Purpose of morphisms

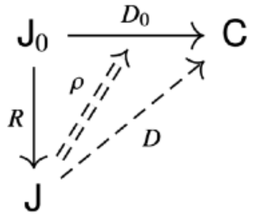
Why care?

- We can use morphisms for a few things, e.g.
  - steady states of diffusion processes
  - different presentations of the same physics (but this is subtle!)
  - boundary (and initial) value problems
    - this is the really nice one!

BVPs (and IVPs)

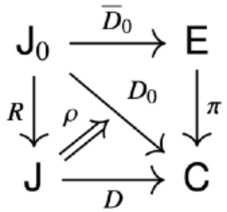
Pretty important for actually solving and modelling stuff

- An **extension** of a diagram $D_0 \colon \mathscr{J}_0 \to \mathscr{C}$ along a functor $R \colon \mathscr{J}_0 \to \mathscr{J}$ is a diagram $D \colon \mathscr{J} \to \mathscr{C}$ and a (backwards) morphism $(R, \rho) \colon (\mathscr{J}, D) \to (\mathscr{J}_0, D_0)$



- Given

    1. an extension of D_0 along R
    2. a lift $\overline{D_0}$ of D_0 through some functor $\pi \colon \mathscr{E} \to \mathscr{C}$



  the **extension lifting problem** is to find an extension $(R, \overline{\rho}) \colon (\mathscr{J}, \overline{D}) \to (\mathscr{J}_0, \overline{D_0})$ of $\overline{D_0}$ along R such that $\overline{D}$ is a lift of D through π in a "2-compatible way"