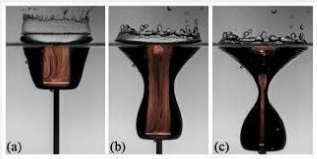
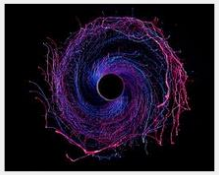
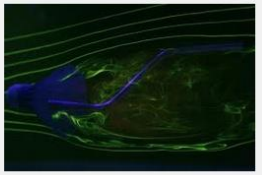




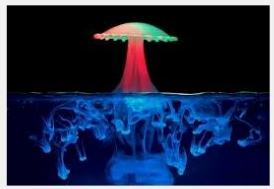
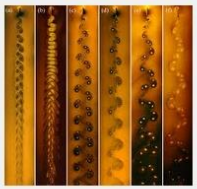



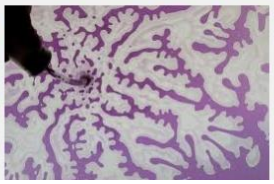



F*** Yeah Fluid Dynamics:

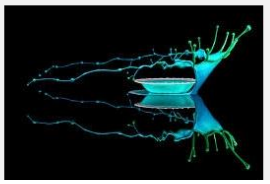


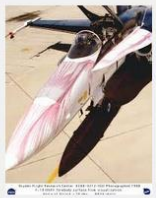


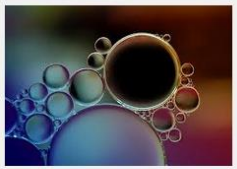



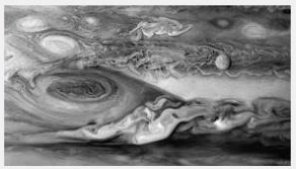


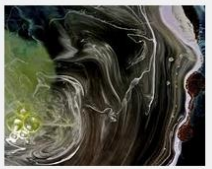
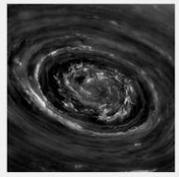
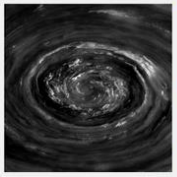





Tips for Connecting with Broader Audiences





Nicole Sharp, PhD

APS DFD Meeting
Atlanta, GA
19 November 2018

FYFD

On science communication

NICOLE SHARP WELCOME ABOUT

APS physics

APS Division of Fluid Dynamics Presentations

- 2018: "F*** Yeah Fluid Dynamics: Tips for Connecting with Broader Audiences," Slideshow
- 2017: "F*** Yeah Fluid Dynamics: Getting into science communication," Slideshow (.pdf, 2.5MB)
- 2016: " 'In a sea of sticky molasses': The physics of the Boston Molasses Flood," Slideshow (.pptx, 43.4 MB)
- 2016: "F*** Yeah Fluid Dynamics: Inside the science communication process," Slideshow (.pptx, 22 MB)
- 2015: "F*** Yeah Fluid Dynamics: On science outreach and appealing to broad audiences," Slideshow (.pptx, ~9.5 MB)
- 2013: "Discrete surface roughness effects on a blunt hypersonic cone in a quiet tunnel," Slideshow (.pdf)
- 2013: "F*** Yeah Fluid Dynamics: Lessons from online outreach," Slideshow (.pdf)
- 2012: "Surface roughness effects on a blunt hypersonic cone," Slideshow (.pdf)
- 2008: "Complex dynamics of a boundary layer with free stream turbulence," Slideshow (.pdf)
- 2007: "Measurements in a boundary layer with intense free stream turbulence," Slideshow (.pdf)

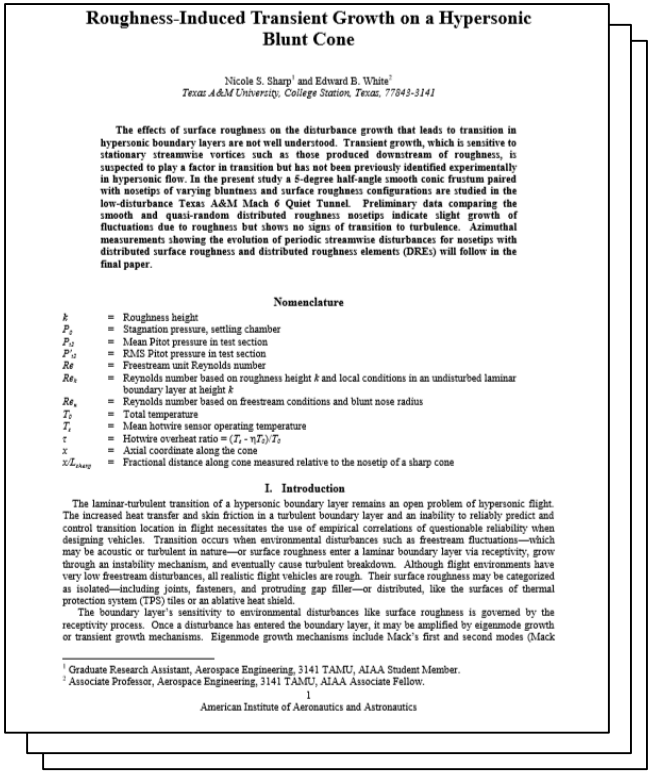
2016: Inside the science communication process

2017: Getting into science communication

2018: Tips for connecting with broader audiences

http://nicolesharp.com/talks

How scientists communicate



Roughness-Induced Transient Growth on a Hypersonic Blunt Cone

Nicole S. Sharp[1] and Edward B. White[2]
Texas A&M University, College Station, Texas, 77843-3141

The effects of surface roughness on the disturbance growth that leads to transition in hypersonic boundary layers are not well understood. Transient growth, which is sensitive to stationary streamwise vortices such as those produced downstream of roughness, is suspected to play a factor in transition but has not been previously identified experimentally in hypersonic flow. In the present study a 5-degree half-angle smooth conic frustum paired with nosetips of varying bluntness and surface roughness configurations are studied in the low-disturbance Texas A&M Mach 6 Quiet Tunnel. Preliminary data comparing the smooth and quasi-random distributed roughness nosetips indicate slight growth of fluctuations due to roughness but shows no signs of transition to turbulence. Azimuthal measurements showing the evolution of periodic streamwise disturbances for nosetips with distributed surface roughness and distributed roughness elements (DREs) will follow in the final paper.

Nomenclature

k = Roughness height
P_0 = Stagnation pressure, settling chamber
P_{t2} = Mean Pitot pressure in test section
P'_{t2} = RMS Pitot pressure in test section
Re = Freestream unit Reynolds number
Re_k = Reynolds number based on roughness height k and local conditions in an undisturbed laminar boundary layer at height k
Re_r = Reynolds number based on freestream conditions and blunt nose radius
T_0 = Total temperature
T_t = Mean hotwire sensor operating temperature
τ = Hotwire overheat ratio = $(T_t - \eta T_0)/T_0$
x = Axial coordinate along the cone
x/L_{sharp} = Fractional distance along cone measured relative to the nosetip of a sharp cone

I. Introduction

The laminar-turbulent transition of a hypersonic boundary layer remains an open problem of hypersonic flight. The increased heat transfer and skin friction in a turbulent boundary layer and an inability to reliably predict and control transition location in flight necessitates the use of empirical correlations of questionable reliability when designing vehicles. Transition occurs when environmental disturbances such as freestream fluctuations—which may be acoustic or turbulent in nature—or surface roughness enter a laminar boundary layer via receptivity, grow through an instability mechanism, and eventually cause turbulent breakdown. Although flight environments have very low freestream disturbances, all realistic flight vehicles are rough. Their surface roughness may be categorized as isolated—including joints, fasteners, and protruding gap filler—or distributed, like the surfaces of thermal protection system (TPS) tiles or an ablative heat shield.

The boundary layer's sensitivity to environmental disturbances like surface roughness is governed by the receptivity process. Once a disturbance has entered the boundary layer, it may be amplified by eigenmode growth or transient growth mechanisms. Eigenmode growth mechanisms include Mack's first and second modes (Mack

[1] Graduate Research Assistant, Aerospace Engineering, 3141 TAMU, AIAA Student Member.
[2] Associate Professor, Aerospace Engineering, 3141 TAMU, AIAA Associate Fellow.

Navier-Stokes Equations

- The general equations of motion for a fluid are nonlinear:

$$\frac{\partial \rho}{\partial t} + \frac{\partial}{\partial x_j}\left(\rho u_j\right) = 0$$ Conservation of mass

$$\frac{\partial}{\partial t}\left(\rho u_i\right) + \frac{\partial}{\partial x_j}\left(\rho u_i u_j + p\delta_{ij} - \tau_{ji}\right) = 0, \quad i = 1,2,3$$ Conservation of momentum

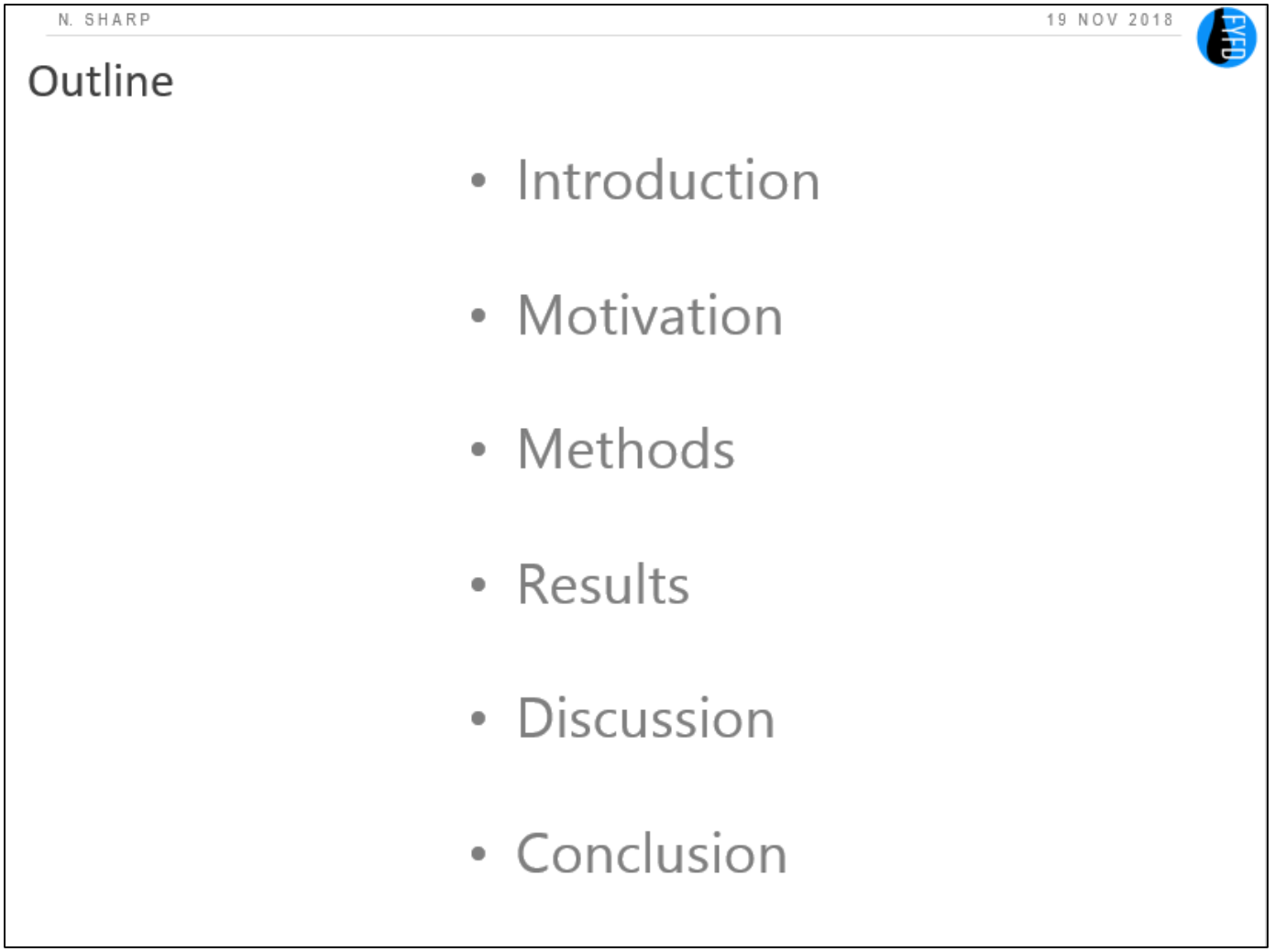
where
- $\rho = density$
- $u_i = velocity$
- $p = pressure$
- $\tau_{ij} = viscous \ \ stress$

- For stability problems, we typically consider disturbances of the form:

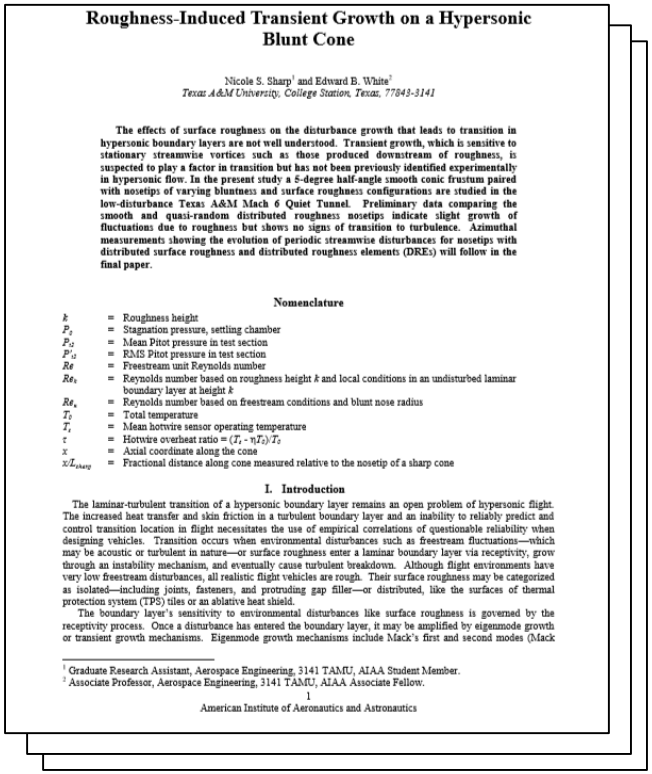
$$u_i(x,y,z,t) = U_i(x,y,z) + u'_i(x,y,z,t)$$

↑ Laminar basic state ↑ Small disturbance

Scientists are taught to remove the storyteller



In fluid mechanics…



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[2] Associate Professor, Aerospace Engineering, 3141 TAMU, AIAA Associate Fellow.

In its first 1-2 years, the average journal article gets:

- 100-200 downloads
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How are stories told?

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The hero’s journey

The hero's journey

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Stages of the Hero's Journey ...
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The Hero's Journey as Divine Blueprint
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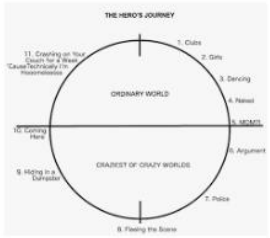

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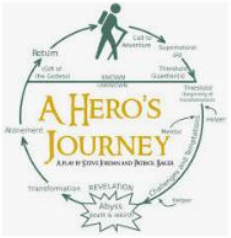

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Psychological Journey – Go Into The ...
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Initiation (Hero's Journey) – Gr...
greattransitionstories.org

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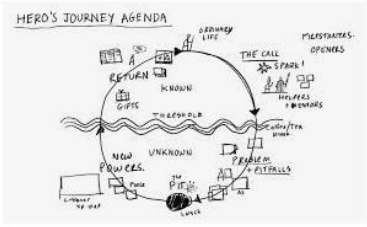
hero.wikia.com



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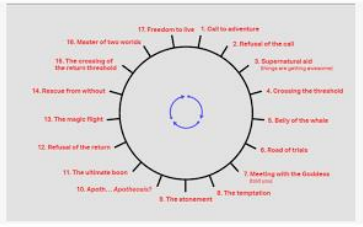

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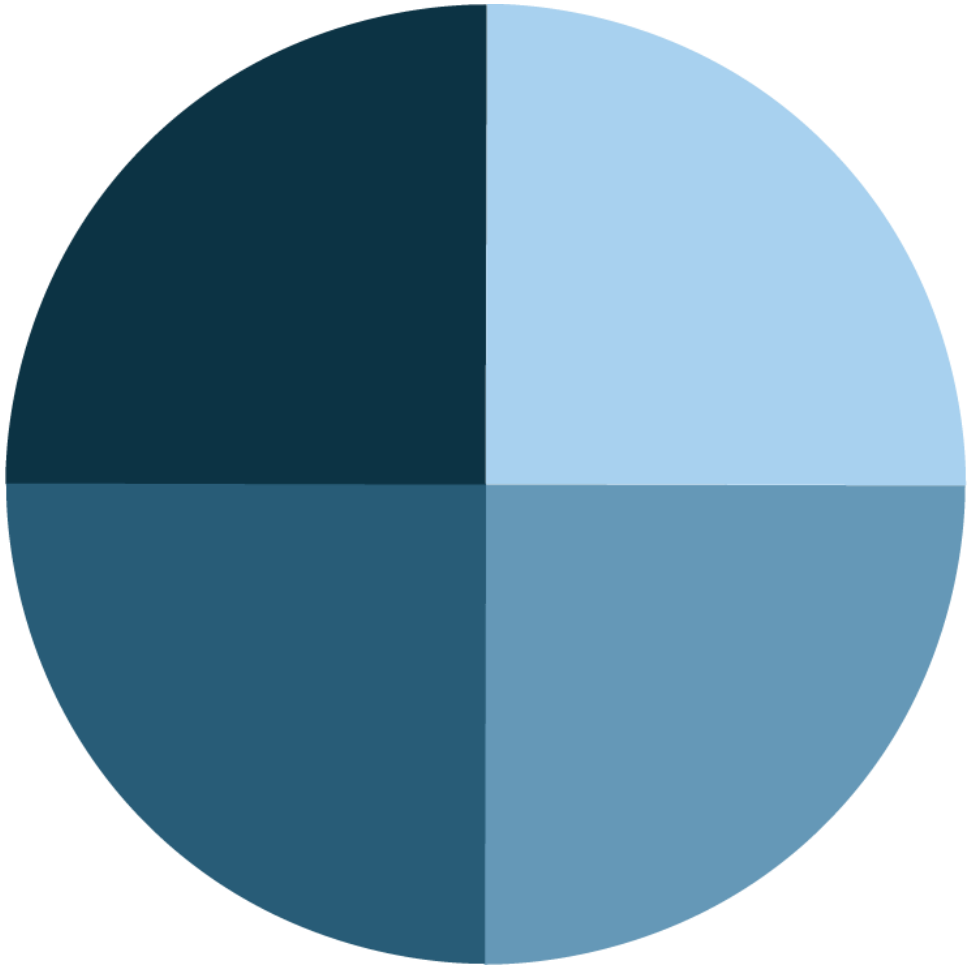
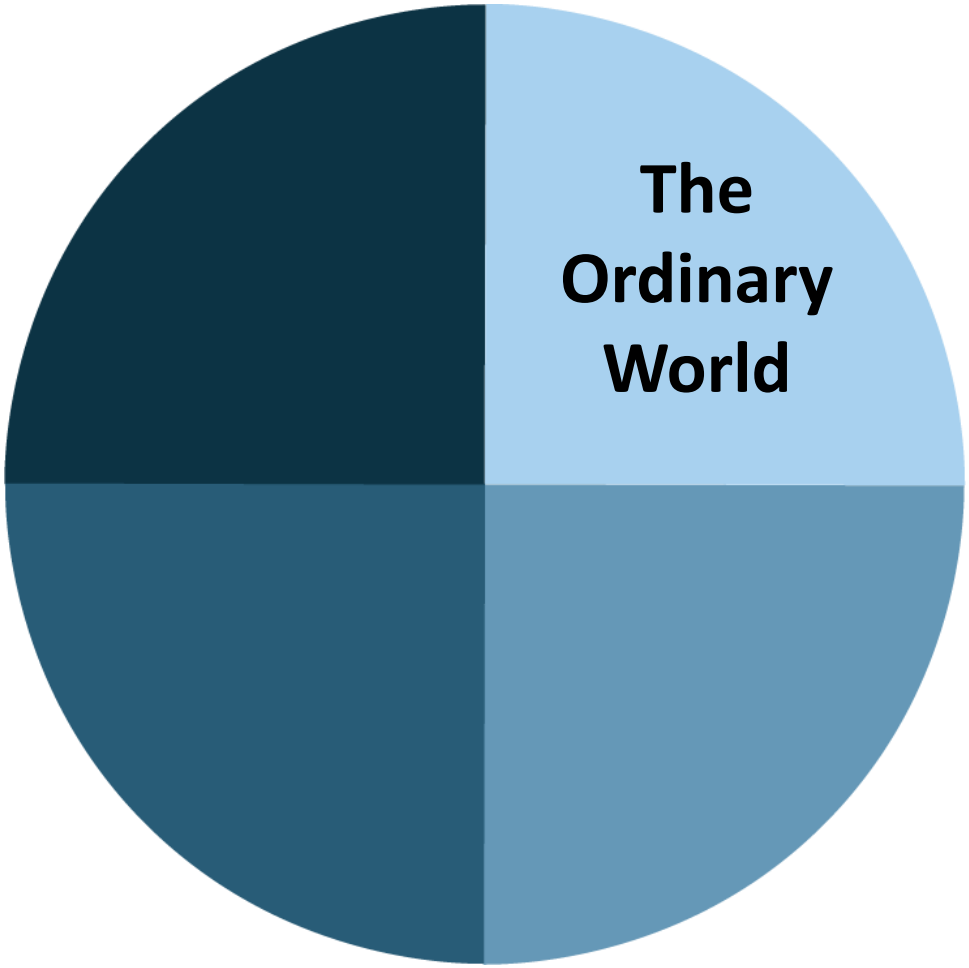
The hero’s journey

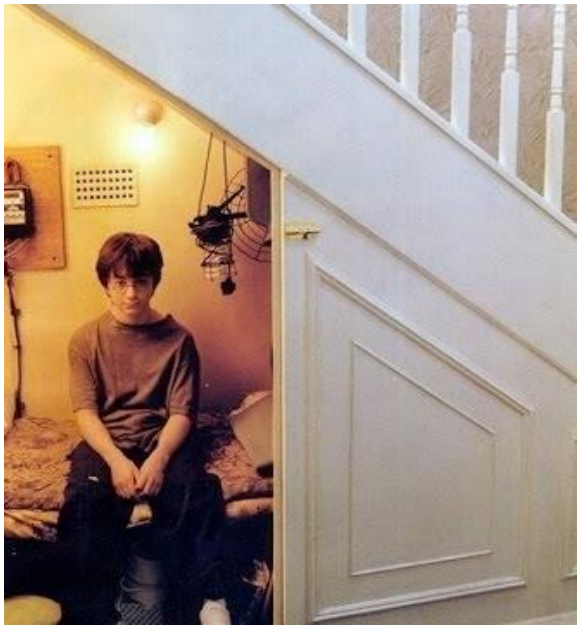


The hero's journey



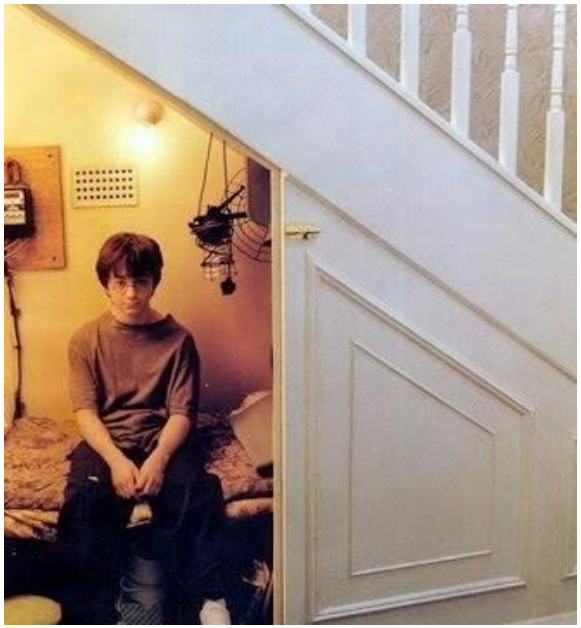
The Ordinary World

Image: New Line Cinema



The Ordinary World

Images: New Line Cinema, Warner Brothers Pictures



The Ordinary World

Images: New Line Cinema, Warner Brothers Pictures, Lucasfilm

The hero's journey

A Transformative Journey

Images: New Line Cinema, Warner Brothers Pictures, Lucasfilm

The hero's journey

Revelation

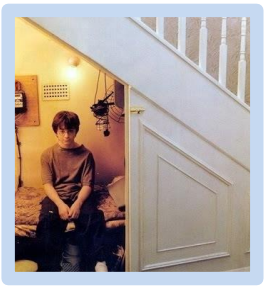
Images: New Line Cinema, Warner Brothers Pictures, Lucasfilm

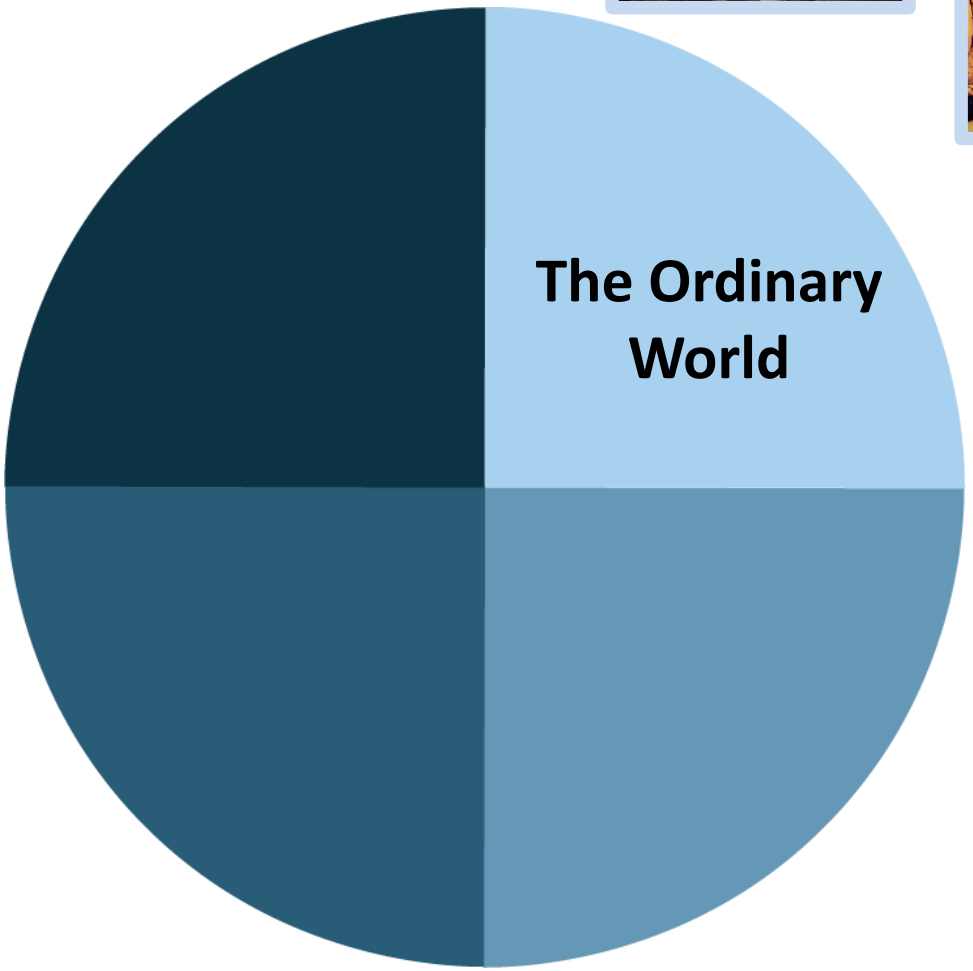
The hero's journey

The Return

Images: New Line Cinema, Warner Brothers Pictures, Lucasfilm

The hero's journey





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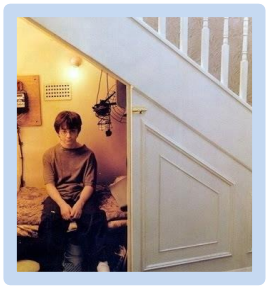

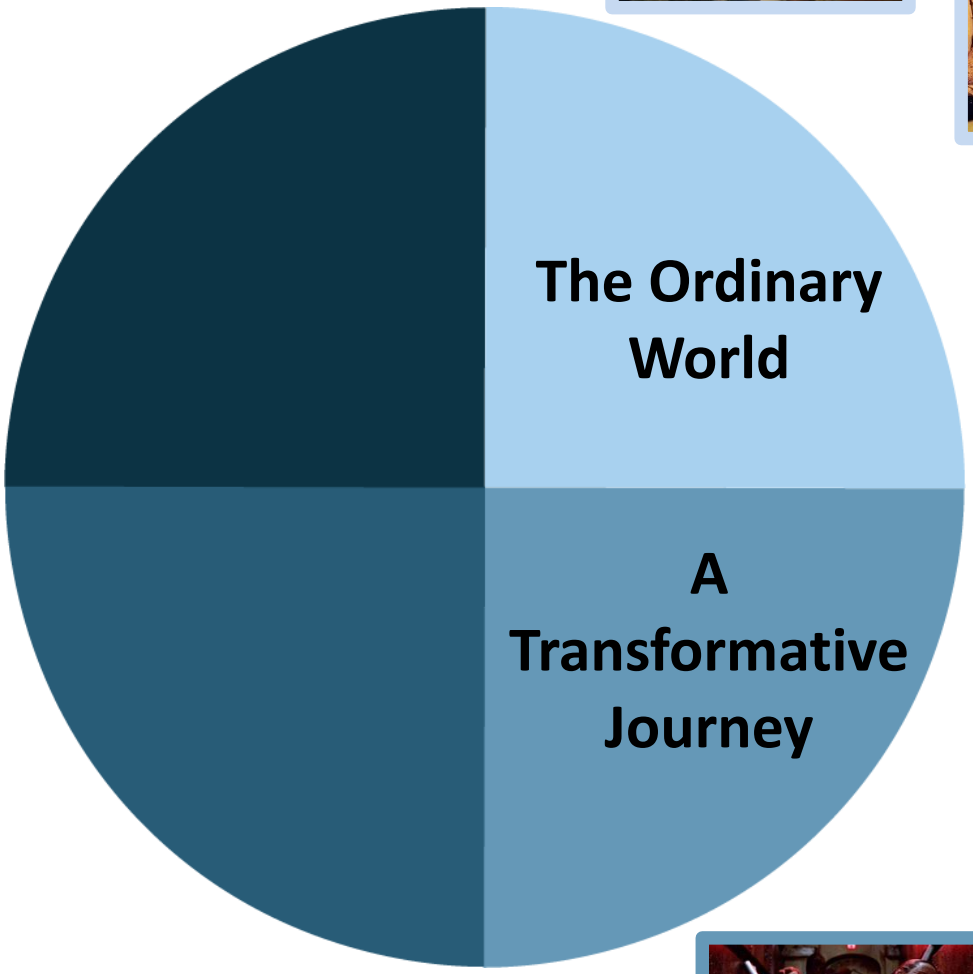

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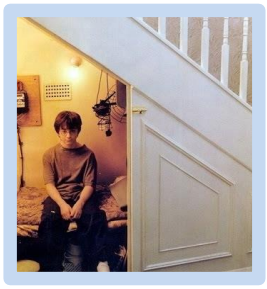
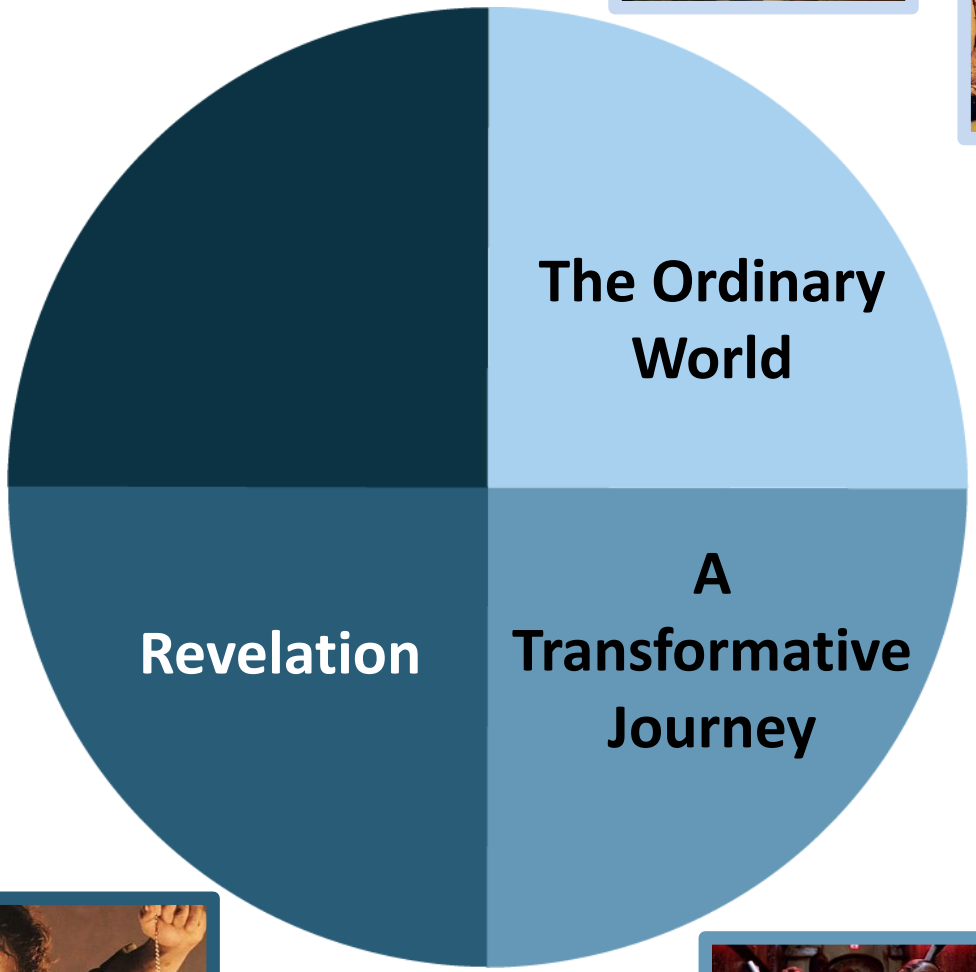
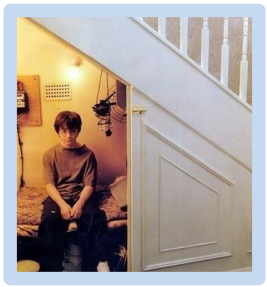




The hero's journey



The Return

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The hero's journey for non-fiction

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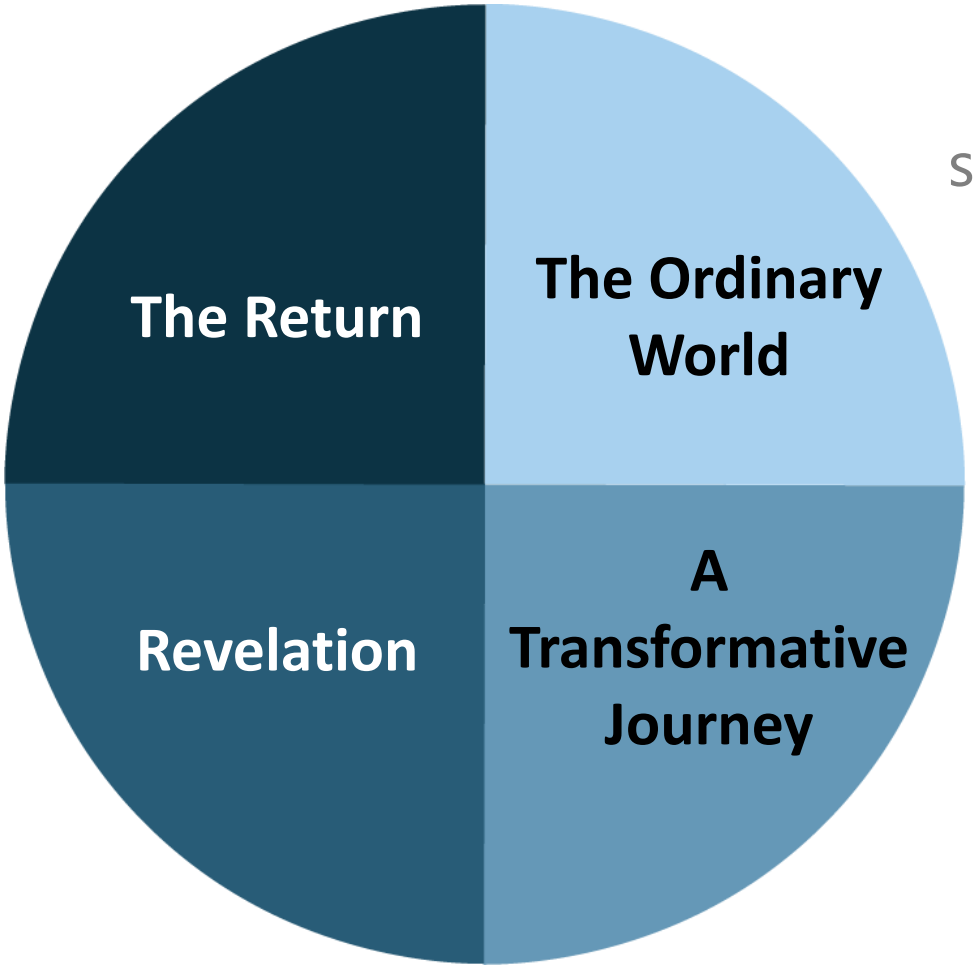
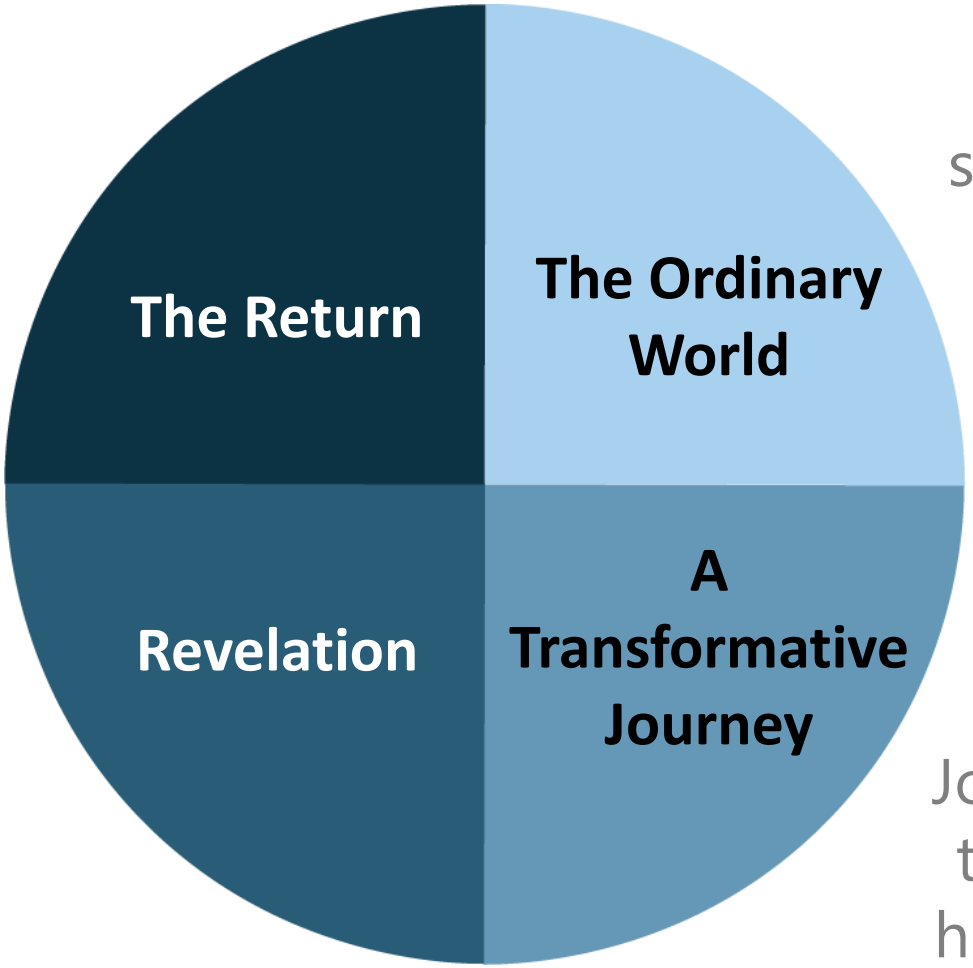


"Here's a strange idea..."

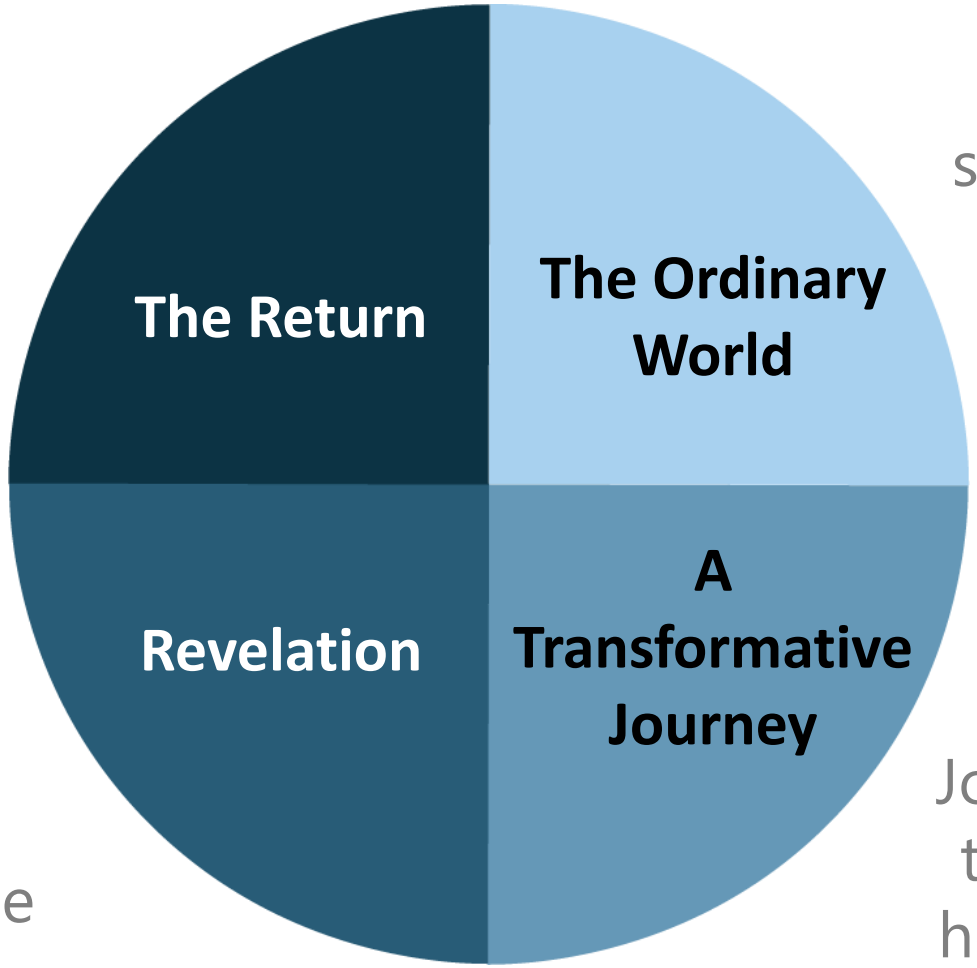
The hero's journey for non-fiction



"Here's a strange idea..."

Journey through the past to see how we reached this point

The hero's journey for non-fiction



"Here's a strange idea..."

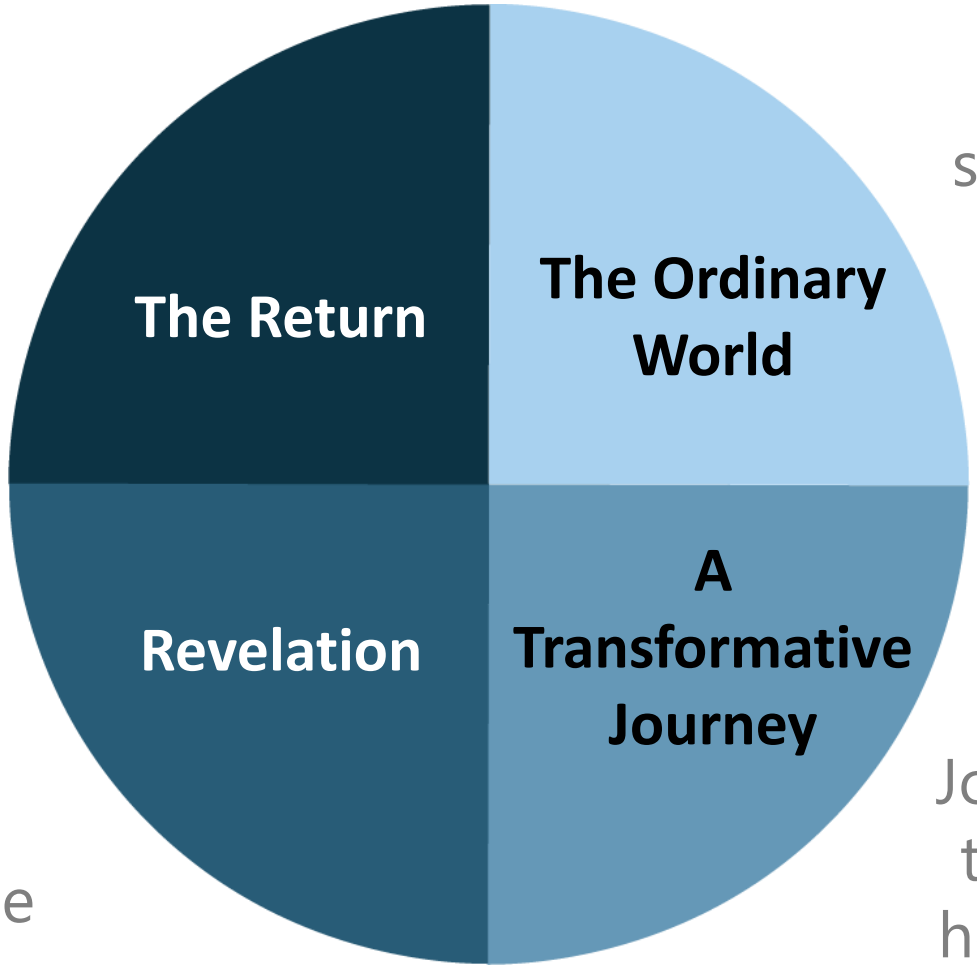
A revelation leads us to the takeaway

Journey through the past to see how we reached this point

The hero's journey for non-fiction

We use the takeaway to reframe the world

"Here's a strange idea..."

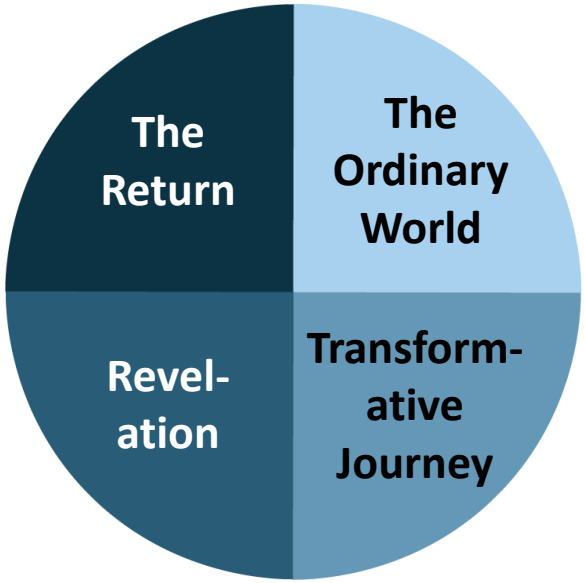


A revelation leads us to the takeaway

Journey through the past to see how we reached this point

Where does this show up?

- NPR
  - e.g. Radiolab color episode

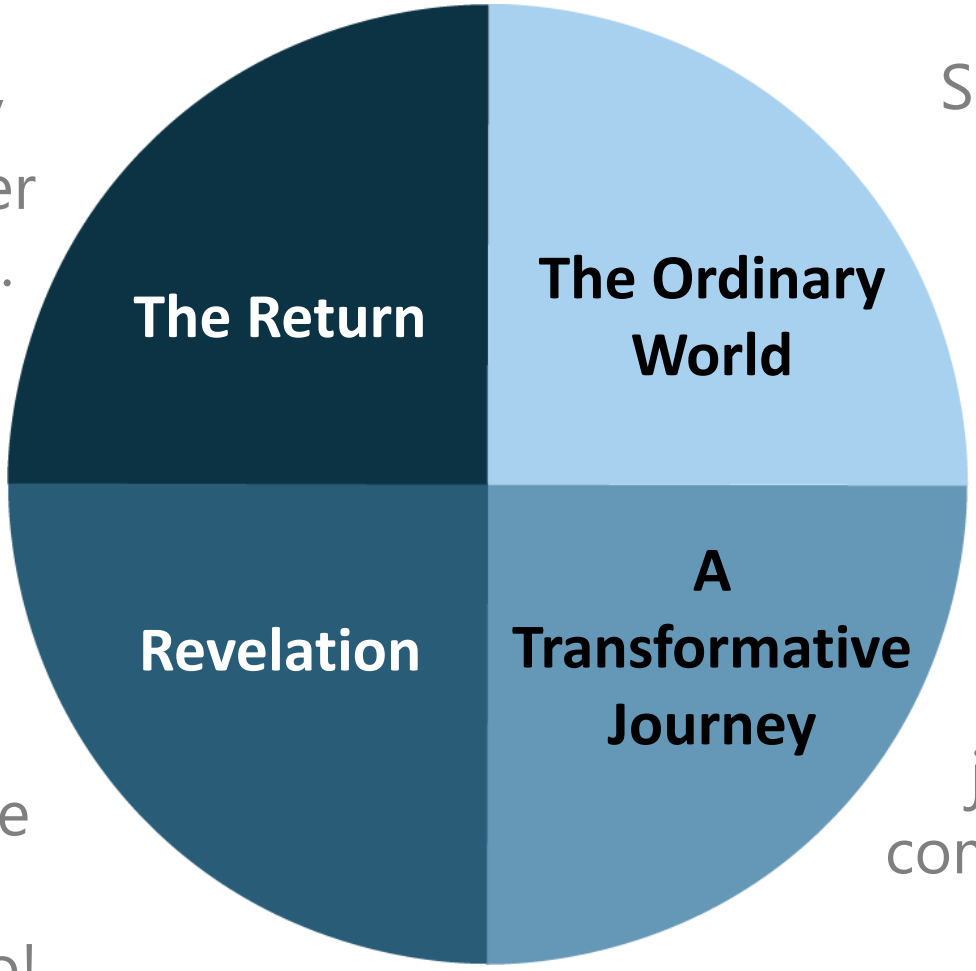


Where does this show up?

- NPR
  - e.g. Radiolab color episode
- PBS
  - e.g. It's Okay to Be Smart, "The Largest Rivers on Earth is in the Sky"
- Your favorite video essays on YouTube
  - e.g. Wisecrack, Pop Culture Detective, etc.

A final example

Following the hero's journey makes for better science stories.



Scientists aren't good at storytelling.

The hero's journey can be used for nonfiction, too!

The hero's journey is a common fictional narrative structure.

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