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# **archery Documentation**

***Release 0.1.8***

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- Source : <https://github.com/jul/archery>
- Tickets : <https://github.com/jul/archery/issues?state=open>
- Latest documentation : <http://archery.readthedocs.org/en/latest/index.html>

It is an enhancement of MutableMapping based on Mixins. It currently only offers:

- addition;
- subtraction;
- multiplication;
- division.

And also mixins for:

- searching

Or treating dict as vectors giving them:

- norms (abs)
- cosine
- dot product



Contents:

## 1.1 Package content

### 1.1.1 archery.trait

see: *Traits are Mixins*

Traits are the Perl equivalent of mixins (ruby behaviour). The mixins in archery are dedicated to provide customisable operator on mapping for :

- addition,
- subtraction,
- division,
- multiplication

archery.trait provides individual trait.

### 1.1.2 archery.quiver

see *Quivers : consistent sets of Traits*

A quiver is a set of traits lovingly assembled so that they are consistent.

### 1.1.3 archery.bow

see *Bow Specialized dict ready to use based on quivers*

Ready made MutableMapping (dict) that supports addition.

### 1.1.4 archery.barrack

see *Barrack: the place for stuff connected to archery*

Misc utilities.

## 1.2 Bow Specialized dict ready to use based on quivers

### 1.2.1 vdict

A dict that supports cosine, abs, dot product:

```
>>> from archery import vdict as Point
>>>
>>> u = Point(x=1, y=1)
>>> v = Point(x=1, y=0)
>>> u.cos(v)
>>> 0.7071067811865475
>>> u.dot(v)
>>> 1
>>> u.cos(2*v)
>>> 0.7071067811865475
>>> u.dot(2*v)
>>> 2
>>> abs(u)
>>> 1.4142135623730951
>>> u3 = Point(x=1, y=1, z=2)
>>> u4 = Point(x=1, y=3, z=4)
>>> u3 + u4
>>> dict(x=2, y=4, z=6)
>>> assert u4 + u4 == 2*u4
```

### 1.2.2 mdict (former Daikyu)

Mnemonic for multiplicative dict that can

- addition;
- subtraction;
- multiplication;
- division (please, please be careful).

It instantiates like a dict:

```
>>> from archery import mdict
>>> b=mdict(x=2, z=-1)
>>> a=mdict(x=1, y=2.0)
>>> a+b
# OUT: {'y': 2.0, 'x': 3, 'z': -1}
>>> b-a
# OUT: {'y': -2.0, 'x': 1, 'z': -1}
>>> -(a-b)
# OUT: {'y': -2.0, 'x': 1, 'z': -1}
>>> a+1
```

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```
# OUT: {'y': 3.0, 'x': 2}
>>> -1-a
>>> # OUT: {'y': -3.0, 'x': -2}
>>> a*b
# OUT: {'x': 2}
>>> a/b
# OUT: {'x': 0}
>>> 1.0*a/b
# OUT: {'x': 0.5}
```

### 1.2.3 Why div is special?

Because div is special and I stick to python 2 behaviour on this one.

<http://beauty-of-imagination.blogspot.fr/2012/05/dividing-is-not-as-easy-at-it-seems.html>

Don't flame me yet, I can provide another diver, but my brain is yet kaput.

**See by yourself::**

```
>>> b/2
# OUT: {'x': 0, 'z': 0}
>>> b/2.0
# OUT: {'x': 1.0, 'z': -0.5}
>>> 2/b
# OUT: {'x': 0, 'z': -2}
```

**But you can correct this::**

```
>>> 2.0/(1.0*b)
# OUT: {'x': 1.0, 'z': -2.0}
```

### 1.2.4 Mixing scalars and records

My preferred part :)

```
>>> 2*mdict(x=1, y="lo", z=[2])
{'y': 'lolo', 'x': 2, 'z': [2, 2]}
>>> mdict(y=1, z=1)*Daikyu(x=1, y="lo", z=[2])*2
{'y': 'lolo', 'z': [2, 2]}
>>> a=mdict(dictception=dict(a=1,b=2), sample = 1, data=[1,2])
>>> b=mdict(dictception=dict(c=-1,b=2), sample = 2, data=[-1,-2])
>>> a+b
{'sample': 3, 'dictception': {'a': 1, 'c': -1, 'b': 4}, 'data': [1, 2, -1, -2]}
>>> mdict(dictception=1, sample=1)* a*b
{'sample': 2, 'dictception': {'b': 4}}
```

Whatever meanings you gave to + it propagates the meaning. For algebraic use I recommend to use algebraic types (complex, numpy arrays, floats, int).

## 1.3 Traits are Mixins

Traits are Mixins, behaviours. All these terms recovers loosely the same idea.

In this case referring to even older conventions traits are concrete classes for abstract classes/interfaces.

`collections.MutableMapping` defines an interface and some concrete methods. Since `isinstance` relies on interfaces (ducktyping) I can safely use it to implement methods that don't exist and will normally work for most Mappings.

### 1.3.1 General Rules:

#### Generic behaviour

The Operation is propagated for each keys of both Mappings and will be propagated to the ending values. If the values are `MutableMapping` with the operation they will propagate. If the values are not `MutableMapping` with the trait, the operation will apply in place.

**Warning:** If your `MutableMapping` with Addition is made of `MutableMapping` without it, you'll have a problem. To solve the problem use `:ref:'bowyer' _`

#### Scalar Operations

A scalar is everything that is not a `MutableMapping`. Trait support things such as integer, array operation by applying the operation on each values of the `MutableMapping`. Order is respected.

#### Inclusive Trait

If a key is absent on one of the Mapping, it will be considered the neutral element. An empty list, for list, 0 for int, 0.0 for float...

The behaviour of addition and subtraction is consistently deriving from the boolean algebrae meaning of `+` in a set context where `+` means union.

Thus Addition and subtraction are inclusive.

#### Exclusive Trait

Multiplication operates as an intersection, because on one hand it is consistent with the set/boolean meaning of multiplication, and also that neutral element of addition, is normally the null element of multiplication. Since multiplication implies division, instead of multiplying by 0 and keeping present in at least one dict, I prefer to avoid the raging division by zero. In short, I try to avoid my dict to explode when dividing by 0. I am weak I know.

### 1.3.2 Summary of the behaviours and dependancies

Operation	Short	Behaviour	Requires	Safe	Name
Copier	copy	None			
Addition	add	Inclusive	copy	Yes	InclusiveAdder
Multiplication	mul	Exclusive	add,copy	Yes	ExclusiveMuler
Substraction	sub	Inclusive	add,mul,copy	Yes	InclusiveSubber
Division	div	Exclusive	add,mul,sub,copy	No	TaintedExclusiveDiver

### 1.3.3 Caveat

#### Why is dividing unsafe?

<http://beauty-of-imagination.blogspot.fr/2012/05/dividing-is-not-as-easy-at-it-seems.html>

## 1.4 Quivers : consistent sets of Traits

Yes, it is a pun, trait = arrow  $\Leftrightarrow$  quiver = set of arrows.

### 1.4.1 Available quivers

#### VectorDict

A quiver to add cosinus/abs/dot to any MutableMappings (A mutable mapping is a meta class that behaves like a dict

```
>>> from archery.quiver import VectorDict
>>> from collection import Counter
>>> from math import cos, pi
>>> class CCos(Counter, VectorDict): pass
>>>
>>> sim = CCos(["word", "hein?"]).cos(CCos(["word"]))
>>> assert sim == cos(pi/4)
>>>
>>> class Point(VectorDict, cos): pass
>>>
>>> u = Point(x=1, y=1)
>>> v = Point(x=1, y=0)
>>> u.cos(v)
>>> 0.7071067811865475
>>> u.dot(v)
>>> 1
>>> u.cos(2*v)
>>> 0.7071067811865475
>>> u.dot(2*v)
>>> 2
>>> abs(u)
>>> 1.4142135623730951
```

#### SimplyAdd

A quiver to make your MutableMapping add:

```
>>> from archery.quiver import SimplyAdd
>>> class Daddy(SimplyAdd, dict): pass
>>>
>>> a= Daddy({'x' : 1 , 'y' : [], 'z' : "hell"})
>>> b= Daddy({'x' : 2 , 'y' : [1,3], 'z', "o"})
>>> print a+b
# {'y': [1, 3], 'x': 3, 'z': 'hello'}
>>> a+=b
>>> print a
```

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```
# {'y': [1, 3], 'x': 3, 'z': 'hello'}
>>>
>>> r=Daddy(a=1)
>>> print r+1
# {'a': 2}
>>> print -1+a
# {'a': 0}
```

If you are smart, you almost have the subtraction  $\wedge \_ \wedge$

## LinearAlgebrae

A quiver to make your MutableMapping support  $+ - / *$

Pretty much as easy to use as SimplyAdd

### 1.4.2 Why quivers?

My purpose is not to make trait for the sake of making traits. It is to have a bigger set of concrete class for purpose. But I want them to be consistent.

My (not yet available) unittest for trait check for actual results (such as  $2+2=4$ ), my unittest (not yet available) test for how well the operations are coupled in terms of commutation, symmetry, distributivity, associativity.

I see nothing wrong in changing the behaviour of add and sub (you may want to have fun with non euclidian space). But you may want an algebra to follow the least surprise principle. That's all about it.

## 1.5 Barrack: the place for stuff connected to archery

### 1.5.1 mapping\_row\_iter

My secret weapon for transforming dict in CSV:

```
>>> from archery.barrack import mapping_row_iter
>>> [ x for x in mapping_row_iter({
...     "john" : {'math':10.0, 'sport':1.0},
...     "lily" : { 'math':20, 'sport':15.0}
... })]
[['john', 'sport', 1.0], ['john', 'math', 10.0],
 ['lily', 'sport', 15.0], ['lily', 'math', 20]]
```

## 1.6 Misc interesting questions

### 1.6.1 What is addition in MutableMapping useful for?

It is used with [parseweblog](#) as an example. I find addition on MutableMapping a very convenient way to reduce by using in place addition (`__iadd__`).

[VectorDict](#) also has an example of map/reduce with [multiprocessing word counting](#)

`MapReduce` is a way of treating big data without consuming too much memory ensuring relatively good performance. It is normally considered to belong to the functional paradigm and is best used with generators.

### 1.6.2 Doesn't it overlaps with defaultdict?

No. Results seems similar, but the `collections.defaultdict` philosophy is different and does not mix in very well with archery because you have a conflict. I therefore admit, there is a design flaw in `VectorDict`.

`defaultdict` creates missing key from a factory (a function with void argument) and will consider that asking for a key that does not exists makes it real.

`MutableMapping` with the default traits will raise an Exception in such case, however, if you add to `MutableMapping`, as the default Adder is Inclusive, it will add the existing key of the source and destination. No values in `MutableMapping` with the default Adder will exists unless there are already defined in the `MutableMappings`.

Since traits are flexible, You or I could provide more stricts dict.

Trait seems to provide `autovivification` but it does not ! No values will be created on the fly.

As a result, there is a conflict between `defaultdict` and traits : for instance with a `defaultdict` when you add with a value that does not exists in one of the dict you should use the default factory. With actual traits, it is assumed the value is the neutral element of addition, thus having far less problems than with `defaultdict`.

### 1.6.3 Why so much fuss on Algebrae if you use Addition 99% of the time?

Because Algebrae is not about knowing the value of  $1 + 1$ , it is about consistency rules for operator. People usually focus on the operand of an operation to check if it works, I focus on the operator behaviour and how well they behave together. Mathematical symbols are a litterature whose intuition can safely work if we stay in the safeguard of the acceptable behaviour. These behaviours are commonly refered: distributivity, neutral element, scalar multiplication (or linear combinations), associativity.

Algebrae, is as a result for me only a functional test for the macro behaviour of addition. Addition alone has **strictly** no sense.

### 1.6.4 What is your naming convention, and what is archery exactly?

It is all explained her : <http://beauty-of-imagination.blogspot.com/2012/05/joice-and-headache-of-naming.html>

### 1.6.5 Why do you ask to sign a legal disclaimer with my blood and sign a pact with Satan if I want to use div?

We you look into the abyss, the abyss look into you: <http://beauty-of-imagination.blogspot.fr/2012/05/dividing-is-not-as-easy-at-it-seems.html>

Using division will make you lose your sanity and your confidence in computers reliability. Unless, you are fully prepared for this, and you have agreed I warned you, and you really know what you are doing : **I warn you to avoid using division on `MutableMapping`.**

I can use `div` since I don't fear losing what I am deprived of (sanity).

## 1.6.6 Who needs archery?

- people wanting to experiment what a good addition on any MutableMapping (dict included) could be (**trait** documentation is for them);
- people wanting to have a consistent set of operations for their MutableMapping (**quiver** is for them);
- those who wants ready made dict pretty practical for map/reduce (**bow** is for them).

## 1.7 Changelog and roadmap

### 1.7.1 Changelog

**0.1.6** Tested py3.2 on my freeBSD, it works for me ©

**0.1.4** closes #6 : trying to install on debian stable is like contemplating a machine frozen 5 years ago. Rerunning tests on debian

**0.1.3** blocking install if tests don't pass

**0.1.2** py3 compliance

**0.1.1** closing [issue5](#) : some performance issue in `__iadd__` aka +=

**0.1.0** initial release

### 1.7.2 Convention:

version x.y.z

while in beta convention is :

- **x** = 0
- **y** = API change
- **z** = bugfix and/or improvement

and then

- **x** = API change
- **y** = improvement
- **z** = bugfix

### 1.7.3 Roadmap

Maybe backporting the search find and replace feature of [VectorDict](#)

## CHAPTER 2

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### Indices and tables

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- `genindex`
- `modindex`
- `search`