Java

Meetup

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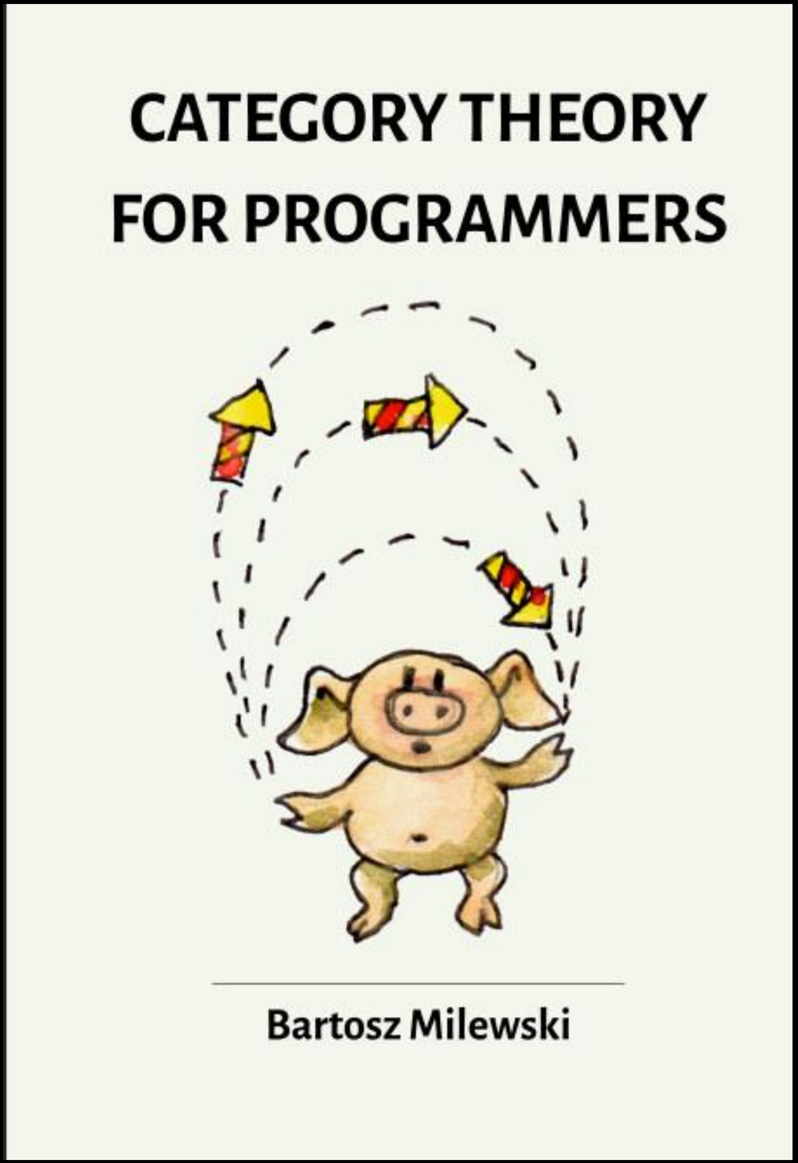
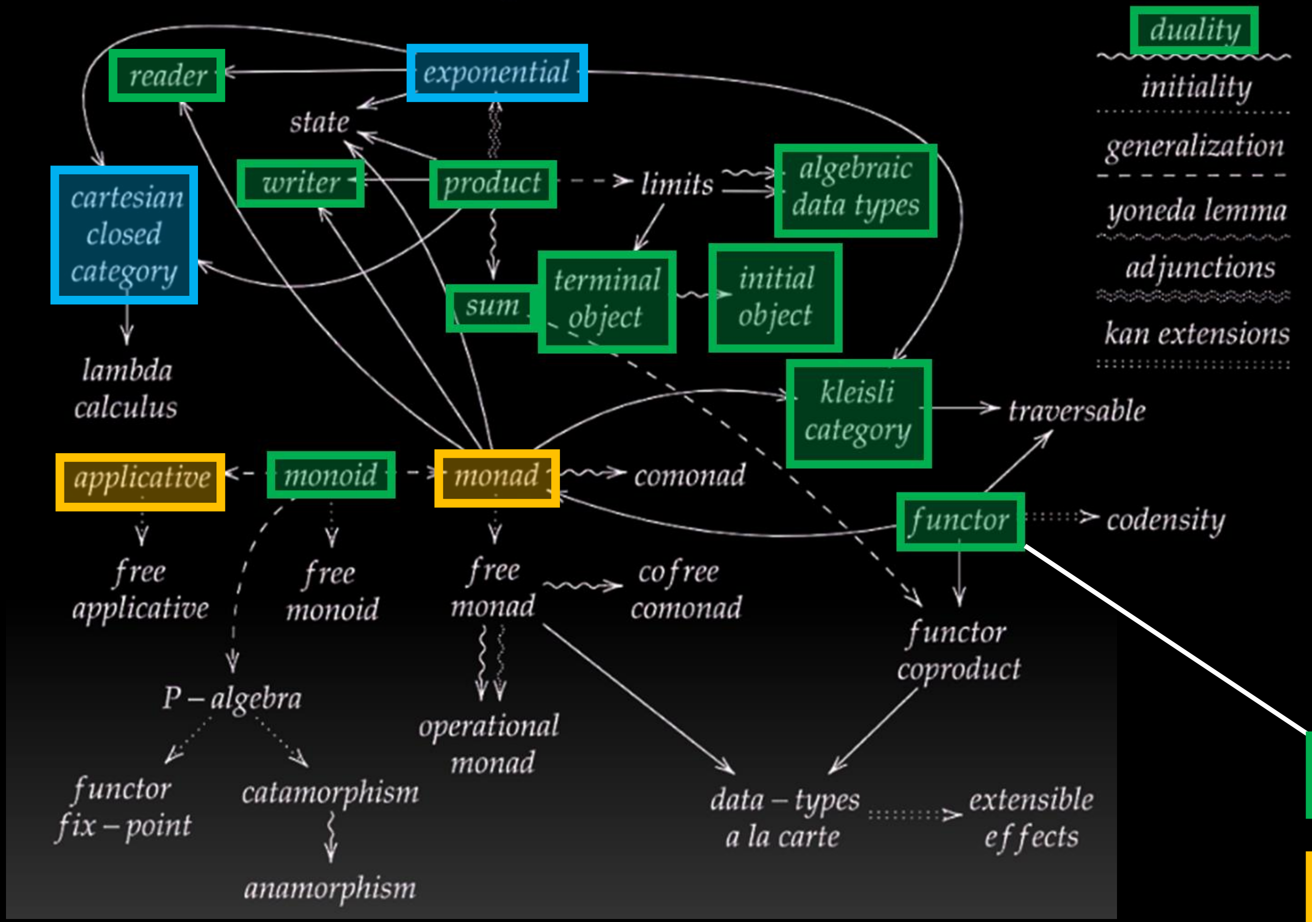
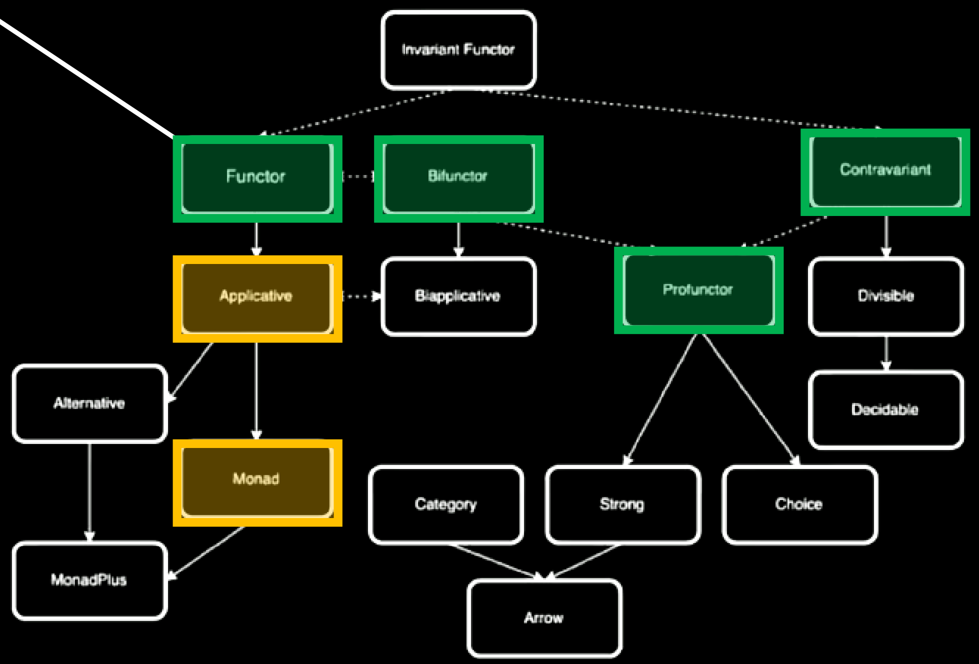


Category Theory for Programmers

Chapter 9: Function Types

The Tools for Thought





9.2 Currying

Currying is essentially built into the syntax of Haskell. A function returning a function:

```
a -> (b -> c)
```

is often thought of as a function of two variables. That's how we read the un-parenthesized signature:

```
a -> b -> c
```

Strictly speaking, a function of two variables is one that takes a pair (a product type):

```
(a, b) -> c
```

It's trivial to convert between the two representations, and the two (higher-order) functions that do it are called, unsurprisingly, `curry` and `uncurry`:

```haskell
curry :: ((a, b) -> c) -> (a -> b -> c)
curry f a b = f (a, b)
```

and

```haskell
uncurry :: (a -> b -> c) -> ((a, b) -> c)
uncurry f (a, b) = f a b
```

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Conor Hoekstra (he/him)

code_report

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LeetCode

905. Sort Array By Parity

Easy 586 62 Favorite Share

Given an array `A` of non-negative integers, return an array consisting of all the even elements of `A`, followed by all the odd elements of `A`.

You may return any answer array that satisfies this condition.

https://leetcode.com/problems/sort-array-by-parity/

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```cpp
auto sortArrayByParity(vector<int>& A) {

    std::partition(
        std::begin(A),
        std::end(A),
        [](auto e) {
            return e % 2 == 0;
        });

    return A;
}
```

Thrust thrust::partition

Conor Hoekstra

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```cpp
auto sort_array_by_parity(auto& A) {

    std::ranges::partition(A,
        [](auto e) { return e % 2 == 0; });

    return A;
}
```

```cpp
auto sort_array_by_parity(auto& A) {

    auto is_even = [](auto e) { return e % 2 == 0; };
    std::ranges::partition(A, is_even);

    return A;
}
```


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[1,2,3,4,5,6]
([1,3,5],[2,4,6])
[1,3,5,2,4,6]
sortArrayByParity :: [Int] -> [Int]
sortArrayByParity = uncurry (++)
. partition odd
33
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13:39 / 58:33

```
Prelude Data.List> partition odd [1..10]
([1,3,5,7,9],[2,4,6,8,10])

Prelude Data.List> :t (++)
(++) :: [a] -> [a] -> [a]

Prelude Data.List> :t uncurry (++)
uncurry (++) :: ([a], [a]) -> [a]
```

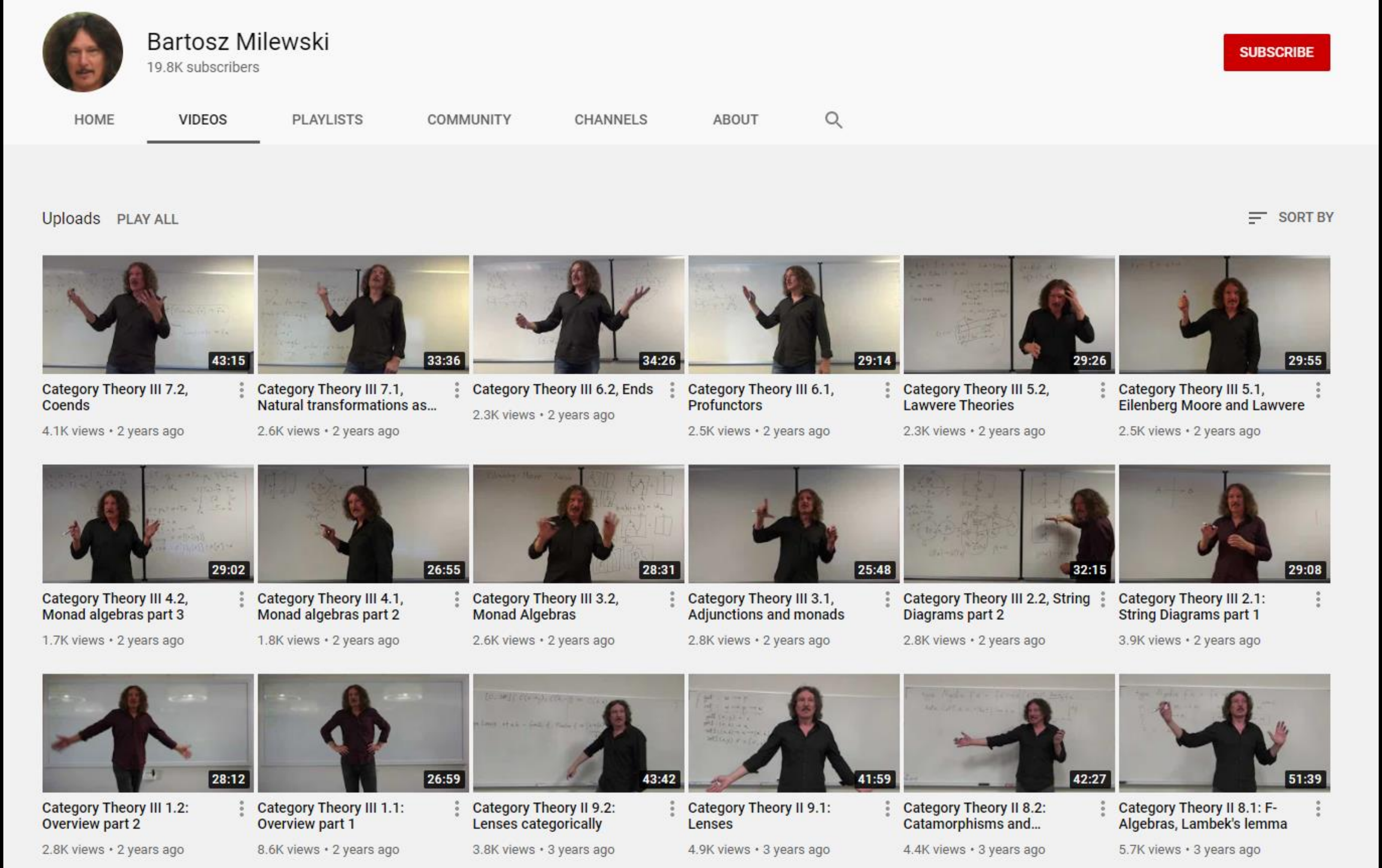
9.4 Cartesian Closed Categories

Although I will continue using the category of sets as a model for types and functions, it's worth mentioning that there is a larger family of categories that can be used for that purpose. These categories are called *Cartesian closed*, and **Set** is just one example of such a category.

A Cartesian closed category must contain:

1. The terminal object,
2. A product of any pair of objects, and
3. An exponential for any pair of objects.

Computers are not only helping mathematicians do their work — they are revolutionizing the very foundations of mathematics. The latest hot research topic in that area is called Homotopy Type Theory, and is an outgrowth of type theory. It's full of Booleans, integers, products and coproducts, function types, and so on. And, as if to dispel any doubts, the theory is being formulated in Coq and Agda. Computers are revolutionizing the world in more than one way.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Category Theory II 9.1: Lenses
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Category Theory II 8.1: F-Algebras, Lambek's lemma
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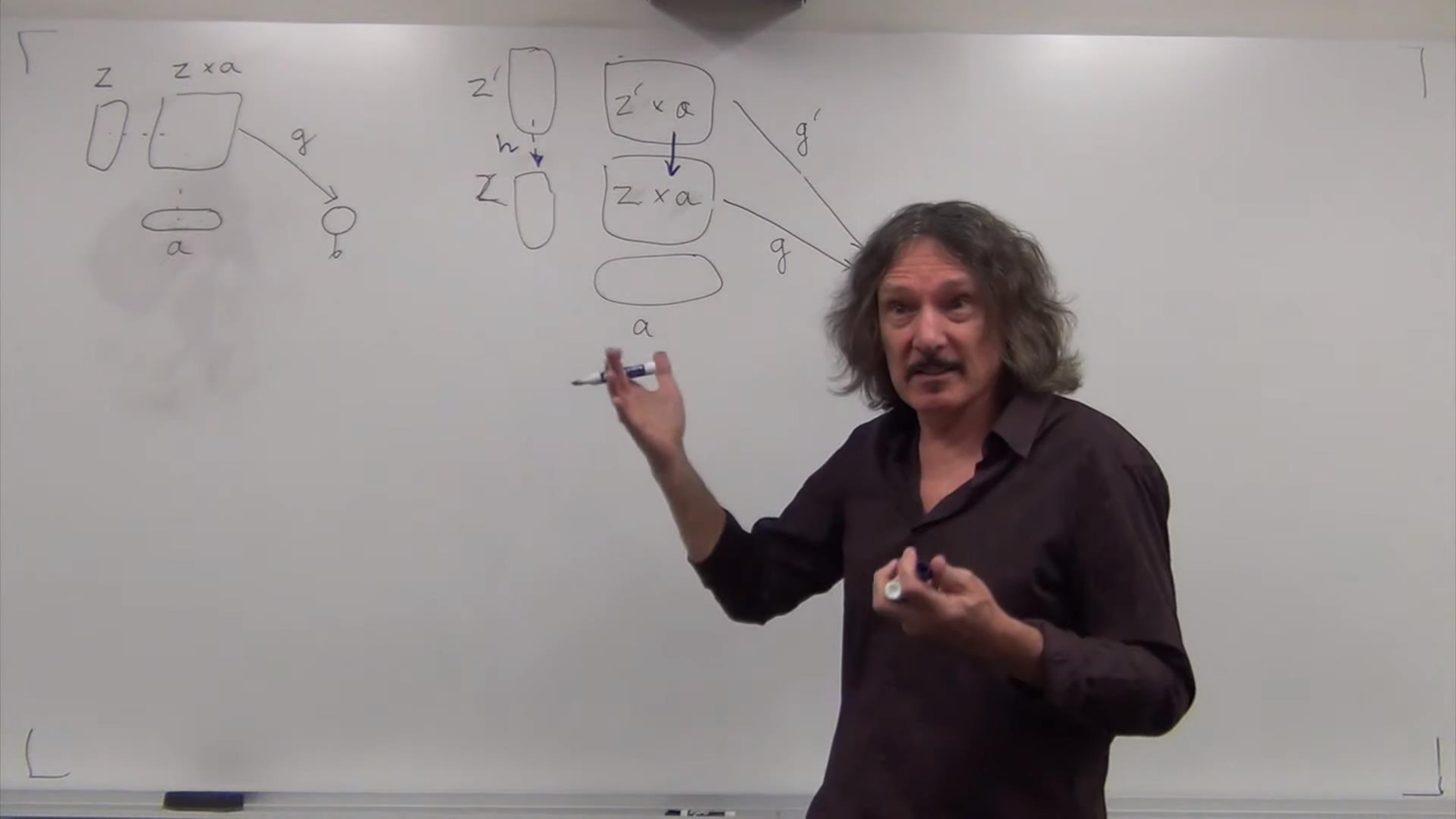
Z
Z × a
g
a
b
Z'
Z' × a
g'
h
Z
Z × a
g
a

I needed the functoriality of the product … a product is a bifunctor … not only does it take two objects and produces a third object but does the same for morphisms.

Bartosz Milewski – Lecture 8.1

Java

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