Resilience Engineering
Meets Outdoor Risk Management

Utilizing Resilience Engineering concepts to improve risk management in backcountry leadership development programs

Goals
- To review the different ways the term 'resilience' is used in the outdoor community
- To advocate for the outdoor community to adopt resilience as graceful extensibility
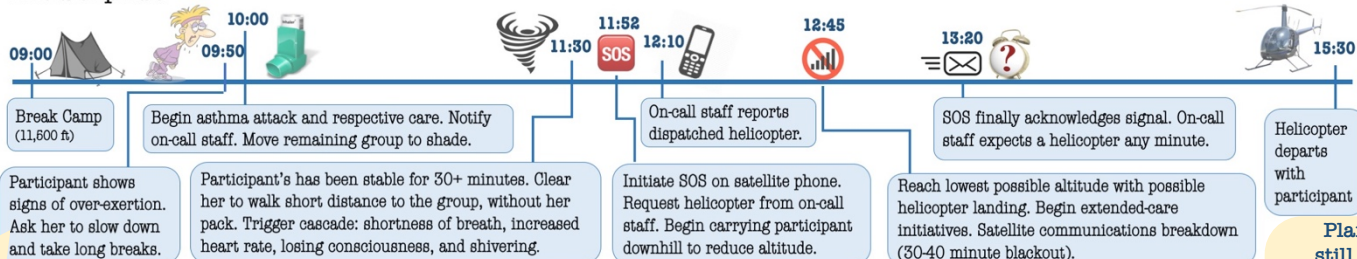
Methods
- Case study analysis of a backcountry medical evacuation through the lens of Resilience Engineering
- Use of Woods' (2015) four concepts of resilience – rebound, robustness, graceful extensibility, and sustained adaptability – as a frame for analysis and discussion

Background
- 12 participants and 2 trip leaders
- Sierra National Forest (California)
- 23-day, 170 mile backpacking expedition
  - Mono Creek to Cottonwood Meadows
- Program aims to develop individual & shared leadership skills

The Surprise

09:00 Break Camp (11,600 ft)

Participant shows signs of over-exertion. Ask her to slow down and take long breaks.

09:50 / 10:00 Begin asthma attack and respective care. Notify on-call staff. Move remaining group to shade.

Participant's has been stable for 30+ minutes. Clear her to walk short distance to the group, without her pack. Trigger cascade: shortness of breath, increased heart rate, losing consciousness, and shivering.

11:30 / 11:52 SOS Initiate SOS on satellite phone. Request helicopter from on-call staff. Begin carrying participant downhill to reduce altitude.

12:10 / 12:45 On-call staff reports dispatched helicopter.

Reach lowest possible altitude with possible helicopter landing. Begin extended-care initiatives. Satellite communications breakdown (30-40 minute blackout).

13:20 SOS finally acknowledges signal. On-call staff expects a helicopter any minute.

15:30 Helicopter departs with participant

I will be writing up this case for publication. In the meantime, please reach out if you're interested in hearing more.

Planning is still valuable to successful trips, but resilience as graceful extensibility focuses on planning AND re-planning in the field.

Resilience is commonly thought of as...

Rebound
the ability to "bounce back" from a disturbance

From the Literature

"An individual may reintegrate resiliently, reintegrate back to homeostasis or baseline, reintegrate with loss, or dysfunctionally reintegrate."[Overholt 2014]

Downfalls
- Does not describe the characteristics that were present before the disturbance that made it possible for the team to cope with an event
- Focuses on what happened after the disturbance (whether or not the team appeared to return to normal operations) instead of how it managed the event

Case Example

While the team was capable of performing the unexpected evacuation, they were left in a degraded state, unable to bounce back to their previous state. Aside from a change in mentality, the group had to continue with all the same food and group gear, now divided between fewer people, and they were two days behind schedule which would force them to move faster or hike longer in the days to come. This degraded state began to wear down some members of the group and three days later several team members considered exiting at the resupply location.

Robustness
the ability to resolve a set of disturbances that were planned for prior and are well-understood

From the Literature

"Every conceivable emergency situation had been identified and analysed; each would trigger an agreed upon response, and each was supported by training, checklists and defined procedures. No doubt these had proved effective on a number of occasions until, one day, a fire of unimaginable severity broke out." [Barton 2007]

Downfalls
- Fails when the disturbances are new, unpredicted, or poorly-modeled
- Focuses on having predetermined responses, i.e. protocols and SOPs, for a long list of potential disturbances (instead of creating adaptive capacity)

Case Example

Prior to the evacuation, the leaders were aware the medical conditions of participants included asthma, so the response to an asthma attack was planned for a variety of altitudes, severity levels, distances from additional medical personnel, etc. The wilderness first responders on the team had trained for helicopter evacuations and had practiced recognizing, treating, and monitoring conditions such as asthma and altitude sickness of various severities (AMS, HAPE, & HACE). Nevertheless, the team had not prepared or planned for HACE that would initially appear to be an asthma attack, combined with extensive technical difficulties with their satellite phones to coordinate the evacuation, yet they were capable of adapting.

Interested in reading more? DD Woods has a new article out: The Theory of Graceful Extensibility DOI: 10.007/s10669 – 018 – 9708 – 3

Resilience is more aptly defined as...

Graceful Extensibility
the ability to adapt when disturbances surpass the boundaries of the plan and of prior experience

From the Literature

"Staff tried in vain to follow the standard procedures but the truth was these did not apply with much relevance to an incident of such scale. The scale of the event was beyond the imagination of the planners." [Barton 2007]

Strengths
- Recognizes that an organization's plan, i.e. RMP or ERP, will never be robust enough to handle all disturbances because resources - such as time, money, and imaginativeness for future disturbances - are fundamentally limited
- Asks how, despite limited robustness, do organizations stretch their capabilities cope with disturbances? How do outdoor leaders adapt so well most of the time?

Case Example

Expanding on the example from the robustness section, adaptations were necessary to cope with the uncertain prognosis, unreliable technological communication for support, and time pressure. When communication channels were lost with the on-call program staff, trip leaders had to adapt for a successful evacuation. This clearly reflects resilience as graceful extensibility.

Conclusion
Resilience should be defined as graceful extensibility because it recognizes and supports how we adapt to surprises in the field.
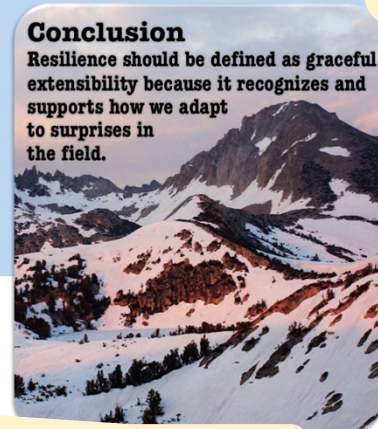
Key Points

Barton, B. Safety, risk and adventure in outdoor activities. Thousand Oaks: Paul Chapman 2007. Print.

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Overholt J, Ewert A. Gender Matters: Exploring the Process of Developing Resilience Through Outdoor Adventure. Journal of Experiential Education 2014; 38.

Woods DD. Four concepts for resilience and the implications for the future of resilience engineering. Elsevier 2015; 141: 5-9.

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If this case resonated with you, if you want to share your stories, or if you want to collaborate on future projects please reach out! Email: reynolds.818@osu.edu