# Doing two things at once

## is sometimes harder than just doing two things at once

- Multiphysics is *the simultaneous simulation of different physical aspects of a single system*
- Example: **conjugate convective heat transfer**
  - a solid body sitting inside a moving fluid, to which we introduce a heat source
  - heat transfer is modelled by e.g. the Laplace equation
  - fluid convection is modelled by e.g. Navier–Stokes and energy equations
  - but these two physical phenomena *interact*

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- **Naive numerical method**
  - Solving just for the body (resp. just for the fluid) gives a boundary condition for the fluid (resp. for the body)
  - Guess some initial boundary conditions, and use to solve for one part, then use the solution to solve for the other part, giving new boundary conditions, and… iterate
  - Problem: rate of convergence depends on initial guess, and there is no systematic way beyond trial and error