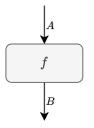
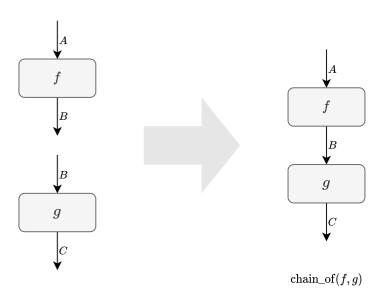
Transformation



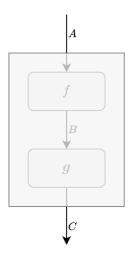
A transformation f maps any input of type A to the output of type B.

Composition



Transformations with compatible input and output can be composed.

Composition is a Transformation



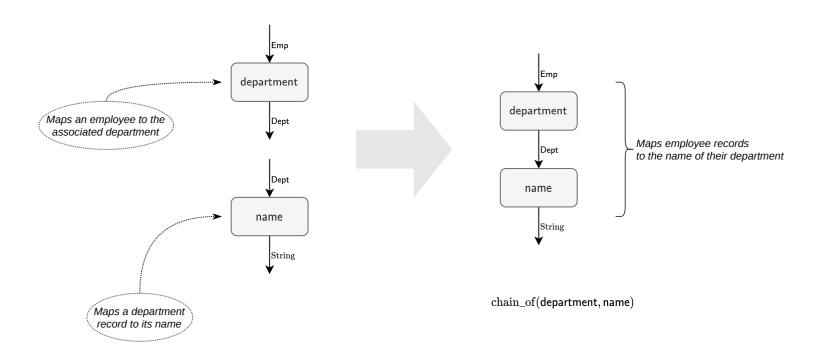
Crucially, composition of transformations is again a transformation.

Composition Combinator

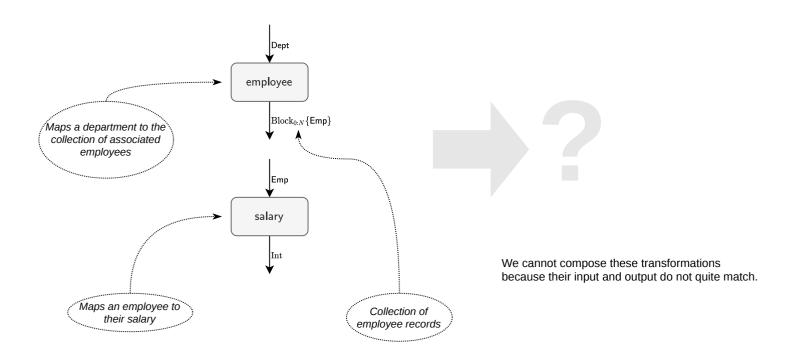


$$\label{eq:composition} \begin{split} & \text{Composition chain_of}\big([]],[]]\big) \\ & \text{is a transformation combinator} \\ & \text{with two arguments.} \end{split}$$

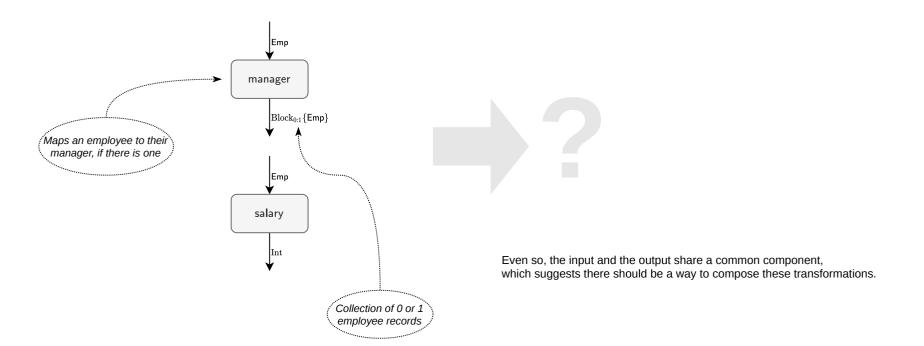
Example: Composition



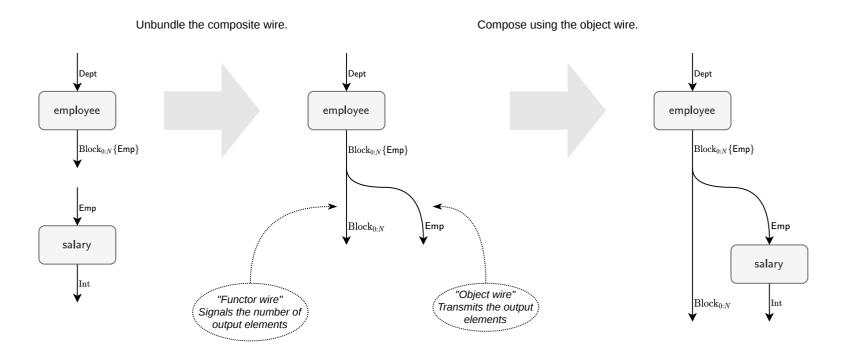
Counter-example: Plural Component



Counter-example: Optional Component



Idea: Unbundle the Wire



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

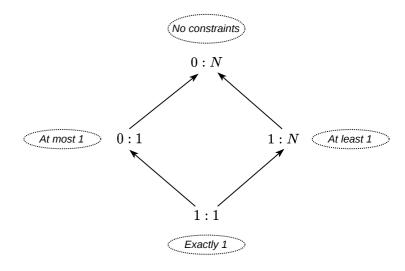
Block Type

A block is a collection of homogeneous elements.

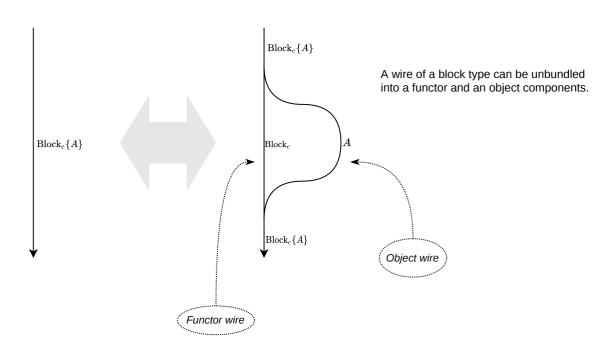
Type of elements

Block $_e\{A\}$ Cardinality of the block

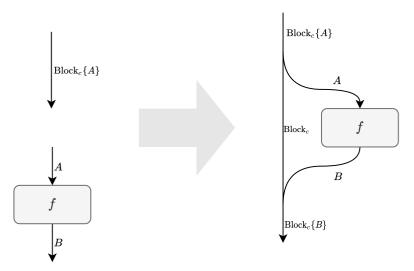
Cardinality is a constraint on the number of elements in a block.



Unbundling



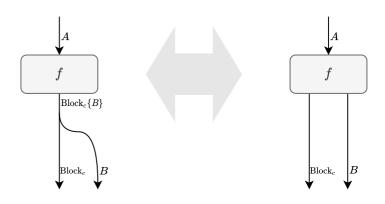
Object Transformation

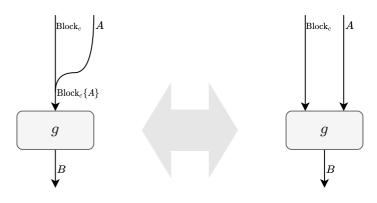


Any compatible transformation can be applied to the object wire, which indicates that the transformation is applied to every element of the block.

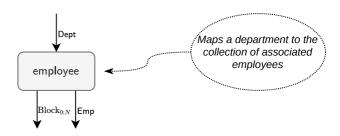
 $with_elements(f)$

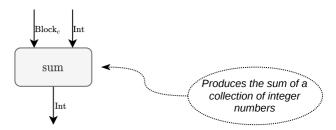
Multiwired Transformations



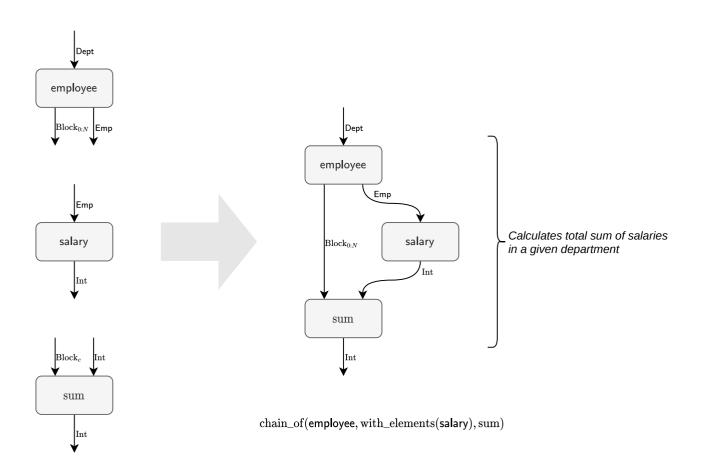


Example: Multiwired Transformations

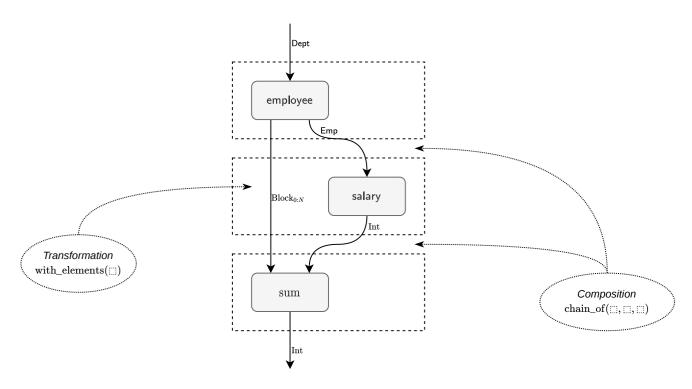




Example: Multiwired Composition



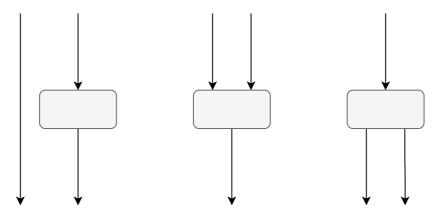
Example: Multiwired Composition Details



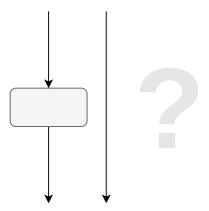
chain_of(employee, with_elements(salary), sum)

Challenge: Functor Transformation

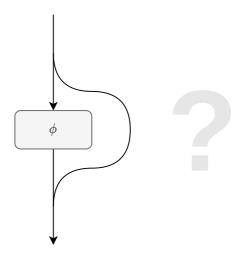
So far we have seen different combinations of transformations and wires: transformations that are applied to the object wire, as well as transformations that consume or produce both functor and object wires.



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

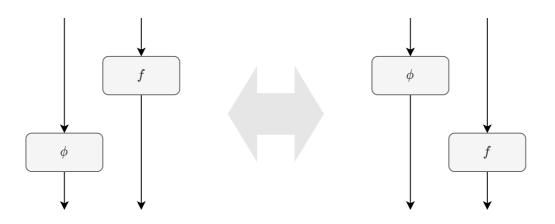


Functor Transformation



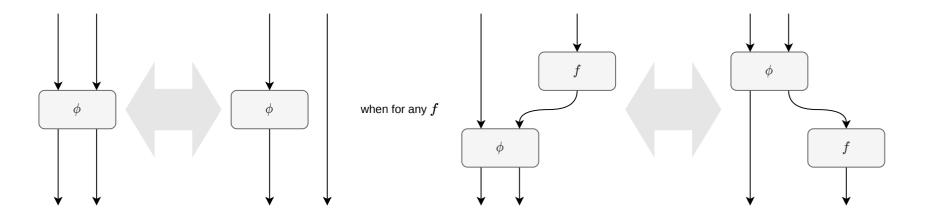
How to define a functor transformation?

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



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

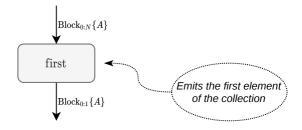
Definition: Functor Transformation



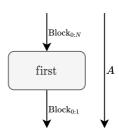
Such transformations are also called *natural*.

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

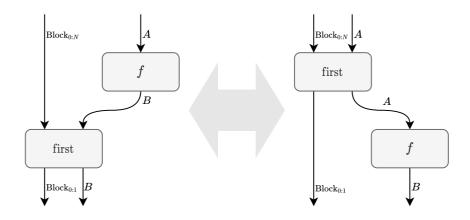
Example: Functor Transformation



This is, in fact, a natural transformation.



Indeed, for any f:A o B,



 $chain_of(with_elements(f), first) \equiv chain_of(first, with_elements(f))$