

Time Hybrids

Lamda Days 2024

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# Time Hybrids

nova science publishers

A New Generic Theory of Reality  
Fred Van Oystaeyen



# Generic Theory



# Generic Theory

- theory of theories



## Generic Theory

- theory of theories
- partially unifying framework theory where theories fit into



# Generic Theory of Reality



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- partially unifying framework theory where theories of reality fit into



# Generic Theory of Reality

- partially unifying framework theory where theories of reality fit into
  - relativity theory





# Generic Theory of Reality

- partially unifying framework theory where theories of reality fit into
  - relativity theory
  - quantum theory



# Generic Theory of Reality

- partially unifying framework theory where theories of reality fit into
  - relativity theory
  - quantum theory
- until now no unifying theory for them has been agreed upon



# Specification



# Specification

- *declares* features



# Specification

- *declares* features
- *defines* laws that come with those declared features



# Specification

- *declares* features
- *defines* laws that come with those declared features
- also *defines* features in terms of declared and defined features



# Implementation



# Implementation

- *defines* declared features of a specification





# Implementation

- *defines* declared features of a specification
- provides proofs of the laws that come with those declared features



## Description (as a painting)



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- below is an informal description of a pipe



## Description (as a painting)

- below is an informal description of a pipe



- well, not really, does it?



# Description (as a computational simulation)



## Description (as a computational simulation)

- this TED talk of [Stephen Wolfram](#) is about a, mathematically well-founded, description of reality that, maybe, can, somehow, be seen as an implementation of the specification of the generic theory of Fred Van Oystaeyen



## Continuous versus Discrete



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- relativity theory resp. quantum theory is a macro theory resp. micro theory, but where do micro and macro end?





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## Continuous versus Discrete

- relativity theory resp. quantum theory is a macro theory resp. micro theory, but where do micro and macro end?
- traditionally, mathematics is used to deal with that in a continuous, analytic way, using shrinking limits of time intervals
- recently, mathematics is used to deal with that in a discrete, algebraic way (if only because of the observational minimal Planck time unit!)



# Discrete



## Discrete

- Stephen Wolfram's mathematics uses an expanding limit of a time interval starting at some time moment (think of a big bang of graph rewriting without specific rules), recall that it is an implementation



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- Stephen Wolfram's mathematics uses an expanding limit of a time interval starting at some time moment (think of a big bang of graph rewriting without specific rules), recall that it is an implementation
- Fred Van Oystaeyen's approach also goes for a discrete, algebraic way but makes no concrete choices, recall that it is a specification



# Generic Theory of Mathematics as a foundation



# Generic Theory of Mathematics as a foundation

- Category Theory is a partially unifying framework theory where theories of mathematics fit into



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  - probability





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  - geometry (topology)



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  - others



# Generic Theory of Mathematics as a foundation

- Category Theory is a partially unifying framework theory where theories of mathematics fit into
  - probability
  - geometry (topology)
  - others
- Category theory is, just like reality, compositional



# Virtual Topology



## Virtual Topology

- Fred Van Oystayen's Virtual Topology is, as far as I know, the most abstract (read: simplest) geometry as far as being useful for modeling reality



# Virtual Topology

- Fred Van Oystayen's Virtual Topology is, as far as I know, the most abstract (read: simplest) geometry as far as being useful for modeling reality
- Virtual Topology is pointfree (cfr Category Theory)



# Program language notation



## Program language notation

- Mathematical notation can overwhelm you

$$R_{\mu\nu} - \frac{1}{2}R g_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$





## Program language notation

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  - many words used for one concept without explanation



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- Natural language notation can confuse you
  - many words used for one concept without explanation
  - one word used for many concepts without defining context
- Program language notation is required to be precise and, therefore may also overwhelm you, but the benefit is that it is checked by a type system that, by the way, is not overwhelmed by it



# Category

```
trait Category[BTC[_], _]  
  extends BtcComposition[BTC], BtcUnit[BTC]:
```



## CategoryLaws

```
trait CategoryLaws[L[_]: Law]:  
  
  def leftIdentity[Z, Y]: BTC[Z, Y] => L[BTC[Z, Y]] =  
    z2y => { i 'o' z2y } '=' { z2y }  
  
  def rightIdentity[Z, Y]: BTC[Z, Y] => L[BTC[Z, Y]] =  
    z2y => { z2y 'o' i } '=' { z2y }
```



## BtcComposition

```
trait BtcComposition[BTC[_], _]:  
  
  extension [Z, Y, X] (y2x: BTC[Y, X])  
    def 'o'(z2y: BTC[Z, Y]): BTC[Z, X]
```



## BtcCompositionLaws

```
trait CompositionLaws[L[_]: Law]:  
  
  def associativity[Z, Y, X, W]  
    : BTC[X, W] => BTC[Y, X] => BTC[Z, Y] => L[BTC[Z, W]] =  
    x2w => y2x => z2y =>  
    { (x2w 'o' y2x) 'o' z2y } '=' { x2w 'o' (y2x 'o' z2y) }
```





## BtcUnit

```
trait BtcUnit[BTC[_], _]:  
  def i[Z]: BTC[Z, Z]
```



# Time

```
trait Time[Moment: Arbitrary: Ordered]
```



# Time

```
trait Time[Moment: Arbitrary: Ordered]
```

- this allows us to



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```
trait Time[Moment: Arbitrary: Ordered]
```

- this allows us to
  - write statements involving arbitrary time moments



# Time

```
trait Time[Moment: Arbitrary: Ordered]
```

- this allows us to
  - write statements involving arbitrary time moments
  - state that one time moment is before another one



# Universe

```
trait Universe[
  Set[_]: Sets,
  Morphism[_ , _]: Category: ActingUponFunction,
  Moment: Time,
  State: [_] =>> VirtualTopology[
    Set,
    State
  ]: [_] =>> Functor[
    [_ , _] =>> MomentMorphism,
    Morphism,
    [_] =>> State
  ]
]
```



## Universe continued



## Universe continued

- this allows us to





## Universe continued

- this allows us to
  - write statements using topological features of universe states



## Universe continued

- this allows us to
  - write statements using topological features of universe states
  - write statements relating time moment transitions, to universe state morphisms (think of an dynamic, expanding universe)



## An example: immobility



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- immobility can be expressed without mentioning real numbers for time and space



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  - Euclides did not use numbers to measure with



## An example: immobility

- immobility can be expressed without mentioning real numbers for time and space
- some history of geometry
  - Euclides did not use numbers to measure with
  - Pythagoras showed that rational numbers were not enough



## immobileAfter

```
val immobileAfter
  : MomentMorphism => L[Function[PreThingsSet, State]] =
mm =>
  {
    pts2s 'o' mm2ptsf(mm)
  } '=' {
    mm2sm(mm) 'a' pts2s
  }
```





## immobileAfter

```
val immobileOnInterval
  : MomentMorphism => PreThingsSet => L[State] =
  case (bm, em) =>
    val mi: Interval[Moment] = interval apply ((bm, em))
    pts =>
      all apply {
        for {
          m <- mi
        } yield {
          {
            (pts2s 'o' mm2ptsf((bm, m)))(pts)
          } '=' {
            (mm2sm((bm, m)) 'a' pts2s)(pts)
          }
        }
      }
    }
```



Reality goes beyond Imagination



## Reality goes beyond Imagination

- the 'a' in the formula is not morphism composition 'o'



## Reality goes beyond Imagination

- the 'a' in the formula is not morphism composition 'o'
- the 'a' in the formula is an action of morphism  $mm2sm(mm)$  on the place function  $pts2s$



## Reality goes beyond Imagination

- the 'a' in the formula is not morphism composition 'o'
- the 'a' in the formula is an action of morphism  $mm2sm(mm)$  on the place function  $pts2s$
- cfr a monoid acting upon a set
- cfr rotations acting upon a Rubic Cube



## More Information

<https://github.com/LucDuponcheelAtGitHub/timeHybrids>



THANKS FOR ATTENDING

