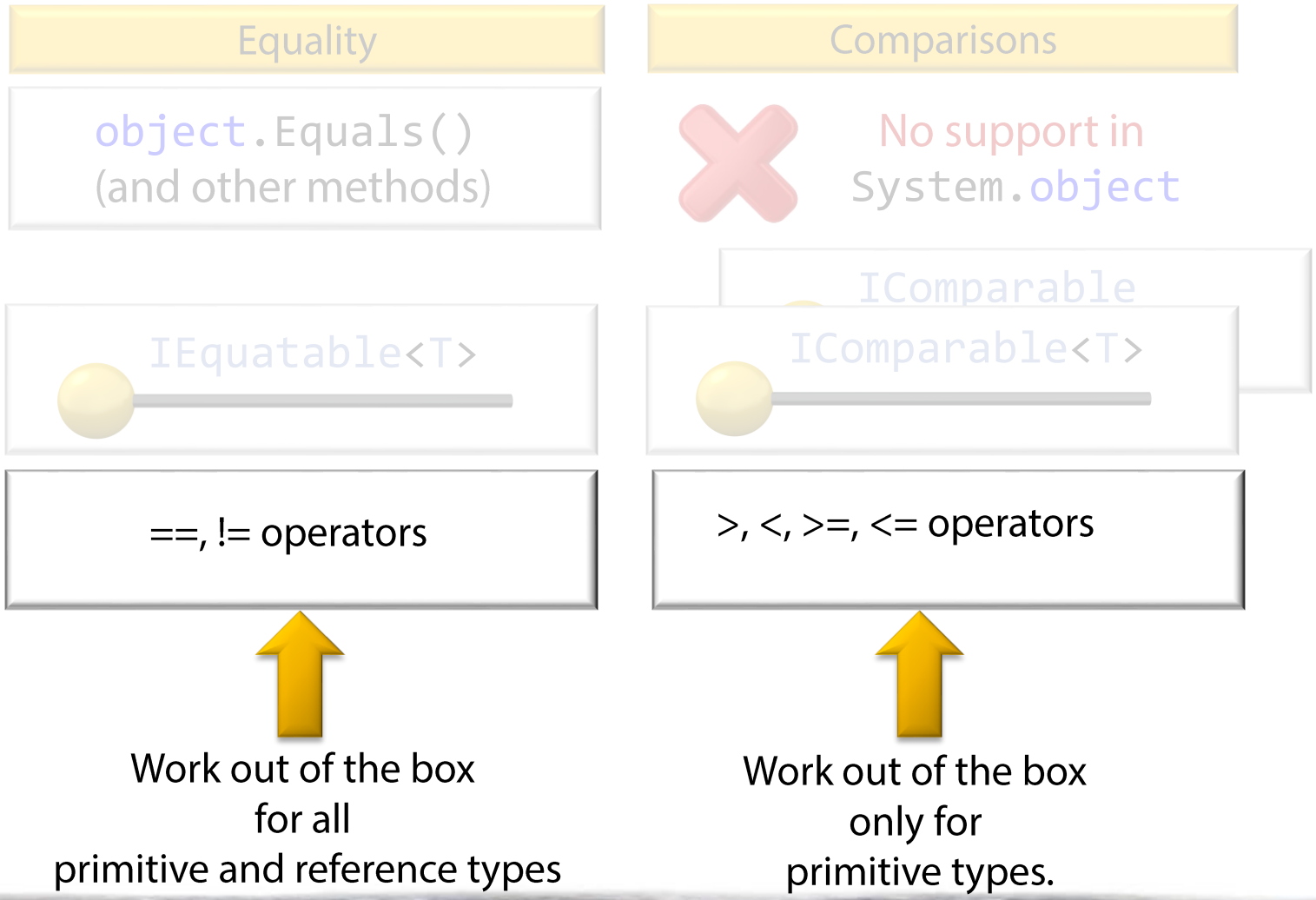
Equality: Reference or value

Comparisons: Value only





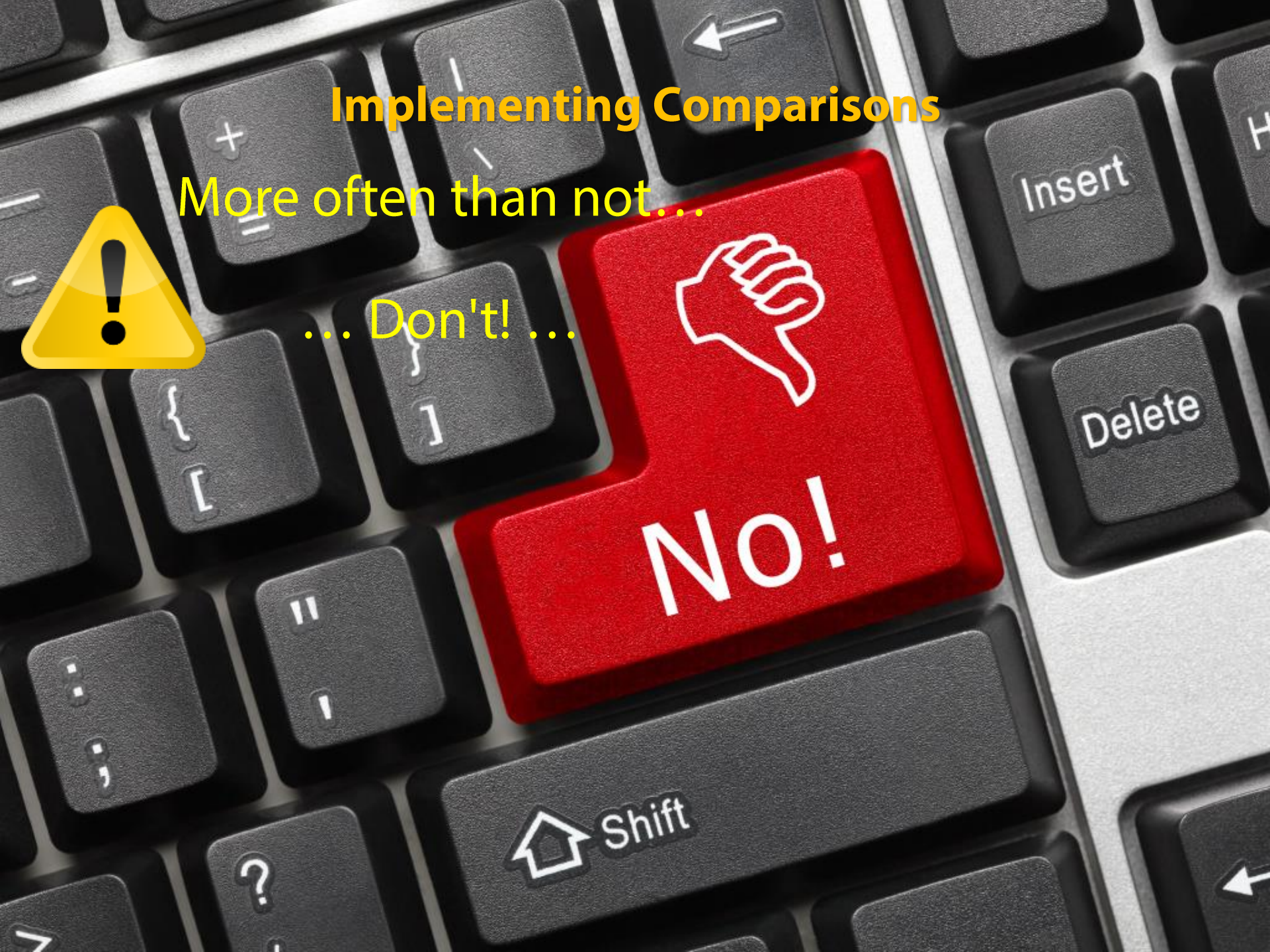
Equality and Comparison Operators



Implementing Comparisons

More often than not…

Implementing Comparisons



Comparing Foods….

Want add ability to sort foods

```
public class Food : IComparable<Food>
{
    public int CompareTo(Food other)
    {
    // what do you put here?
    }
```

Comparing Foods….

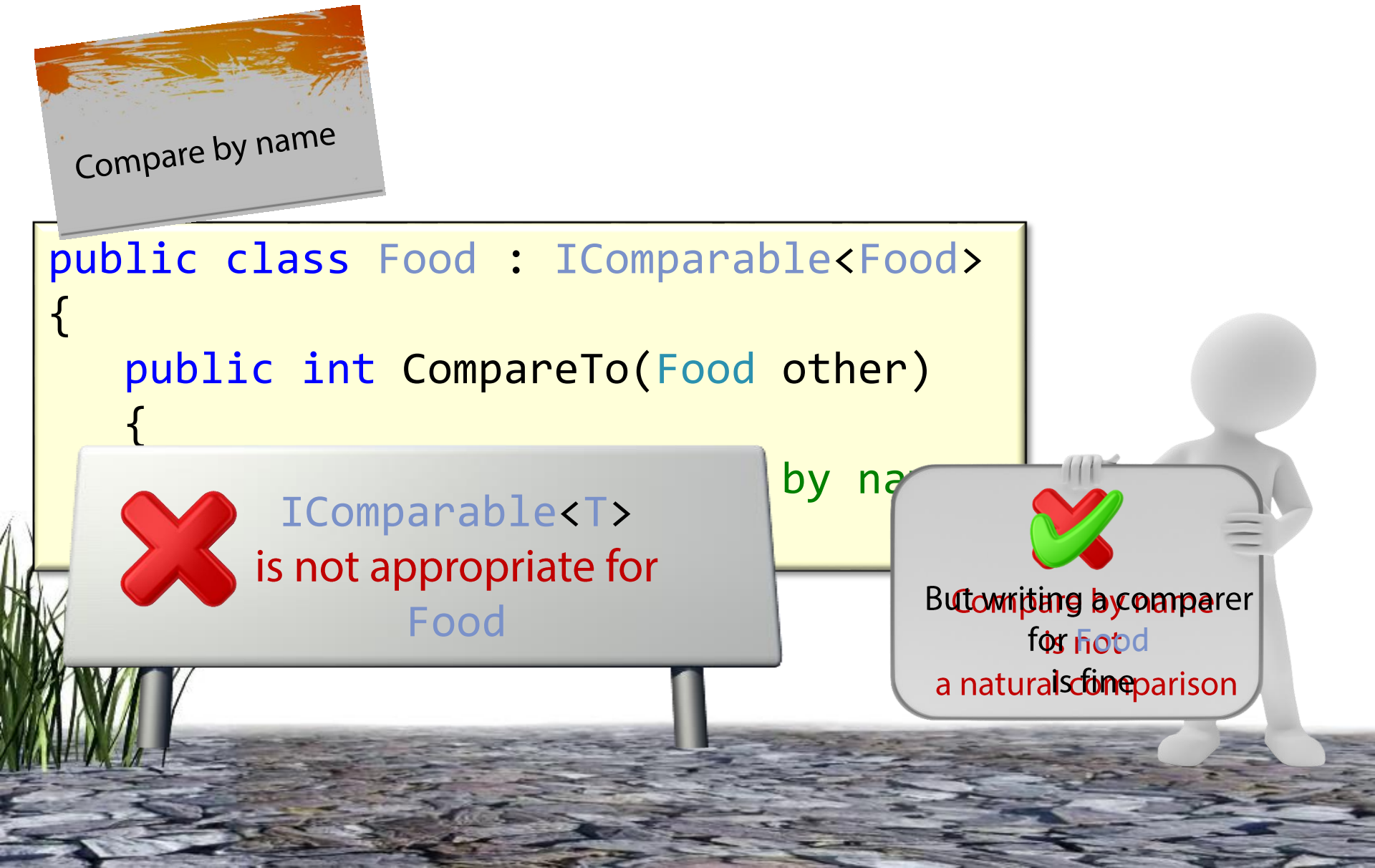
Compare by name?

Compare by food group?

Compare by calories?

```
public class Food : IComparable<Food>
{
    public int CompareTo(Food other)
    {
    // what do you put here?
    }
```

Comparing Foods….



Extra Issues for Reference Types

More checks in strongly typed `CompareTo()`…

```
// if CalorieCount is a class
public int CompareTo(CalorieCount other)
{
   if (other == null)
      return 1; // any instance comes after null
   if (ReferenceEquals(other, this))
      return 0;
   if (other.GetType() != this.GetType())
      // probably can't handle this
      throw new ArgumentException();
   // the logic - finally
   return this._value.CompareTo(other._value);
}
```

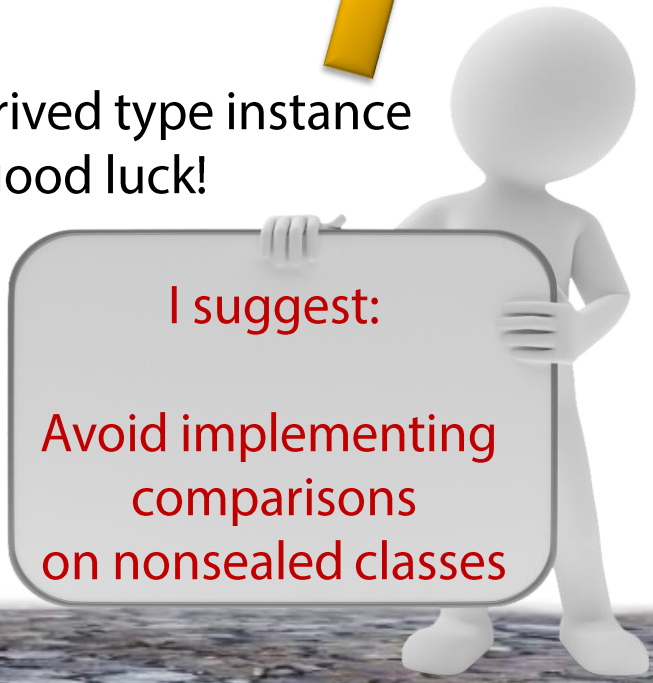
Extra Issues for Reference Types

If CalorieCount is an unsealed class…

… this happens…

```
public int CompareTo(CalorieCount other)
{
```

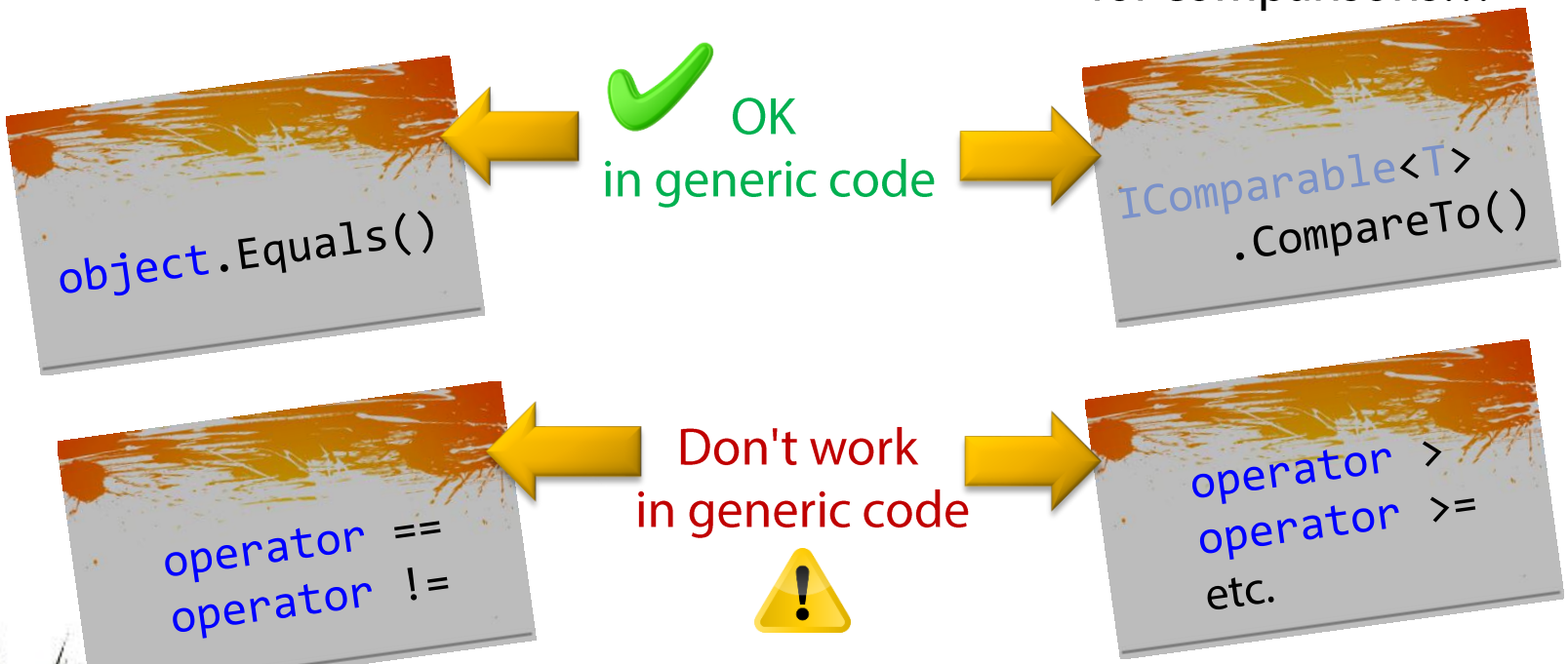
If this is a derived type instance
– good luck!



Generic Code

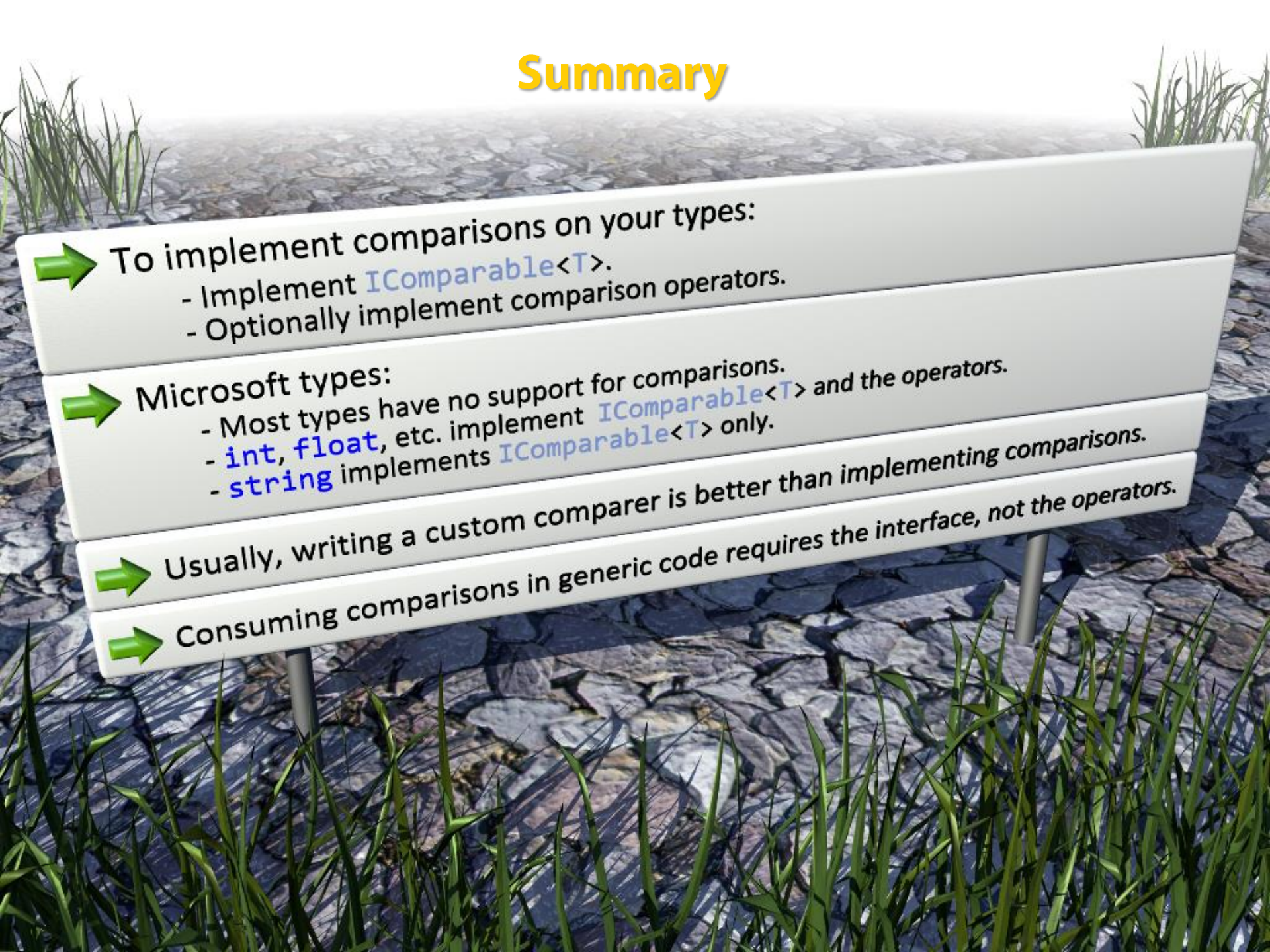
Recall for equality…

It's the same
for comparisons…



Code Demo

Summary


To implement comparisons on your types:
- Implement IComparable<T>.
- Optionally implement comparison operators.
Microsoft types:
- Most types have no support for comparisons.
- int, float, etc. implement IComparable<T> and the operators.
- string implements IComparable<T> only.
Usually, writing a custom comparer is better than implementing comparisons.
Consuming comparisons in generic code requires the interface, not the operators.