

Transformation



A transformation f
maps any input of type A
to the output of type B .

Composition



Transformations with compatible input and output can be composed.

Composition is a Transformation



Crucially, composition of transformations is again a transformation.

Composition Combinator



Composition `chain_of(□, □)`
is a transformation combinator
with two arguments.

Example: Composition



Counter-example: Plural Component



We cannot compose these transformations because their input and output do not quite match.

Counter-example: Optional Component



Even so, the input and the output share a common component, which suggests there should be a way to compose these transformations.

Idea: Unbundle the Wire



Attaching a transformation to the object wire indicates that the transformation is applied to all element of the collection.

Block Type

A block is a collection of homogeneous elements.



Cardinality is a constraint on the number of elements in a block.



Unbundling



Object Transformation



Any compatible transformation
can be applied to the object wire,
which indicates that the transformation
is applied to every element of the block.

Multiwired Transformations



Example: Multiwired Transformations



Example: Multiwired Composition

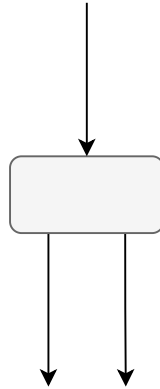


Example: Multiwired Composition Details



Challenge: Functor Transformation

So far we have seen different combinations of transformations and wires:
transformations that are applied to the object wire, as well as
transformations that consume or produce both functor and object wires.



What we miss is a notion of a transformation applied to the functor wire.

Functor Transformation

Since a functor transformation does not act on the object wire, it cannot interfere with any transformations applied to the object wire.



How to define a functor transformation?



This property can be taken as a definition of a functor transformation.

Definition: Functor Transformation



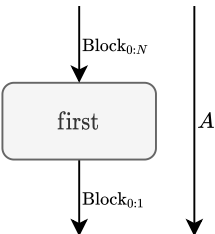
Such transformations are also called *natural*.

Branch of mathematics that studies natural transformations is called the *category theory*.

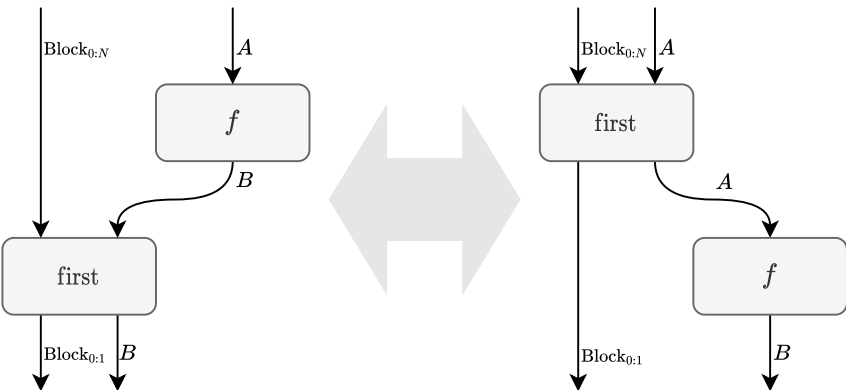
Example: Functor Transformation



This is, in fact, a natural transformation.



Indeed, for any $f : A \rightarrow B$,



$$\text{chain_of}(\text{with_elements}(f), \text{first}) \equiv \text{chain_of}(\text{first}, \text{with_elements}(f))$$