Time Hybrids

A New Generic Theory of Reality

Fred Van Oystaeyen

Time Hybrids

Trying to understand the book using Programmatic Notation

Luc Duponcheel

WARNING 1

My understanding of the book
may not correspond with what Fred had in mind.

WARNING 2

Only a small part of the book will be dealt with.

WARNING 3

The natural language of this presentation is informal.

...

but

...

The programming language of this presentation is formal.

WARNING 4

Do not expect me to go into all details.
There is room for questions after the presentation.

Part One

Setting the scene.

How the traditional theory models reality.

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- Reality evolves from continuous to discrete driven by (measure based) shrinking time intervals.

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  go to 0.
- Mathematically this approach from (continuous) intervals to (discrete) points is ok.
  But is it ok in reality?
- No: there does not exist *"something"* at any point.
  "when time goes to 0", *reality itself* is, eventually, not observable any more.

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  the geometry of the universe is *dynamic* :
  place transitions are driven by *moment intervals* and *movement* can be defined *functorially*.
- Mathematically this approach from discrete to continuous is ok.
  But is it ok in reality?
- Yes, but: reality will always be discrete for us.
  "when time goes to ∞", reality is, eventually, not observable any more *by us*.

Part Two

Generic Theory

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Generic Theory

- I tend to think of a *generic theory*
  as a
  partially unifying specification theory
  where
  theories are *specific implementations* of.

Theories of Reality

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- *Relativity Theory*.

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- *Quantum Theory*.

Theories of Reality

- *Relativity Theory*.
- *Quantum Theory*.
- Until now no *fully unifying theory* has been agreed upon.

Theories of Mathematics

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- *Group Theory*.

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- *Measure Theory*.

Theories of Mathematics

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- . . .

Theories of Mathematics

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- . . .
- I tend to think of *Category Theory* as a *Generic Theory of Mathematics*.

Compositionality

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  - *Data-like components*.

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- Components can,
  starting from *atomic components*,
  be *composed* to *composite components*.
- Components come in two classes.
  - *Funtion-like components*.
  - *Data-like components*.
- Both come with *limits*.

Correspondences (traditional)

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- In the traditional theory
  there is a *"functorial" correspondence* between
  $t \to p(t)$, the *place function* of *"something"*,
  and
  $t \to v(t)$, the *velocity function* of *"something"*,
  as
  $v(t) = d(p(t))/dt$, a limit for time interval sizes going to 0.

Correspondences (new)

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- In the new theory
  sets of "something"s evolve to a limit for time interval sizes going to ∞.
  In the dynamic universe *places themselves* change driven by *time intervals* and
  the *movement* of *sets of "somethings"s after* resp *at* a time interval
  is defined as a *"functorial" correspondence* without any limits involved.

Category Theory

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  - Data-like *objects*.
  - Function-like *morphisms* between objects.
- Category theory is function-like compositional.
  - Morphisms can be *composed sequentially*.

Part Three

Specification and Implementations

Specification

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- *Declares features*.

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- Declared features, together with their laws, form the *requirements* of the specification.
- *Defines* features in terms of declared and defined features.

Implementations

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- *Define* declared features.

Implementations

- *Satisfy* the requirements of the specification.
- *Define* declared features.
- *Come with proofs* of the laws for those defined features.

Part Four

Writing a specification and its implementations programatically

Composition

```
trait Composition[Morphism[_, _]]:

  extension [Z, Y, X](ymx: Morphism[Y, X])
    def o(zmy: Morphism[Z, Y]): Morphism[Z, X]

  type Transition = [Z] =>> Morphism[Z, Z]
```


Composition

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  is a *binary type constructor* parameter of
  `Composition`.
- *Types* `Z`, `Y`, `X`, . . . *implicitly* model *(homogeneous) sets*.
- *Values* `z`, `y`, `x`, . . . *implicitly* model *elements*.

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Composition

Composition

- $\circ$ is a *sequential composition operator*.

Composition

- `o` is a *sequential composition operator*.
- Values `zmy` . . . are morphisms from `Z` to `Y`.

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- `Transition` involves only one type `Z`.

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```

Associativity

```
def associativity[Z, Y, X, W]
    : Morphism[Z, Y] =>
        Morphism[Y, X] =>
            Morphism[X, W] =>
            L[Morphism[Z, W]] =
  zmy =>
    ymx =>
      xmw =>
        {
            (xmw o ymx) o zmy
        } `=` {
            xmw o (ymx o zmy)
        }
```

Unit

```
trait Identity[Morphism[_, _]]:

  def i[Z]: Morphism[Z, Z]
```


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Category

```
trait Category[Morphism[_, _]]
  extends Composition[Morphism],
      Identity[Morphism]:

  def composeAll[Z]
    : List[Transition[Z]] => Transition[Z] =
    _.foldLeft(i)(_ o _)
```

Functor

```
trait Functor[
    FromMorphism[_, _]: Category,
    ToMorphism[_, _]: Category,
    Correspondence[_]
]:

  def f[Z, Y]: Function[
    FromMorphism[Z, Y],
    ToMorphism[Correspondence[Z], Correspondence[Y]]
  ]
```

Time, Universe, (Pre-)Things

Time, Universe, (Pre-)Things

- *We introduce a generic model for space-time where time is just a totally ordered set ordering the states of the universe at moments where over (not in) each state we define potentials or pre-things which are going to evolve via correspondences between the momentary potentials to existing things. Existing takes time. We can define a place function where some set of pre-things is mapped to a place of the topology of the universe.*

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- *Things* are artifacts of the *existing reality*.

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- *Observing takes even more time.*

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- *Pre-things* are *momentary*.
- *Things* are artifacts of the *existing reality*.
- *Existing takes time.*
- *Observing takes even more time.*
- *What is it that we observe?*

Part Five

Code fragments.

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- fragment

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More Information

https://github.com/LucDuponcheelAtGitHub/timeHybrids

THANKS FOR ATTENDING