

# Lost on the Trail

Investigating hiking wayfinding and trail navigation in the US national parks



# Yosemite National Park

## 2005-2009

- 2nd highest park for reported search and rescue incidents
- 25% of the total NPS SAR costs
- 10% of all NPS SAR operations
- Approximately 250 rescues per year, nearly 70% of all incidents involve hikers

## 2019

- 225 reported search and rescue incidents
- 61% of all incidents involved hikers
- Majority of incidents took place on two of Yosemite's most popular trails

# Goals and Objectives

## 1. Identify/Understand

Document current trail signs on popular hiking trails

Analyze data from incident reports

Experience the environment of the user

## 2. Learn/Observe

Reviewed existing park guidelines

Talk to users and collect feedback about trail signs

Attend lectures and ask questions from the experts

## 3. Create/Test

Create design principles using best wayfinding practices

Design new system

Test new system

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# Identify/Understand



# Identify/Understand





# Identify/ Understand

- 25% of rescues occur on Mist Trail
- Upper Yosemite Fall

## 2019

Yosemite National Park  
Search and Rescue Incident Locations

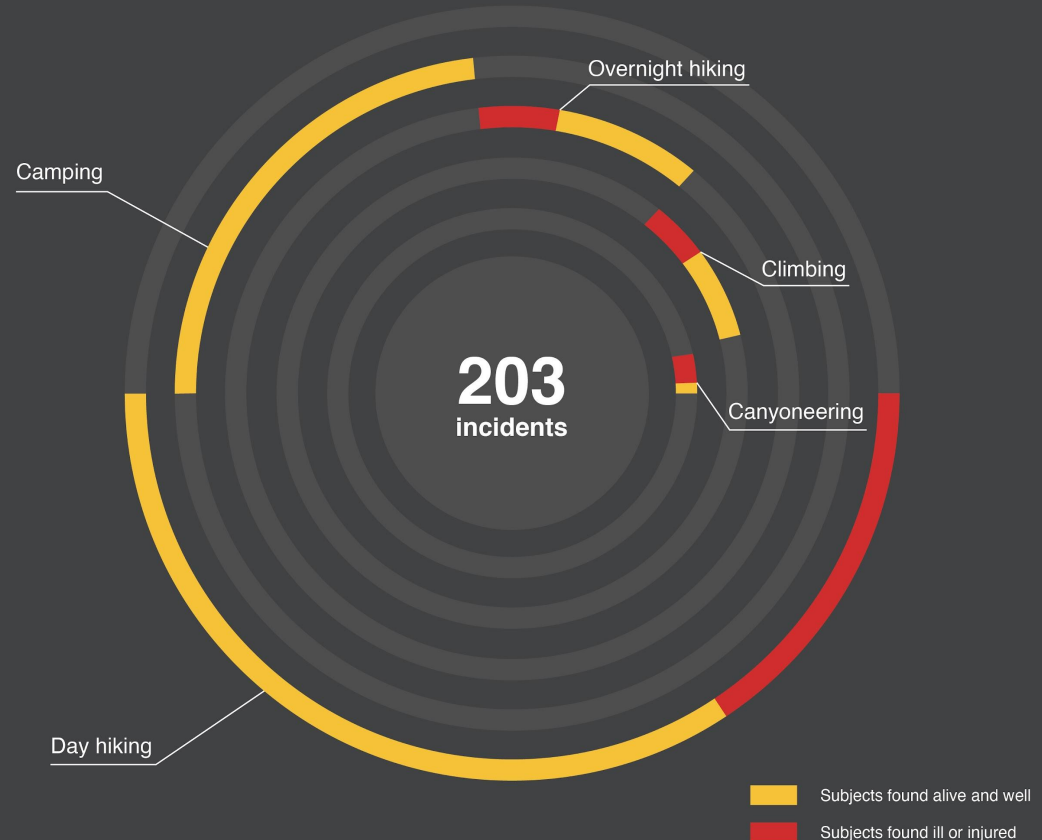


# Identify/ Understand

- 47% day hikers
- 14% overnight hikers

## 2019

Yosemite National Park  
Search and Rescue Incident Types

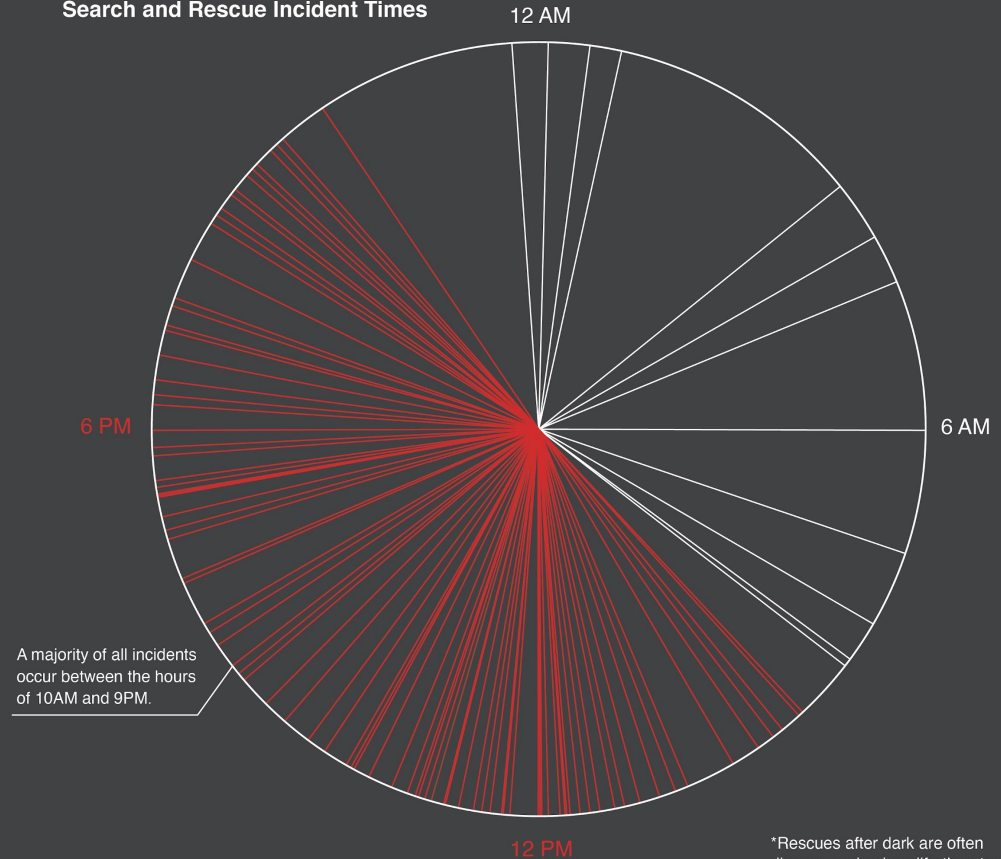


# Identify/ Understand

- Majority of all incidents are reported between the hours of 10a.m. – 9p.m.

## 2019

Yosemite National Park  
Search and Rescue Incident Times



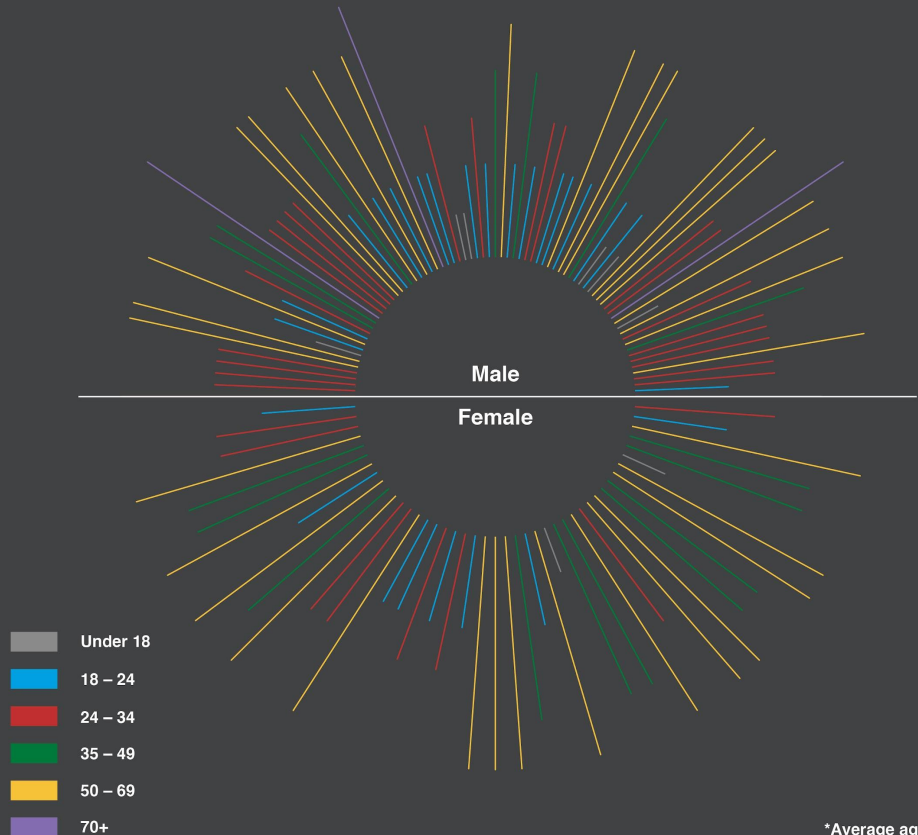
\*Rescues after dark are often discouraged unless life-threatening.

# Identify/ Understand

- Primarily male
- Average age is 37.94

## 2019

Yosemite National Park  
Search and Rescue Incident Statistics



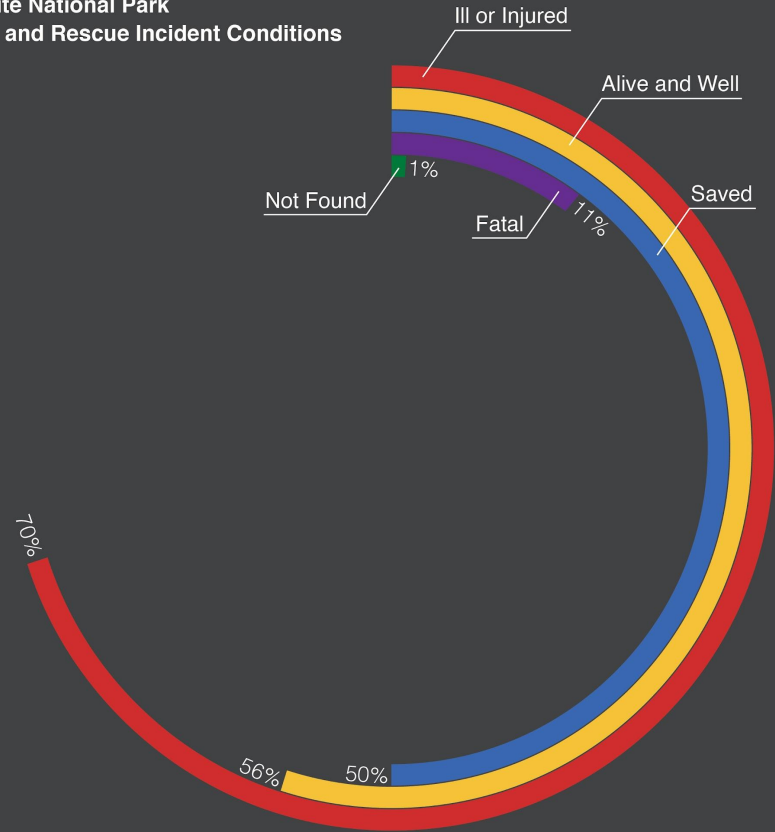
\*Average age is 37.94

# Identify/ Understand

- Primarily ill or injured
- 11% were fatalities
- 1% were never found

## 2019

Yosemite National Park  
Search and Rescue Incident Conditions



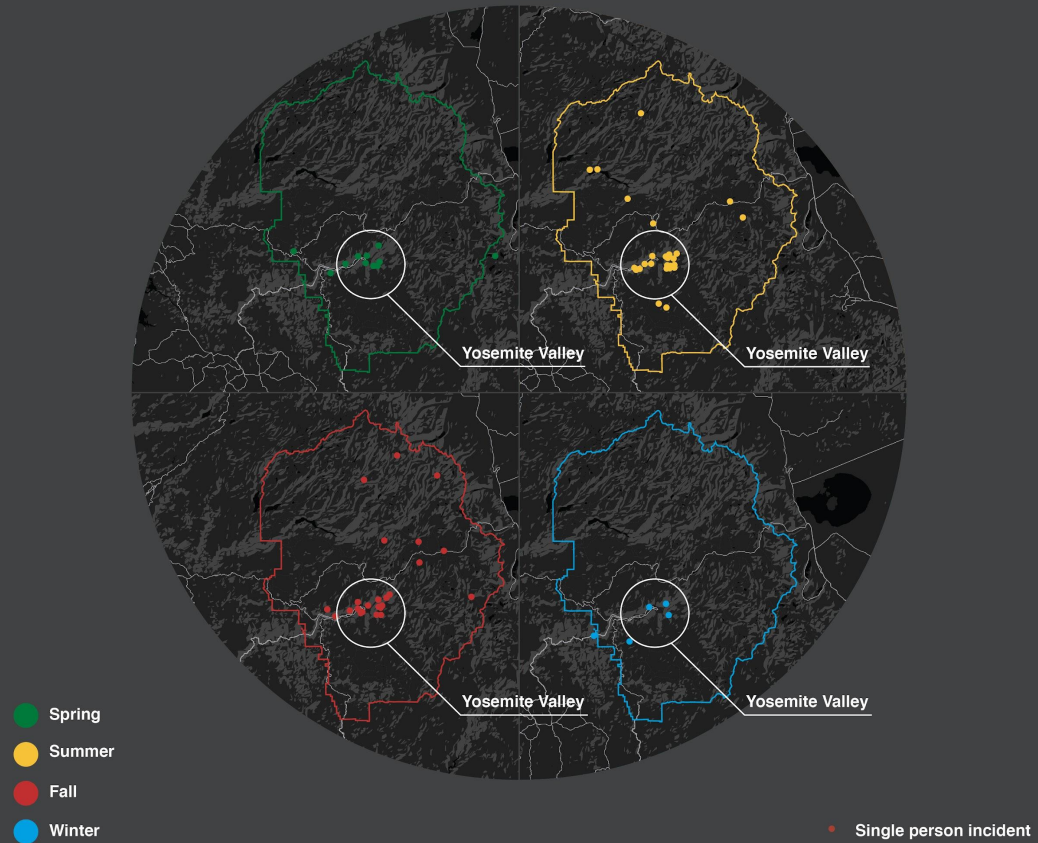


# Identify/ Understand

- Most incidents occurred during summer and fall seasons

## 2019

Yosemite National Park  
Search and Rescue Incidents per Season



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# Learn/Observe

- Design Guidelines for Yosemite Valley
- Sign and Poster Guidelines for the Forest Service
- UniGuide

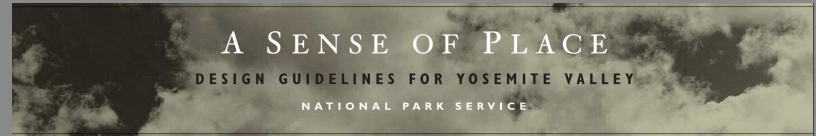


Figure 1. Front cover for A Sense of Place. U.S. Interior Department National Park Service. (2012). *A Sense of Place: Design Guidelines for Yosemite National Park*. Interior Department National Park Service.



Figure 2. Front cover of guidelines for Forest Service. USDA Forest Service Trail Signing. Trail Construction and Maintenance Notebook. (2007)



Figure 3. Front cover of UniGuide. U.S. Interior Department National Park Service. *National Park Service UniGuide Standards Manual: Identification, Wayfinding and Visitor Information for National Parks*. (2002). Interior Department National Park Service.

# Comparative Analysis





# Surveys

- Trail sign usage
- Trail conditions
- Trail difficulty
- Nighttime hiking



# Surveys

- Trail sign usage
- Trail conditions
- Trail difficulty
- Nighttime hiking

Select an option

Novice/Beginner (I am new to hiking or I have little experience with hiking. I hike at a slow/easy pace and I generally hike on flat, easy terrain)

Moderate (I have experience with hiking different types of terrain and elevation. I have experience hiking for a few hours with frequent breaks as the distance or elevation increases)

Advanced (I have experience with hiking at least half a day. I can handle several thousand feet in elevation gain. I can keep a moderate pace and I have enough experience to know when to conserve energy on the trail. I have experience hiking in multiple weather conditions and I know how to prepare for cold and hot conditions.)


Expert (I have experience with full day hikes in different weather conditions. I know how to prepare for hikes with severe elevation gain and difficult terrain. I know how to conserve energy at a slow pace and when to rest. I have the ability to plan for multi-day hikes.)

Novice/Beginner

Moderate

Advanced

Expert



Did you use trail signs at the trailhead BEFORE starting your hike? \*

Yes

No

←

→

# Surveys

- Trail sign usage
- Trail conditions
- Trail difficulty
- Nighttime hiking

Table 3.2. Hiking difficulties experienced by hikers on Mirror Lake

Hiking difficulties	n	%
Ensuring they were on the correct trail	8	40%
Locating the trail signs/markers	5	25%
Locating the trailhead	2	10%
Planning enough time for the hike	1	5%
Planning enough food/water for the hike	1	5%
Terrain changes	1	5%
Planning for the hike	0	0%
Completing the hike	0	0%
None	10	50%



	Signs/trail markers were easy to read and understand.	Signs/trail markers were conveniently placed and easy to locate.	Signs/trail markers provided helpful information.	Signs/trail markers disrupted my hiking experience.	There were not enough signs/trail markers.
Mist Trail	Completely Agree	Completely Agree	Completely Agree	Completely Agree	Completely Agree
	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree
	Slightly Agree	Slightly Agree	Slightly Agree	Slightly Agree	Slightly Agree
	Neither Agree Nor Disagree	Neither Agree Nor Disagree	Neither Agree Nor Disagree	Neither Agree Nor Disagree	Neither Agree Nor Disagree
	Slightly Disagree	Slightly Disagree	Slightly Disagree	Slightly Disagree	Slightly Disagree
	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree
	Completely Disagree	Completely Disagree	Completely Disagree	Completely Disagree	Completely Disagree
Upper Yosemite Falls	Completely Agree	Completely Agree	Completely Agree	Completely Agree	Completely Agree
	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree
	Slightly Agree	Slightly Agree	Slightly Agree	Slightly Agree	Slightly Agree
	Neither Agree Nor Disagree	Neither Agree Nor Disagree	Neither Agree Nor Disagree	Neither Agree Nor Disagree	Neither Agree Nor Disagree
	Slightly Disagree	Slightly Disagree	Slightly Disagree	Slightly Disagree	Slightly Disagree
	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree
	Completely Disagree	Completely Disagree	Completely Disagree	Completely Disagree	Completely Disagree
Mirror Lake	Completely Agree	Completely Agree	Completely Agree	Completely Agree	Completely Agree
	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree
	Slightly Agree	Slightly Agree	Slightly Agree	Slightly Agree	Slightly Agree
	Neither Agree Nor Disagree	Neither Agree Nor Disagree	Neither Agree Nor Disagree	Neither Agree Nor Disagree	Neither Agree Nor Disagree
	Slightly Disagree	Slightly Disagree	Slightly Disagree	Slightly Disagree	Slightly Disagree
	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree
	Completely Disagree	Completely Disagree	Completely Disagree	Completely Disagree	Completely Disagree

# Low Light Readability

Table 5.6 Contributing Factors to People Being Reported as Lost\*

Main Contributing Factor	n	%
Lost Trail Accidentally	36	16.9%
Failure to Communicate Plan Effectively	25	11.7%
Miscalculation of Time or Distance	20	9.4%
Darkness	15	7.0%
Left Trail Intentionally	12	5.6%
Insufficient Information/Error in Judgment	12	5.6%
Snow on Ground	11	5.2%
Wrong Trail Taken	10	4.7%
Fatigue/Physical Condition	9	4.2%
Steep Terrain	6	2.8%
Emotionally Upset	5	2.4%
Ground Level Fall	4	1.9%
Skied Wrong Trail	3	1.4%
Suicide	2	0.9%
Falling Snow	2	0.9%
Rain	2	0.9%
Insufficient Equipment/Clothing/Experience	2	0.9%
Ice/Snow	1	0.5%
Above Ground Level Fall	1	0.5%
Drugs	1	0.5%
Animals	1	0.5%
Unknown	33	15.5%
<b>Total</b>	<b>213</b>	<b>100.0%</b>

\*Several factors may have contributed, but only the primary factor was recorded.

Figure 1. Contributing Factors to People Being Reported as Lost. Doke, Jared. Analysis of Search Incidents and Lost Person Behavior in Yosemite National Park (2012). University of Kansas.

November 2012

## Chapter 5 Trail Signing

Table 5-3—Regulatory and warning sign requirements

Trail type	Sign face	Minimum size (inches)	Color	Shape or sign type
Hiker/pedestrian pack and saddle	Retroreflective not required; use for added emphasis	Warning: 12 x 12	If used, follow MUTCD colors	If used, follow MUTCD shapes
Wilderness	Never retroreflective	Regulatory: limited use at trailhead Warning: do not use	NA NA	NA NA
Cross-country ski, urban setting or night skiing	Shall be retroreflective	Warning: 12 x 12	Shall follow MUTCD colors	Shall follow MUTCD shapes
Cross-country ski, semi-primitive motorized and nonmotorized ROS	Retroreflective not required; use for added emphasis	Warning: 12 x 12	If used, follow MUTCD colors	If used, follow MUTCD shapes
Bicycle, paved or coincident with roads	Shall be retroreflective	Shall follow MUTCD table 9B-1	Shall follow MUTCD colors	Shall follow MUTCD shapes
Mountain bike	Shall be retroreflective	Warning: 12 x 12	Shall follow MUTCD colors	Shall follow MUTCD shapes
ATV/motorcycle	Shall be retroreflective	Warning: 12 x 12	Shall follow MUTCD colors	Shall follow MUTCD shapes
Snowmobile retroreflective	Shall be	Warning: 12 x 12 MUTCD colors	Shall follow MUTCD shapes	Shall follow
Water Shall follow		Shall be	Warning: 12 x 12 retroreflective	Shall follow MUTCD colors

Figure 2. USDA Forest Service Trail Signing. Trail Construction and Maintenance Notebook. (2007)

# Biomimicry

- Imitation of nature's processes, forms, or systems
- Encourages collaboration fields outside of design
- Sustainable solutions

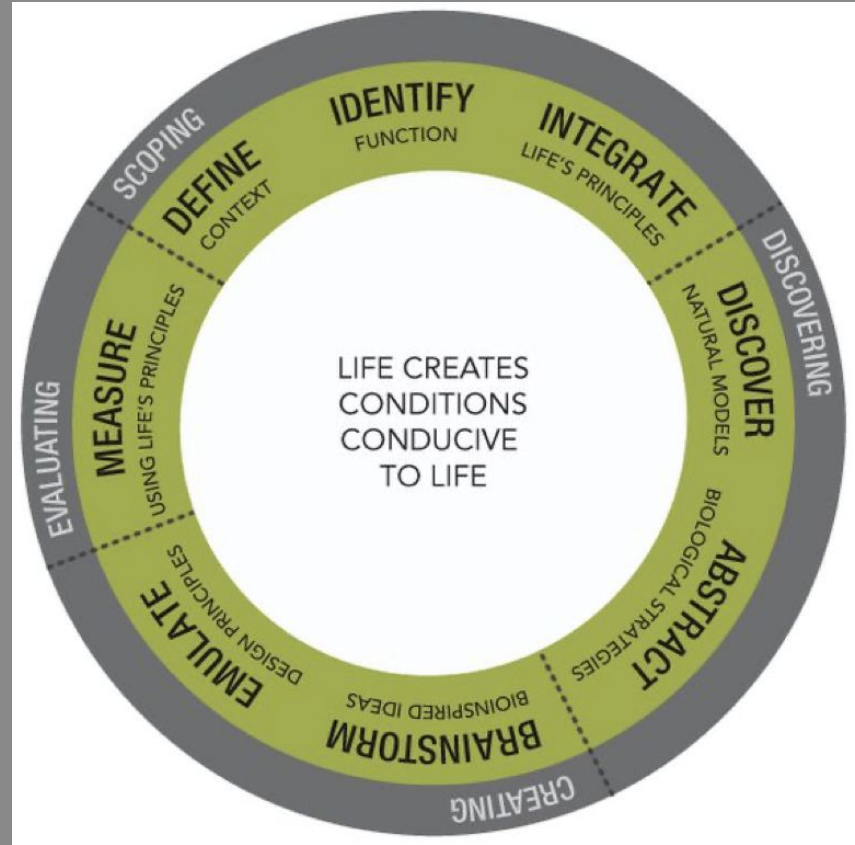
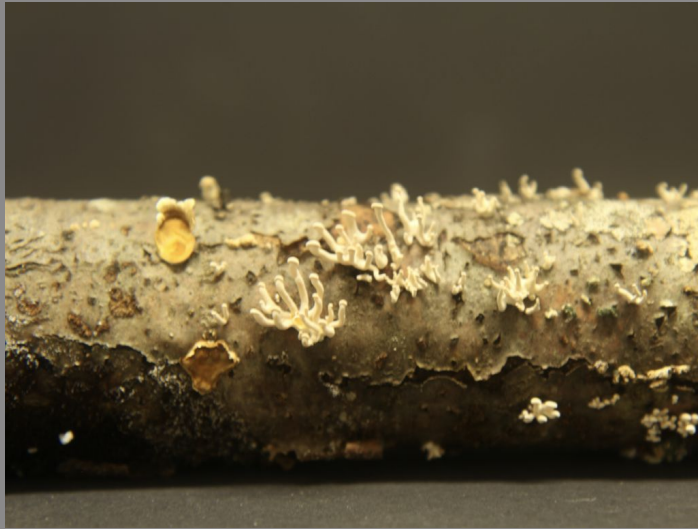
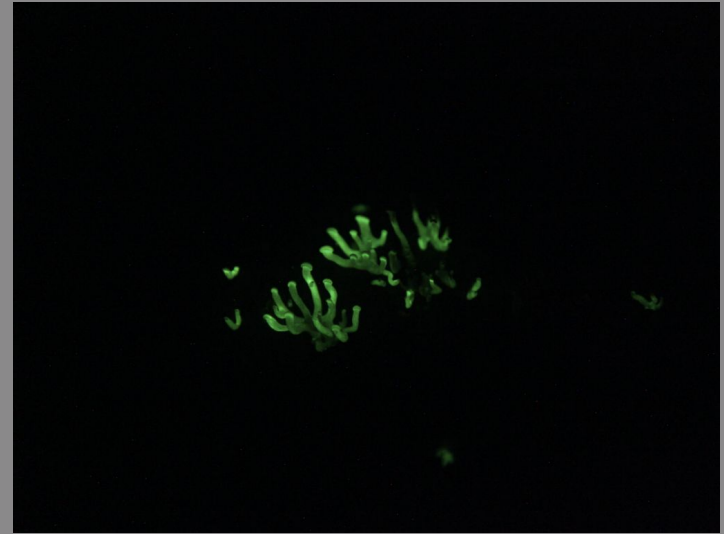


Figure 1. Cycle of Biomimetic Design. *BIOMIMICRY: GENIUS OF BIOME*. (2016, September). Retrieved from <http://www.imprintculturelab.com/wp-content/uploads/2013/08/BIOMIMICRY2.jpg>

# Biomimicry



Panellus Stipticus



Glowing Panellus Stipticus

# Biomimicry

- Dr. Bruce Branchini
- Luciferase extraction from fireflies
- 90% activity for at least 6 weeks
- Bioluminescence imitation

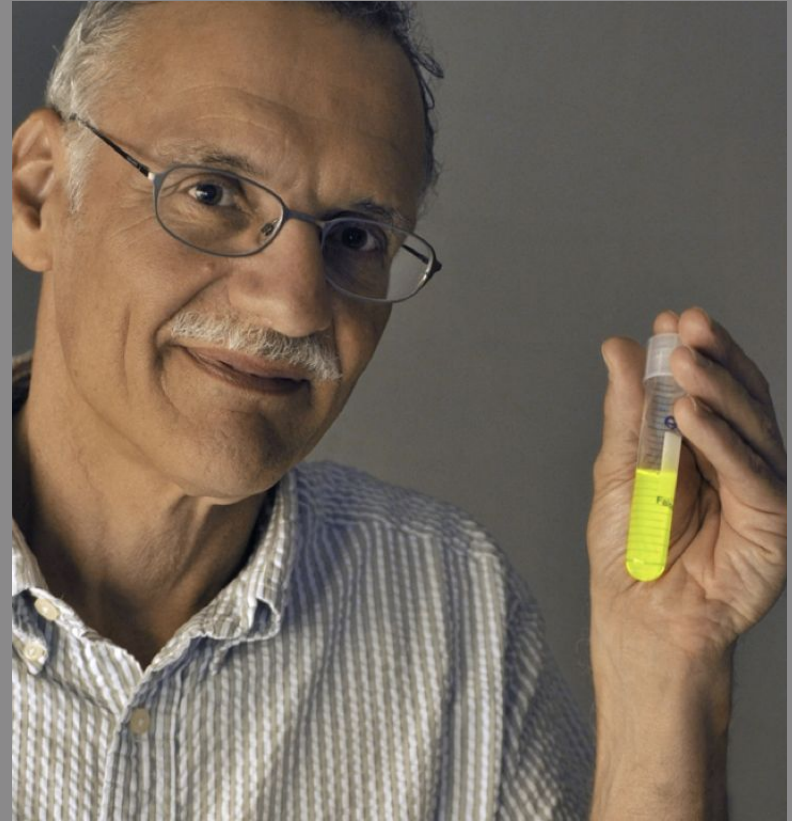


Figure 1. Bruce Branchini holding a test tube with bioluminescent protein. *Military eyes the secrets of fireflies*. (2010, September).

<https://www.theday.com/article/20100912/NWS01/309129808/1018>

# Biomimicry

- Glowing marker
- Glowing trail sign information



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# Create/Test

## Wayfinding Guidelines

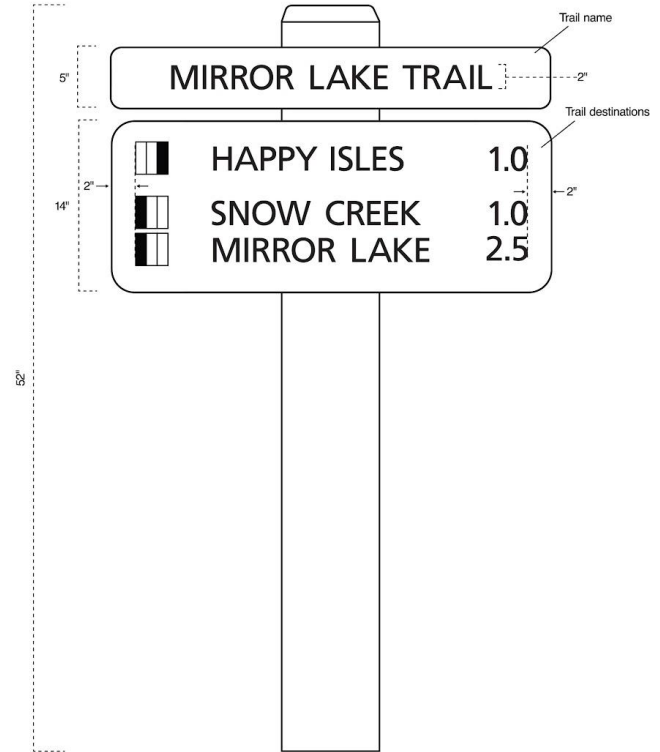
1. Create an identity for each park using a cohesive voice and similar styling (National Park Service (U.S.))
2. Use landmarks to provide orientation cues (Sorrows and Hirtle)
3. Provide signs or trail markers at decision points (Kettunen)
4. Install trail markers for high visibility (“Willamette National Forest - Hiking”)
5. Use reassurance markers to identify hiking trails (“Willamette National Forest - Hiking”)

# Create/Test

## Design Principles

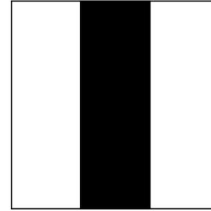
1. Sans serif fonts should be used on all hiking signs (Unimark International et al.)
2. Letter size is determined by viewing distance (Arthur and Passini)
3. Non-verbal pictographic information (symbols or icons) should be used sparingly and oftentimes with verbal information (Arthur and Passini)
4. Directional communication should be consistent (UniGuide)
5. Trail sign layout should be consistent with minimal information (Arthur and Passini)

# Create/Test

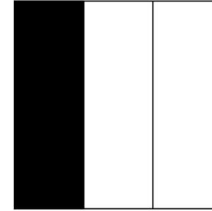


# Create/Test

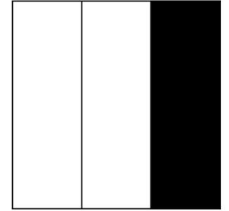
Continue Straight



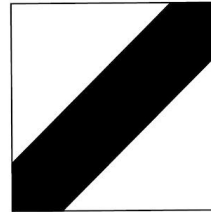
Left Turn



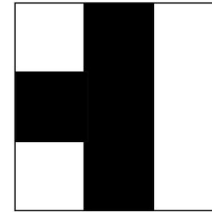
Right Turn



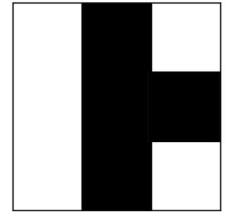
Switchbacks



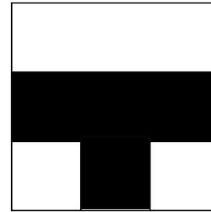
Left Connecting



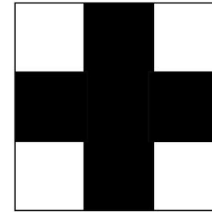
Right Connecting



T-Junction



Four-way Junction



# Create/Test



# Create/Test

- 6/6 – continue straight, left turn, right turn, t-junction, four-way
- 5/6 – right connecting
- 4/6 – left connecting
- 2/6 – switchbacks

What is your hiking experience?


Novice/Beginner (I am new to hiking or I have little experience with hiking. I hike at a slow/easy pace and I generally hike on flat, easy terrain)

Moderate (I have experience with hiking different types of terrain and elevation. I have experience hiking for a few hours with frequent breaks as the distance or elevation increases)

Advanced (I have experience with hiking at least half a day. I can handle several thousand feet in elevation gain. I can keep a moderate pace and I have enough experience to know when to conserve energy on the trail. I have experience hiking in multiple weather conditions and I know how to prepare for cold and hot conditions.)

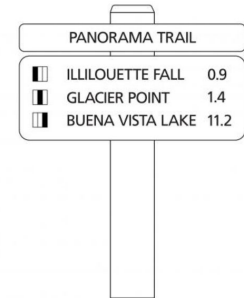
Expert (I have experience with full day hikes in different weather conditions. I know how to prepare for hikes with severe elevation gain and difficult terrain. I know how to conserve energy at a slow pace and when to rest. I have the ability to plan for multi-day hikes.)

The following marker has appeared on the trail you are currently hiking.



Please identify the upcoming trail direction as indicated by the marker shown above:

The following sign appears at a trail junction on Panorama Trail.



Which direction would you hike to get to Illilouette Fall?

Continue Straight

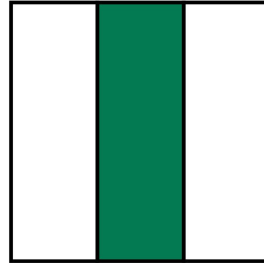
Turn Left

Turn Right

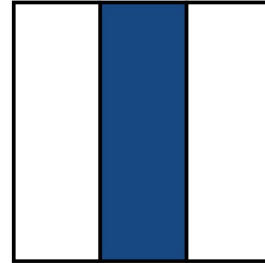
# Create/Test

- Green = Easy
- Blue = Moderate
- Black = Strenuous

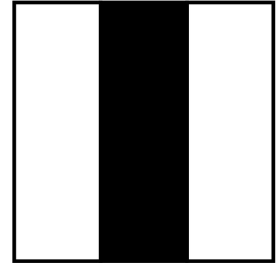
A



B



C





# Future Research

## User Testing

More user testing on hiking trails with in-person testing

## Expanded System

Full system with trailhead signs, paper maps, mobile applications, etc.

## Difficulty Ratings

An improved difficulty rating scale that changes depending on the difficulty of trail sections

# Thank you

Any questions? Email me at [mitschke.sara@gmail.com](mailto:mitschke.sara@gmail.com).

Sara Mitschke, MFA Communication Design