

# THE INFRAMENT

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*Experience the vibrations of the earth.*





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By abstracting land information into a sonic landscape, seismic sound instruments encourage visitors to contemplate the mysteries of the wild around them and their presence in it.

Change works slowly but constantly in geology. When we look at a striated canyon wall in the desert, we can see the multicolored strata clearly defined. Each layer of minerals and sediment is a period of time compressed and reformed throughout epochs.

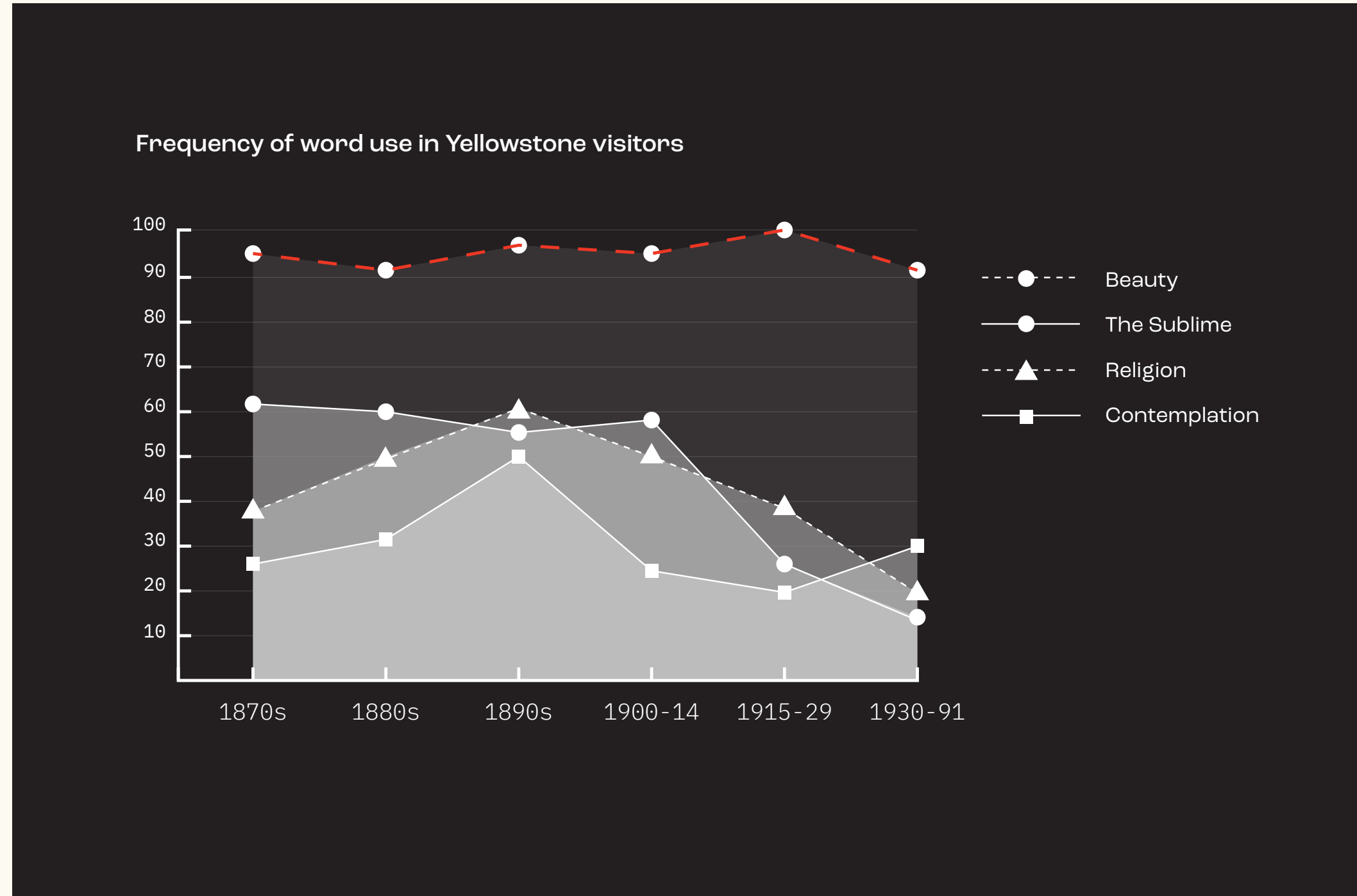
In Yellowstone National Park, the geologic history of the land is less visible, but no less present. Lava flow underground shapes and reshapes the plates above. Seismometers constantly stream out recordings of vibrations in the ground in the form of waves that narrow with stillness and bulge with activity. The vibrations are too slow to hear or feel, but they still shake our bodies imperceptibly.

John O'Donohue, an Irish philosopher, believes that beauty in a landscape is much more than the physical forms of the land. It is the elemental rhythm of the place. What if park visitors could come into rhythm with the elemental in Yellowstone?

Eco-theologists argue that human spiritual worldviews affect how we interact with and learn about nature. For the last century, mentions of “the sublime” and “religion” in literature about Yellowstone have been declining. By sonifying seismic data of specific locations in Yellowstone, the Inframent creates a sonic landscape that invites visitors to feel the sublime of Yellowstone. Just as geology changes our perception of time by compressing eons of earth history into one canyon wall, sound has the potential to reform time.

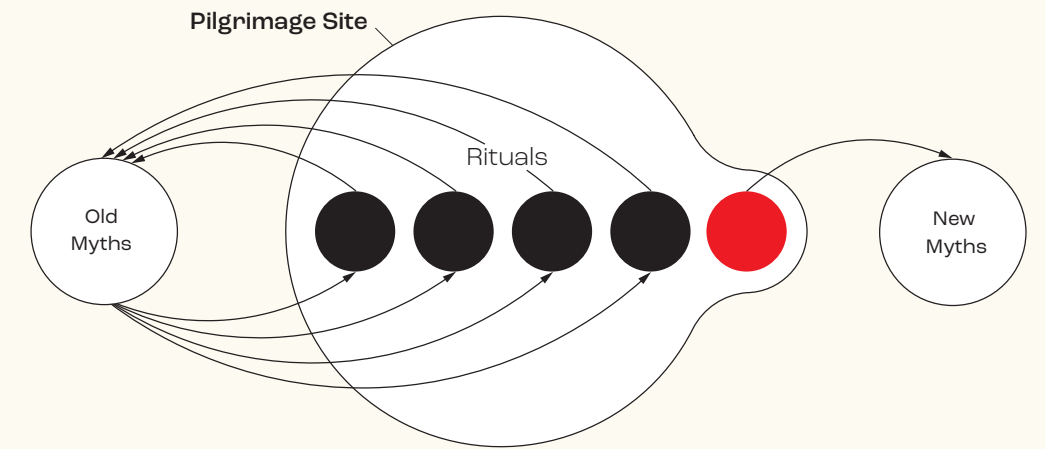
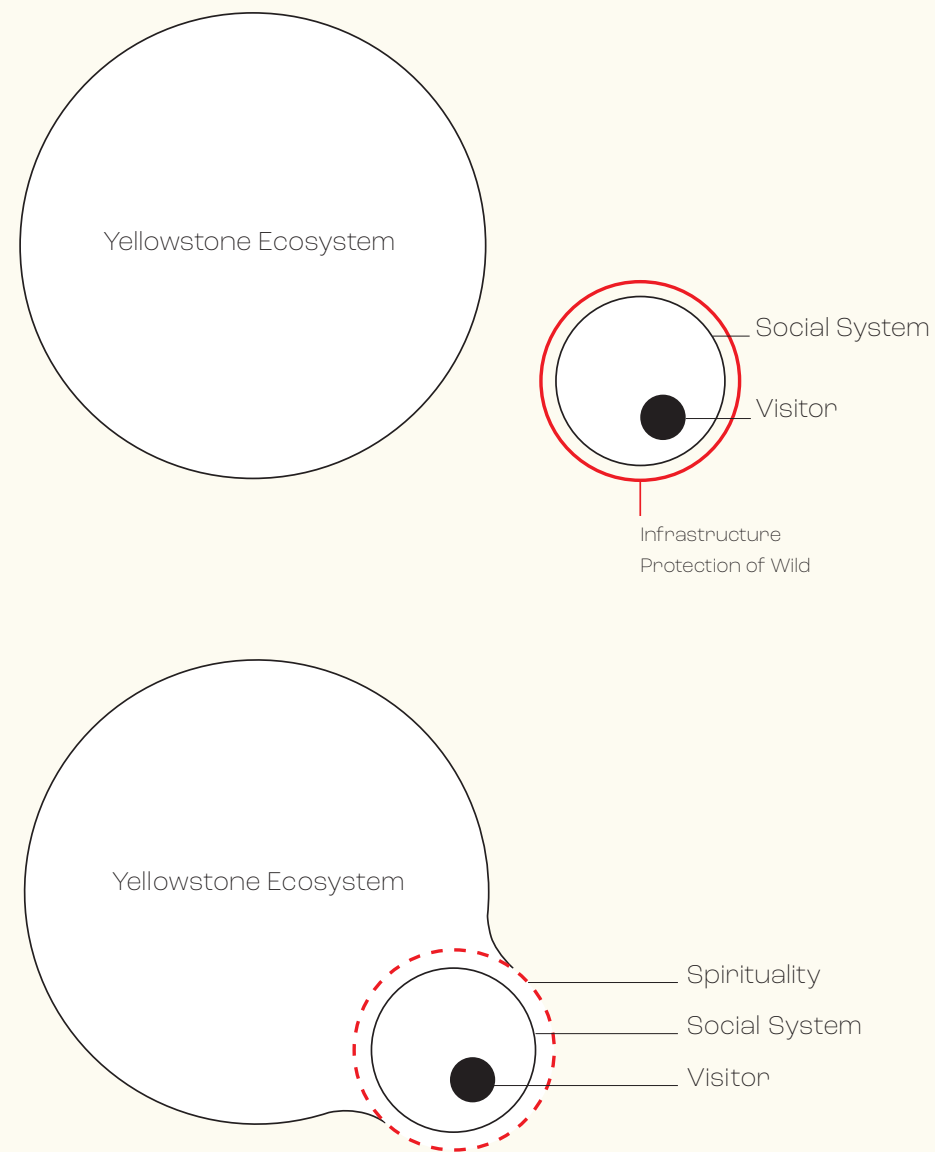
Only 2% of Yellowstone visitors leave roads or boardwalks, the most heavily trafficked areas of the park. In an effort to ensure visitor safety and the health of the ecosystem, the infrastructure of roads and boardwalks perpetuate a false dichotomy between “human” and “nature”.

Within writings about Yellowstone in the past century, the frequency of the words “religion,” “sublime,” and “contemplation,” have fallen under 30%, while “beauty” remains above 90 percent. **(Meyer, 1994)**



The problem of accommodating large amounts of visitors has created a park experience in which visitors feel separate from the ecosystem.

Social systems exist within ecosystems and are dependent on them (Ostrom, 2009). Visitors to Yellowstone are nested within the ecosystem. However, the problem of accommodating large amounts of visitors has created a park in which visitors feel separate from the ecosystem. Spiritual experiences can help to restore the connection between visitors and the ecosystem.



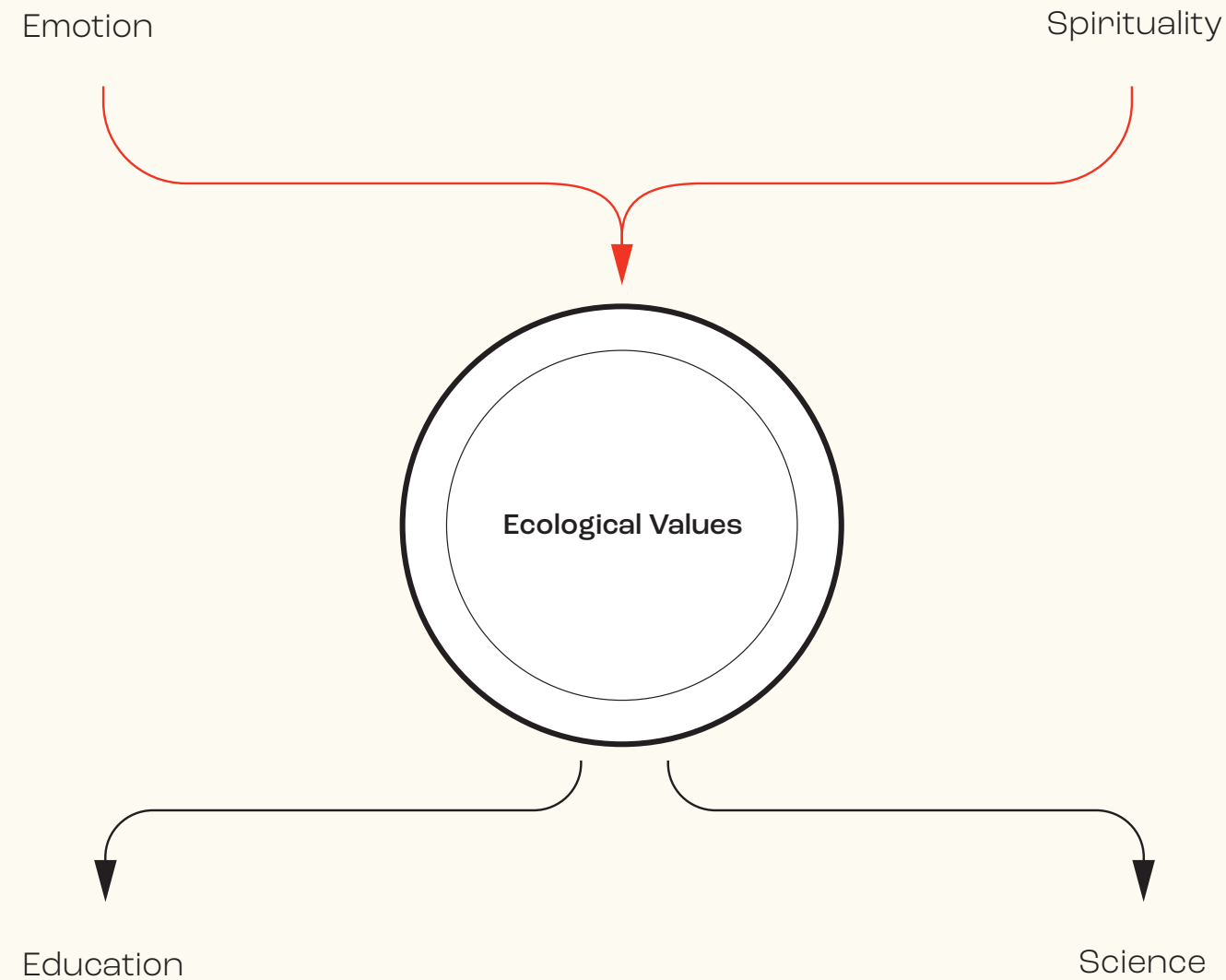
National parks are pilgrimage sites that embody the collective myths of American culture. (Ross-Bryant, 2005). Rituals take place at pilgrimage sites and are informed by myths and tradition.

The current Yellowstone rituals reinforce old myths about the park like individualism and the untouched frontier.

The Inframent adds a new ritual to the park pilgrimage experience and changes myths about Yellowstone.

Eco-theologists believe that human connection to the land requires both a scientific and spiritual understanding of our environment.

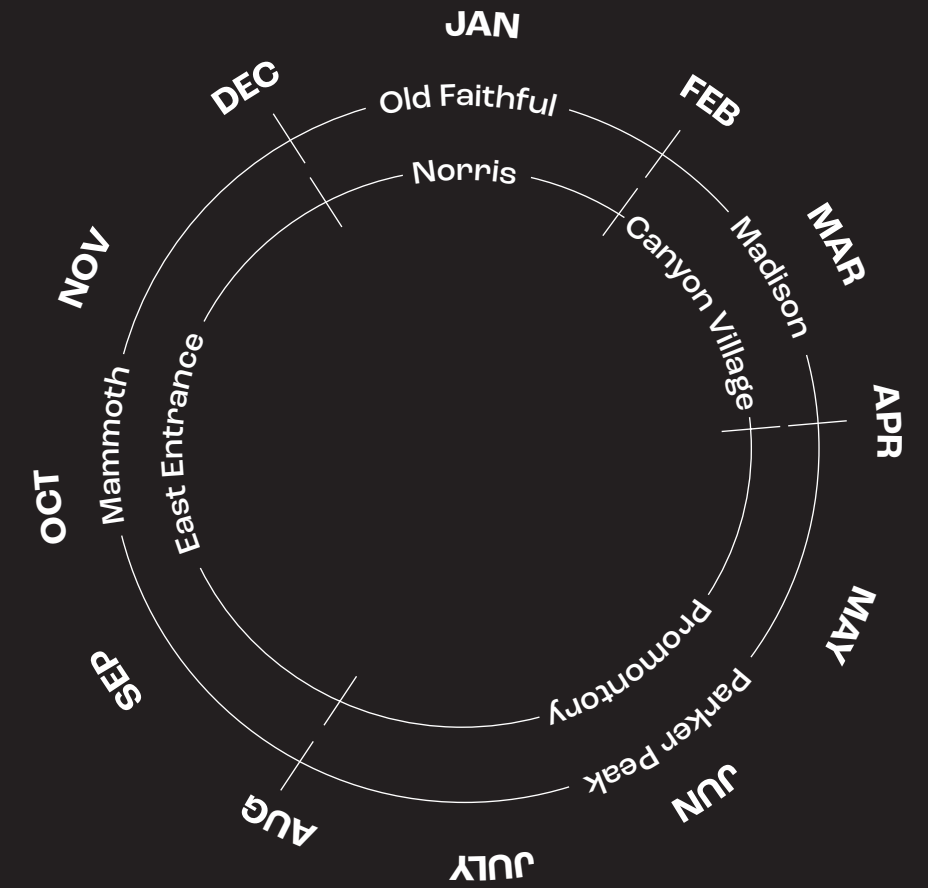
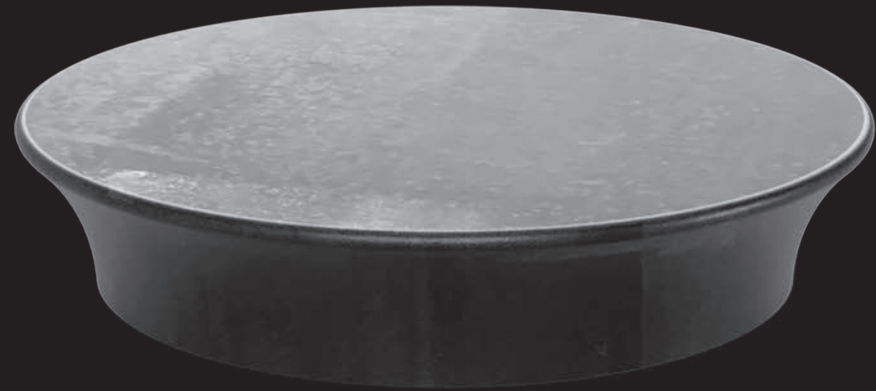
The Inframent adds opportunity for emotional and spiritual experiences in Yellowstone to supplement the education and science already taking place.



*“Human culture shows that science and spiritual endeavor grow from a common root, a common aspiration to know what is true and what is real.”*

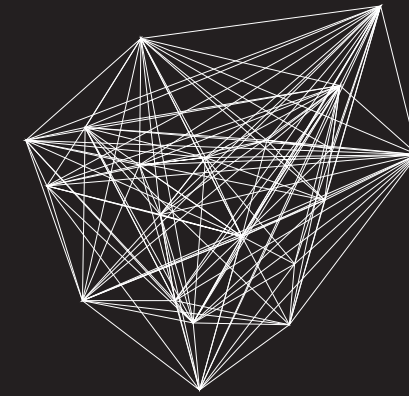
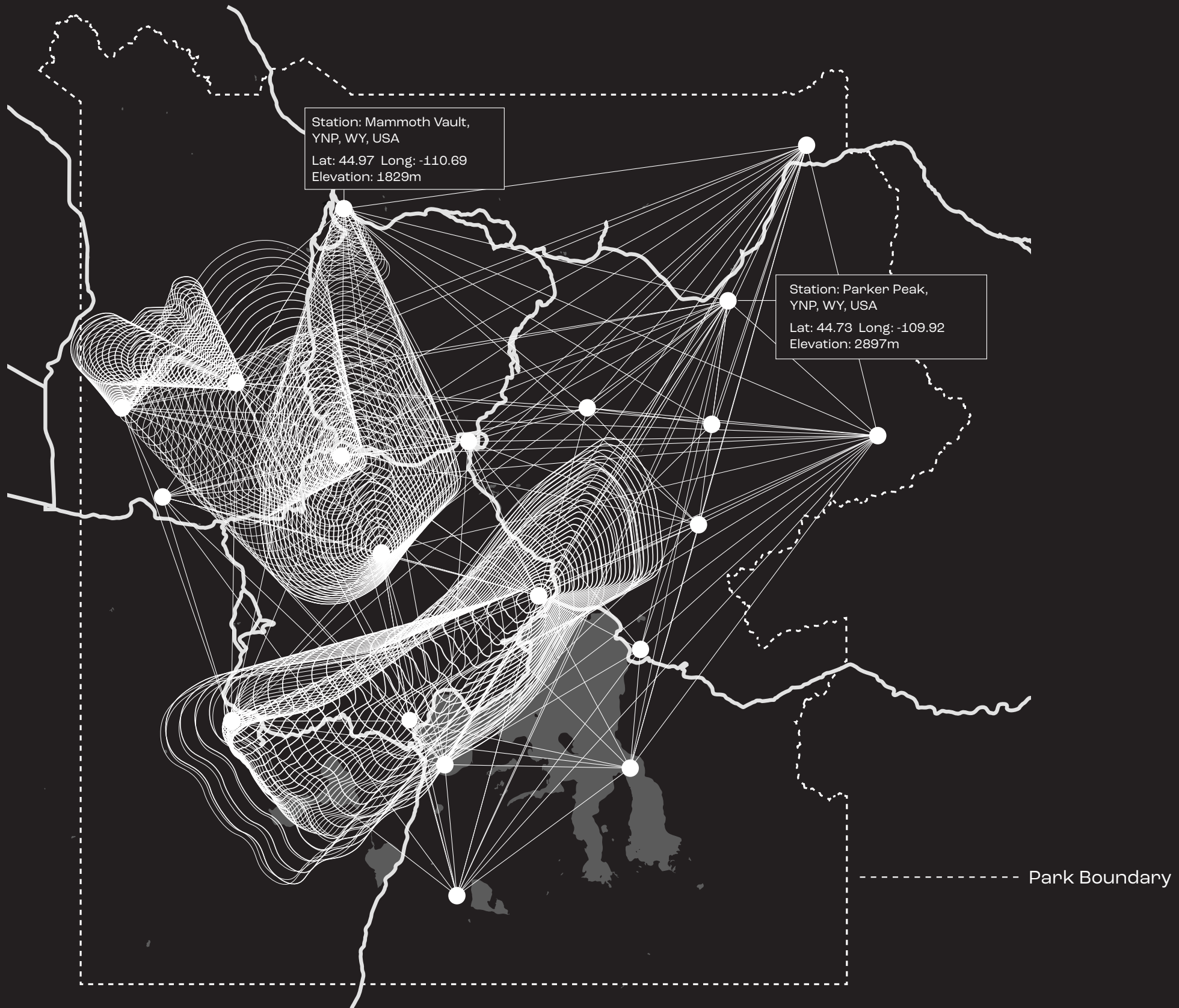
- Adam Frank, Science and the Sacred

The Inframent is a platform of sound experiences that take place throughout Yellowstone. The 32 seismometers in the park each produce a unique sound based on nearby seismic activity.

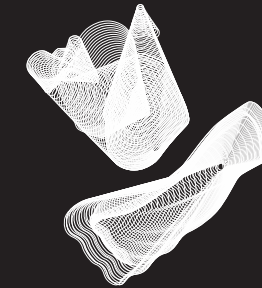


**Relocation**

The inframents will be installed in new locations every few months. This provides an opportunity for crowd mitigation during the highly visited months.



Each of the seismometers in YNP monitor a specific area around the most active center, the caldera (**University of Utah, 1983**). Transmitted by radio waves, the geological network creates an orchestra of seismic activity.



Locations of recent earthquakes create a map of the activity underground. (**ASL, 1990**). The seismometers closest to these movements interpret a unique reading of the activity. Looking at the readings as a whole assembles a seismic orchestra.



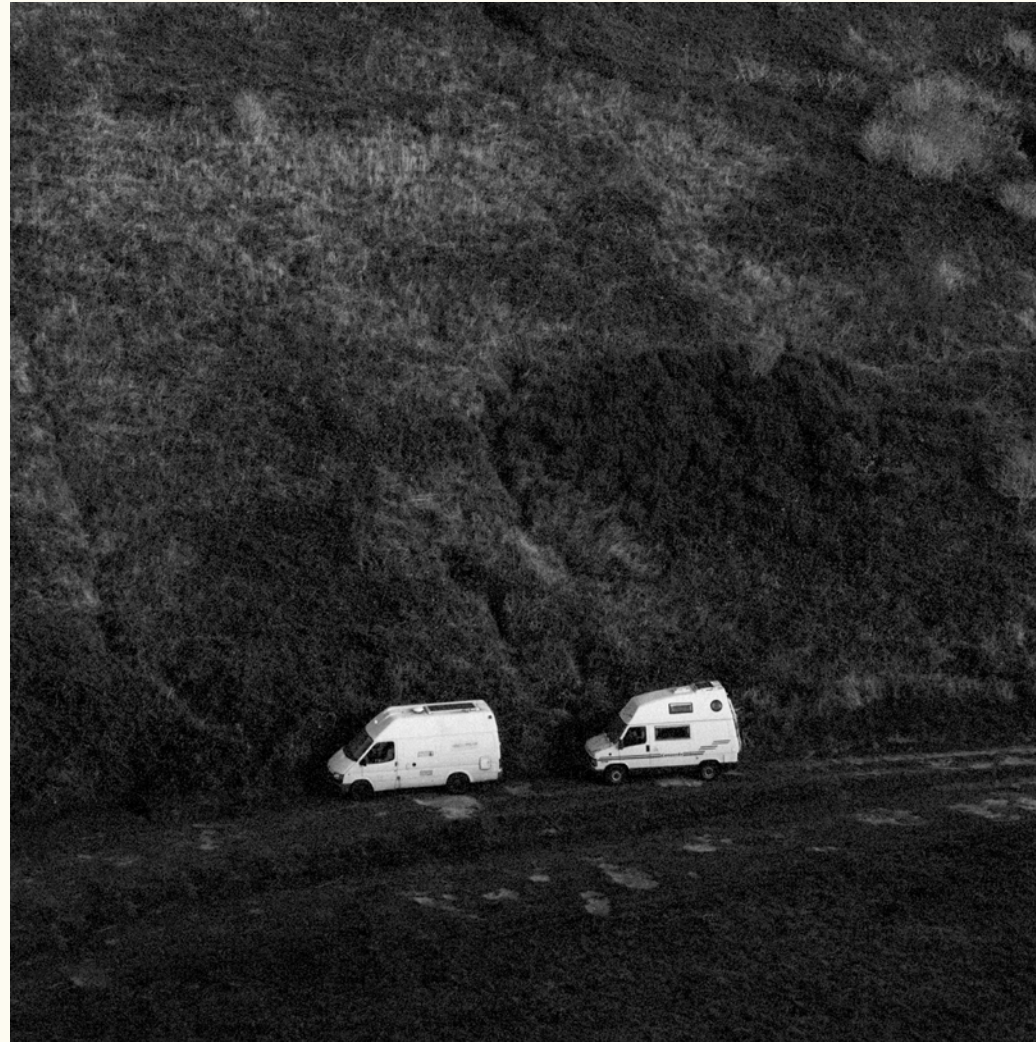
Segmentation of park visitors based on average length of stay (Mings et al., 1992) and the activities most likely to participate in (Benson et al., 2013; Kulesza et al., 2012).



**Backcountry Enthusiast**

- Activities
- Rock climbing
  - Camping
  - Overnight hiking

18% of Visitors  
 2 person group ●●  
**4 days in park**



**Windshield Tourist**

- Activities
- Sightseeing
  - Roadside exhibits
  - Nature viewing

22% of Visitors  
 3 person group ●●●  
**5 days in park**



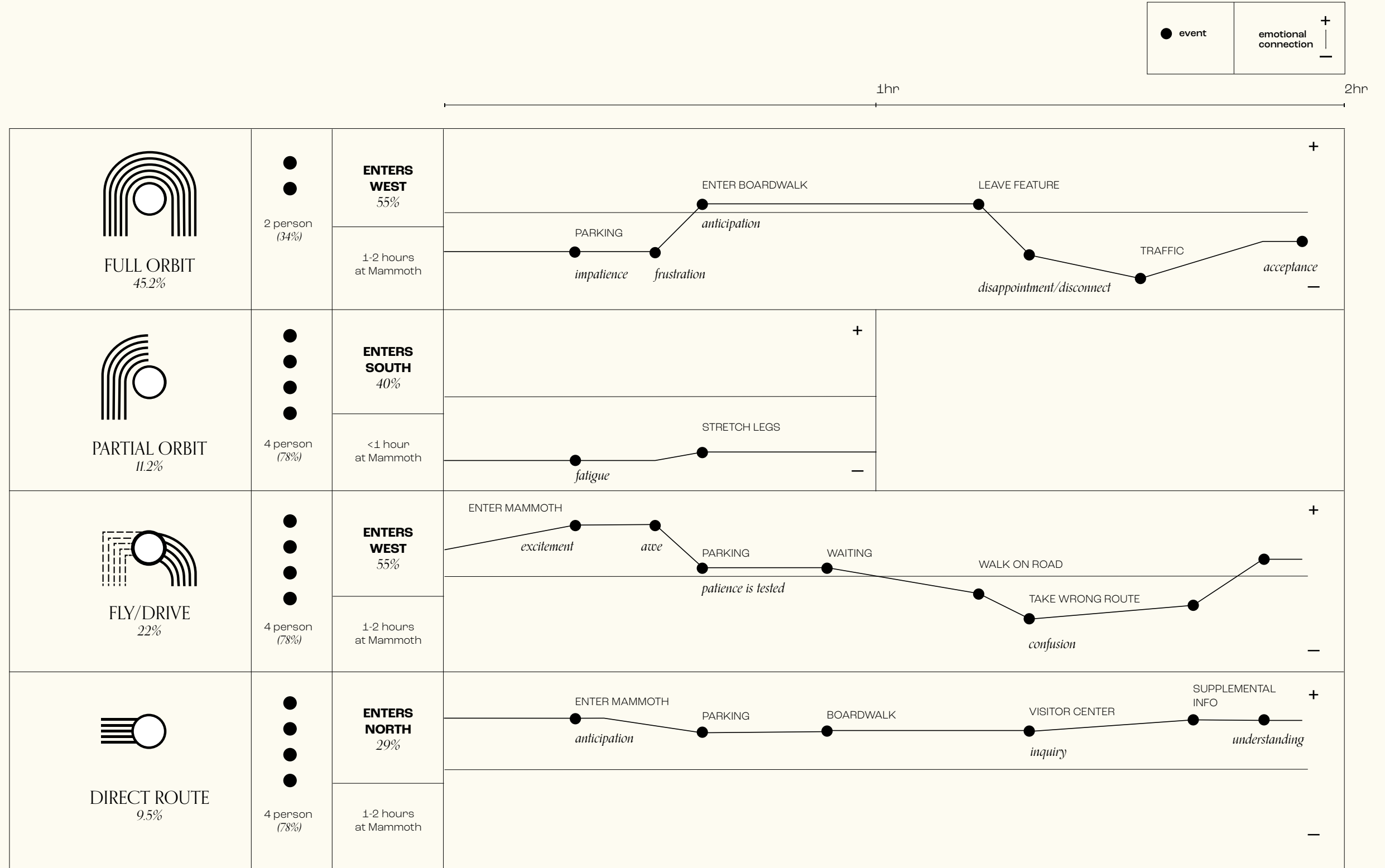
**Do-It-All-Adventurist**

- Activities
- Ranger programs
  - Day hiking
  - Visiting Museums

29% of Visitors  
 3 person group ●●●  
**8 days in park**

Segmentation of park visitors based on travel demographics, group size, and length of stay.

Current Visitor Journey at Mammoth Hot Springs



**SITE ANALYSIS:**

Mammoth Hot Springs

Mammoth Hot Springs is a popular site near Yellowstone's north entrance. The Inframent would be placed on the Sepulcher Trail near a parking area.

**Station Description:**

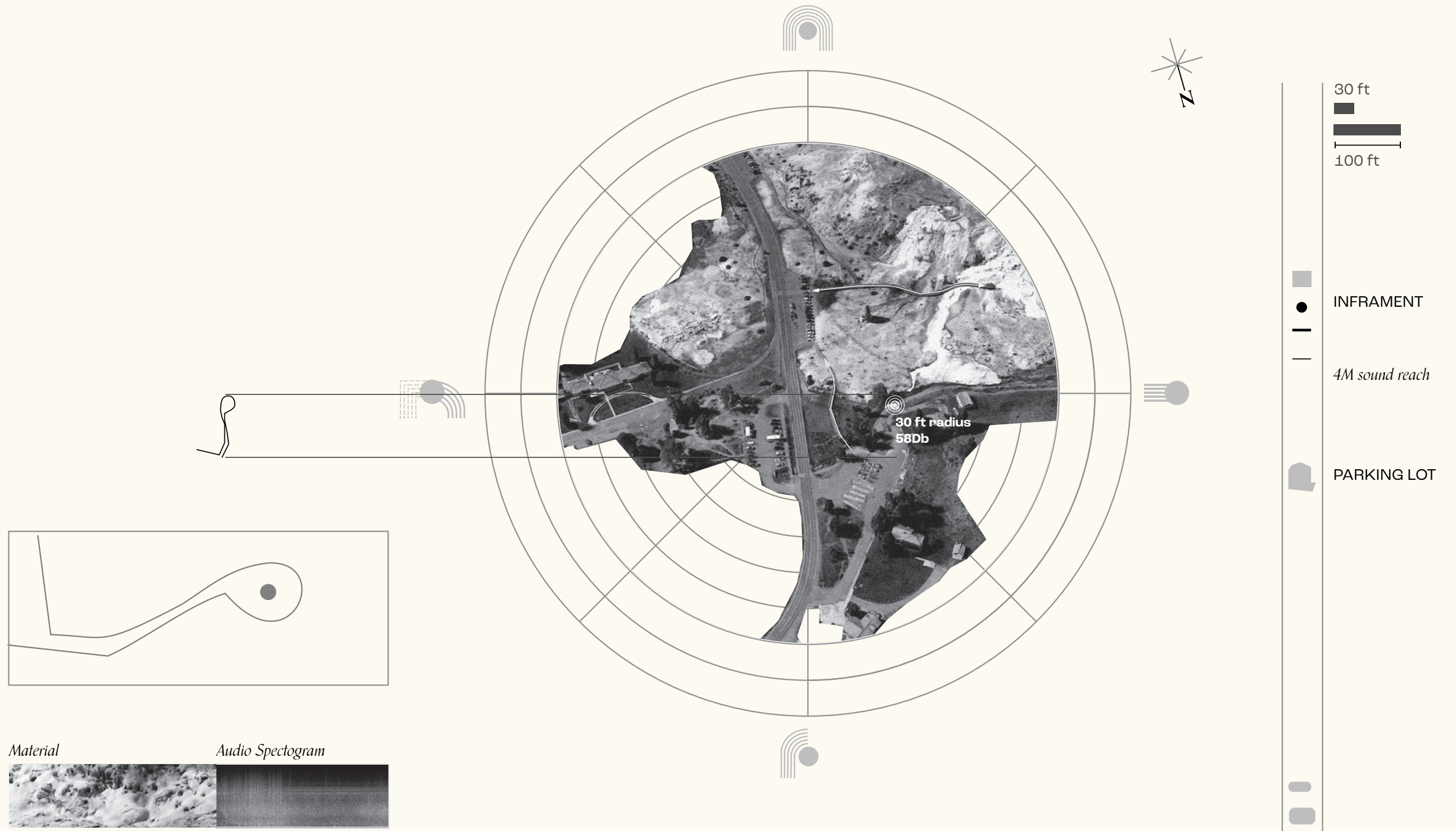
Mammoth Vault, YNP, WY, USA

Lat: 44.97 Long: -110.69

Elevation: 1829m

Sensor Type: Short Period  
L-4c seismometer

SEED Channels EH



**VISITOR INTERACTION:**

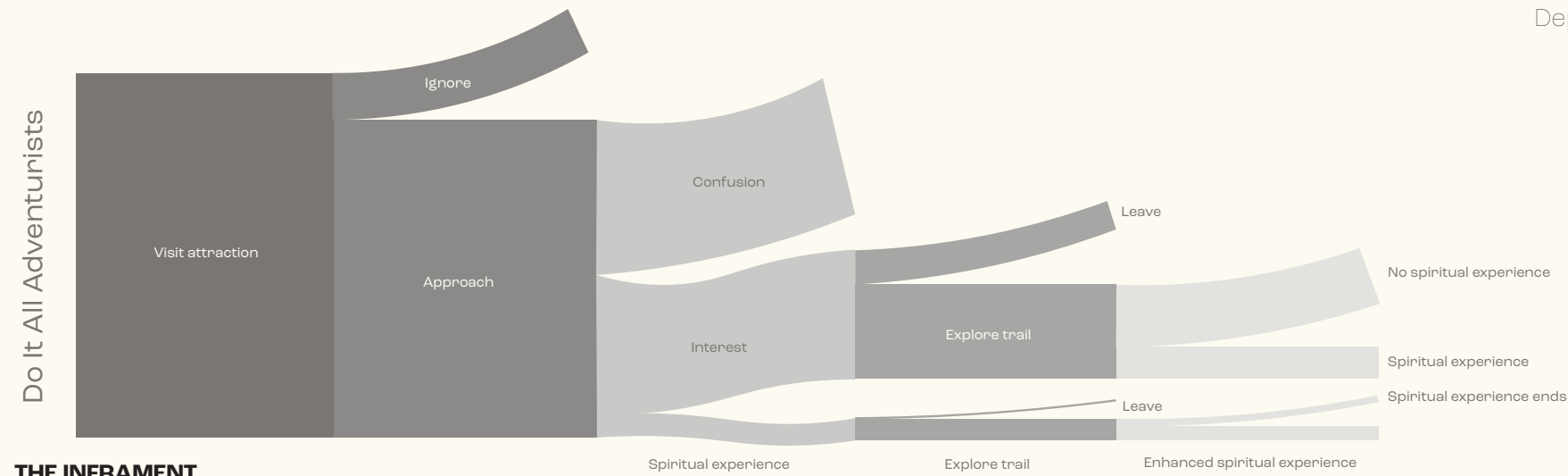
Mammoth Hot Springs

The Mammoth installation acts as a gateway from boardwalks and cars to a deeper understanding of the dynamics of Yellowstone's caldera.

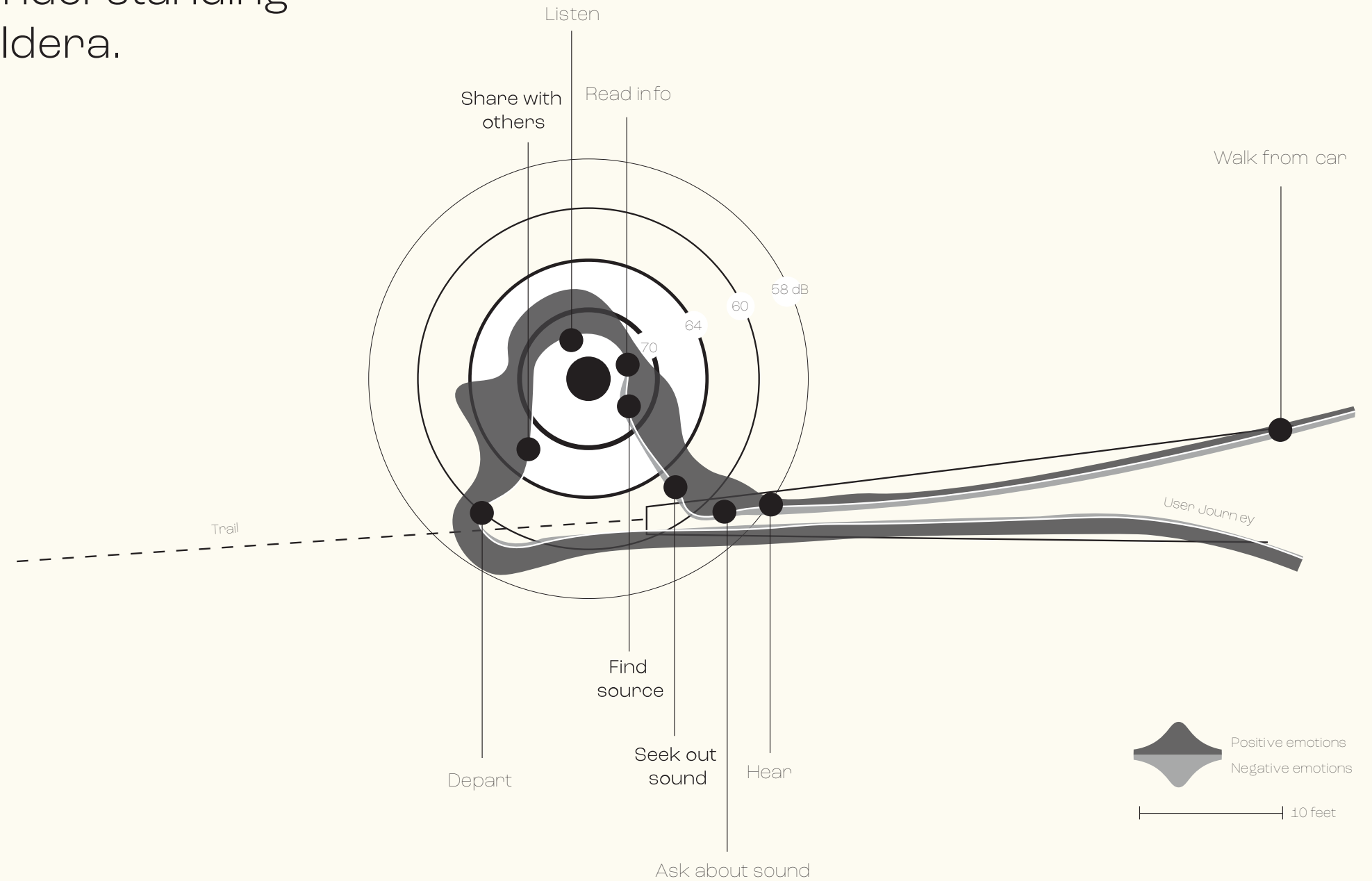
Visitors at the Mammoth Inframent will feel most positive while listening to the sounds and sharing the experience with others nearby. They will depart from the Inframent feeling more connected to Yellowstone than they did on the roads or boardwalks.

The Mammoth Inframent would be mostly visited by the Do-It-All Adventurists. Based on visitation demographics, we predicted the amount of

visitors who would have a spiritual experience at the Inframent. **(Benson et al., 2013)**



**THE INFRAMENT**



**SITE ANALYSIS:**

Parker Peak / Hoodoo Basin

Hoodoo Basin, near Parker Peak, is located on a backcountry trail 17 miles away from the nearest road. The Inframent would be placed next to the trail just before the edge of the basin.

**Station Description:**

Parker Peak, YNP, WY, USA

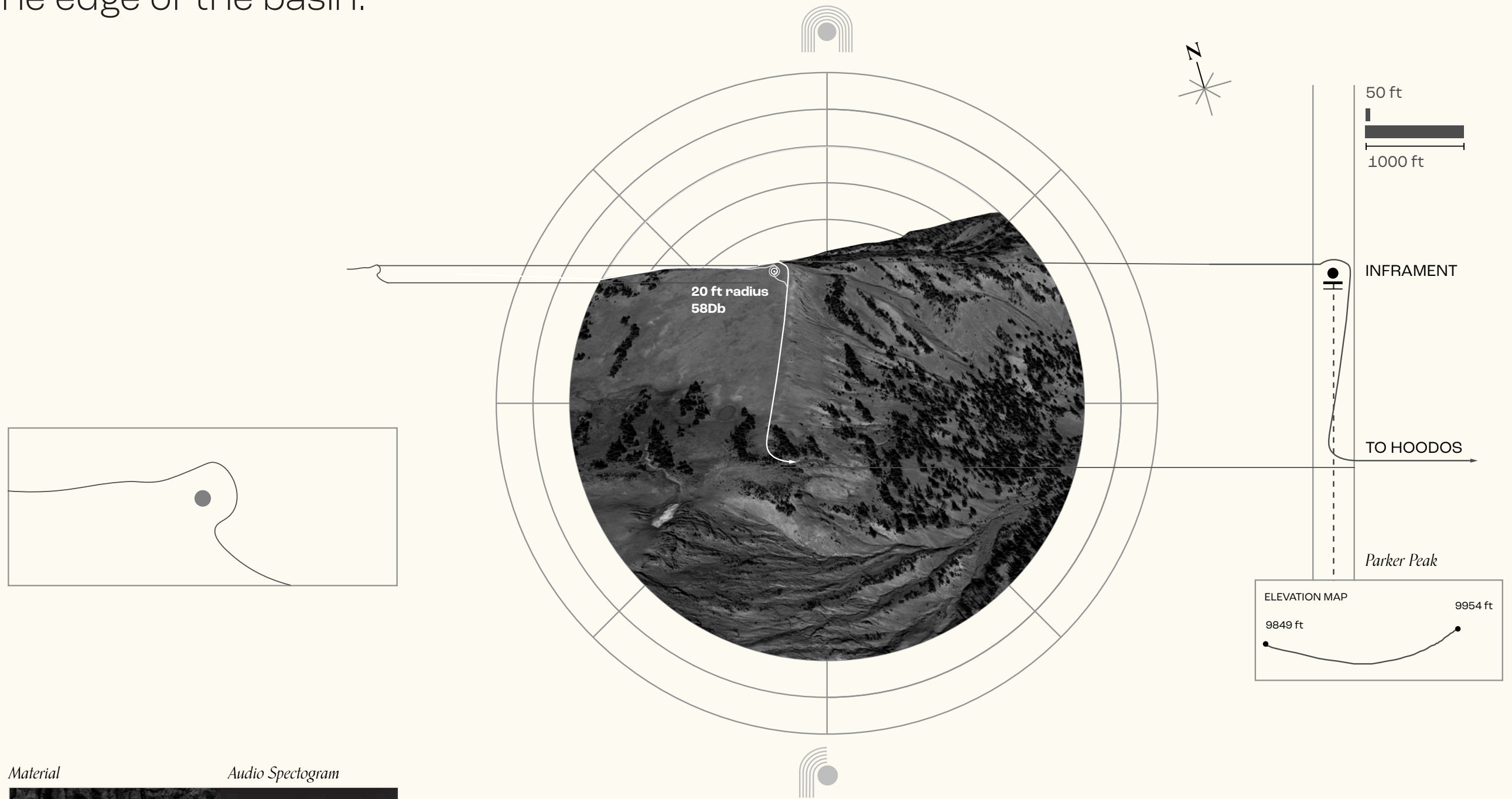
Lat: 44.73 Long: -109.92

Elevation: 2897m

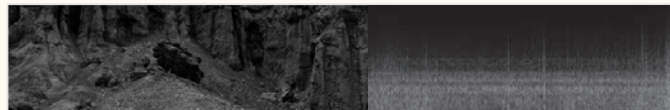
Sensor Type: Short Period

Mark Products L-4 seismometer

SEED Channels EHE, EHN, EHZ



Material



Audio Spectrogram

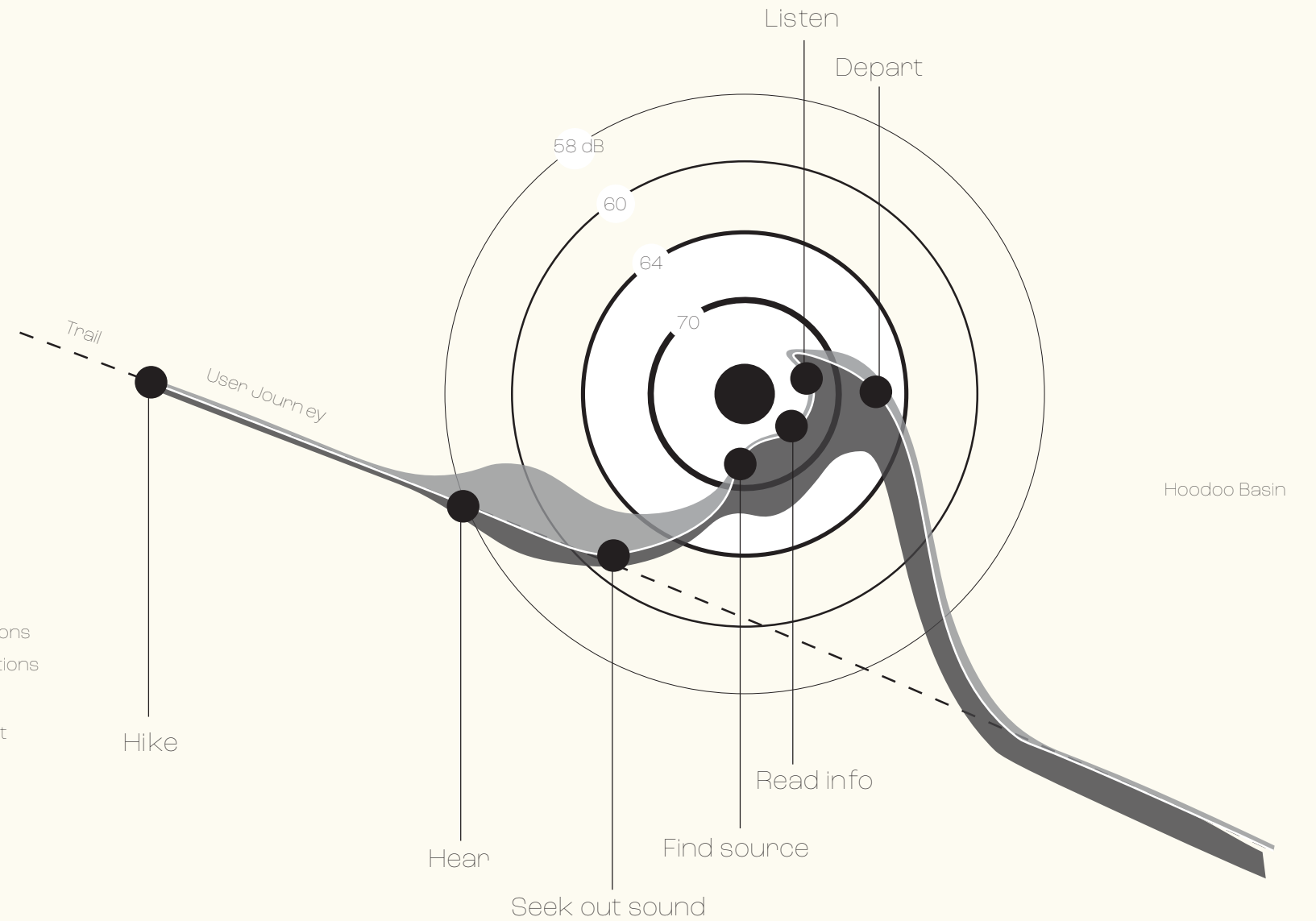
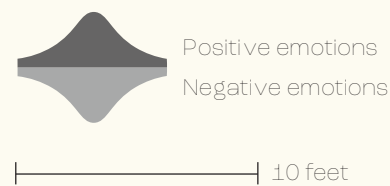
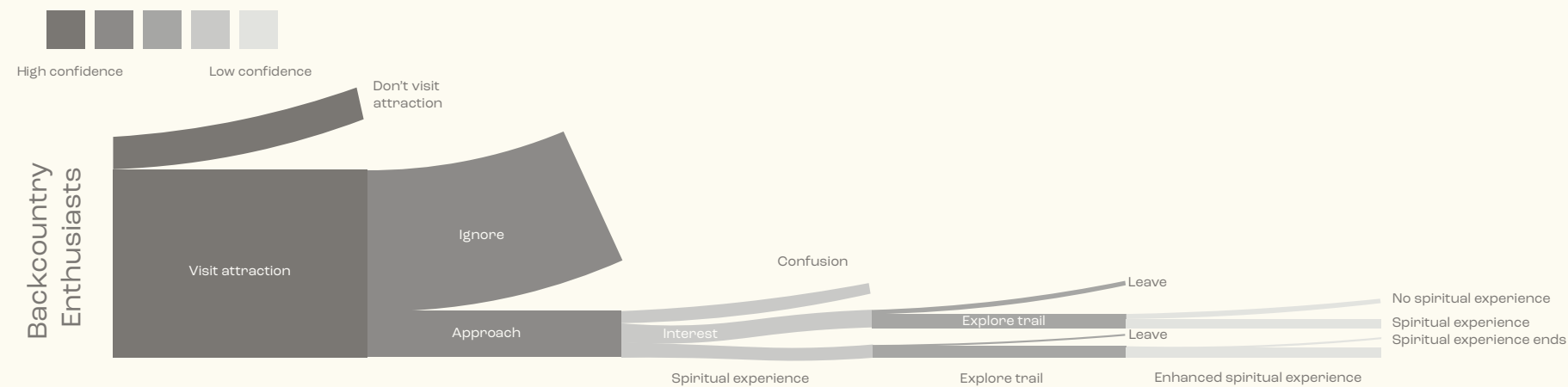
**VISITOR INTERACTION:**

Parker Peak / Hoodoo Basin

At Parker Peak, the Inframant deepens backcountry hikers' reflection about the landscape they are immersed in.

Hikers may be initially confused when encountering the Inframant in the backcountry. After reading the information and listening to the sounds, however, hikers will feel more spiritually connected to the basin they are about to enter.

The Parker Peak Inframant would be mostly visited by the Backcountry Enthusiasts. Based on visitation demographics, we predicted the amount of hikers who would have a spiritual experience at the Inframant.



The Inframent vibrates a steel shell with the waves of seismic motion, creating sound that is broadcast to Yellowstone visitors.



*The Inframent invites visitors to fall to the ground and feel a connection to the earth, where the vibrations of the caldera originate. A sacred heartbeat.*

The Inframent sonifies data collected from the seismometer network in Yellowstone.

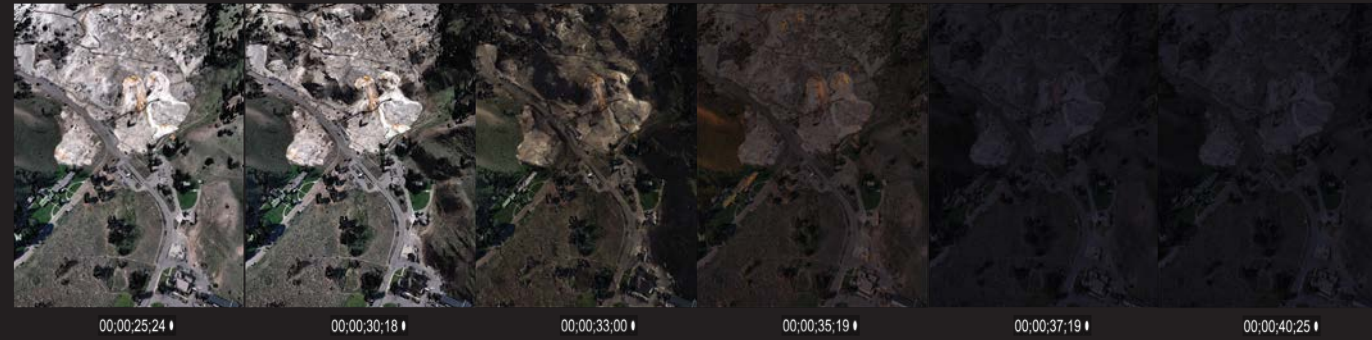
**Data Sourcing**

Seismic activity is remotely accessed within 30 minutes of the seismometer recordings. “.Seed” is the standard file type for captured movement. Seed data for the Inframent was accessed through the University of Utah seismometer network courtesy of Jamie Farrell and IRIS.gov.

**Scripting**

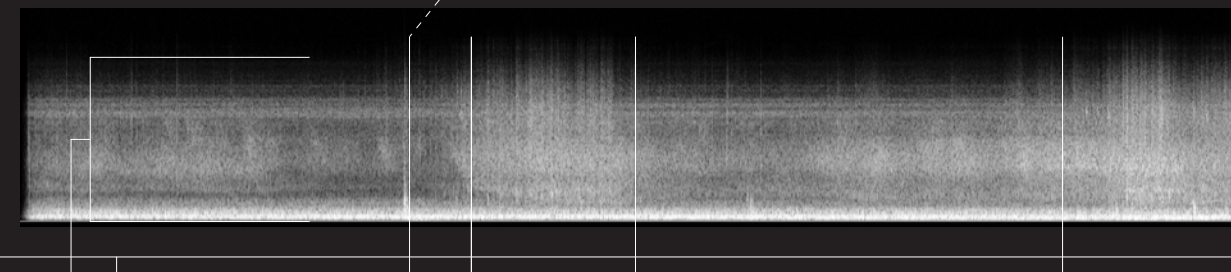
Using a Mat-Lab script, courtesy of University of Utah geologist Jeff Moore, geographic seed data is translated into text files including the time-code (1:65 ratio), geophone x-height and y-height. Infrasonic sound is stepped up to higher Hz that is audible by the human ear.

24 hr

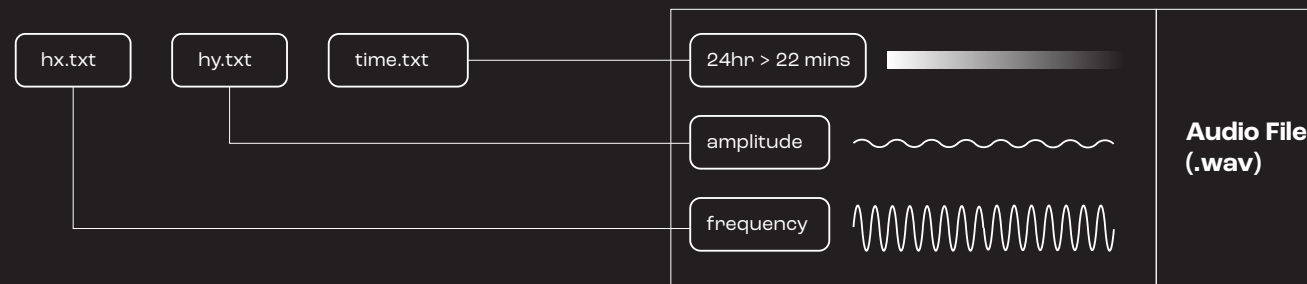


24 hours of seismic activity are sped up to 22 minutes of audio at a higher frequency.

22 mins



The data is analyzed for geographic activity using a spectrogram image showing the amplitude and frequency of the seismometer recordings.

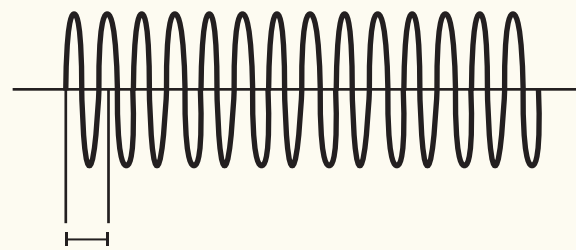




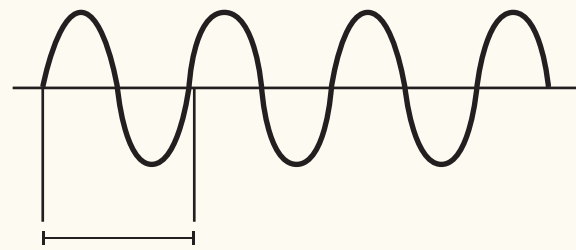
Sound Reverberation

Because of its reverberation wavelength, steel sonifies vibrations at a greater distance. (Fuchs, 2017). At a frequency of 100 Hz, The wavelength through steel completes a distance of 168ft.

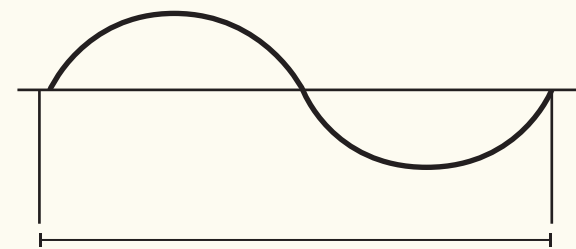
Frequency of 100 Hz. in all cases.



Wavelength in Air= 11.27 ft



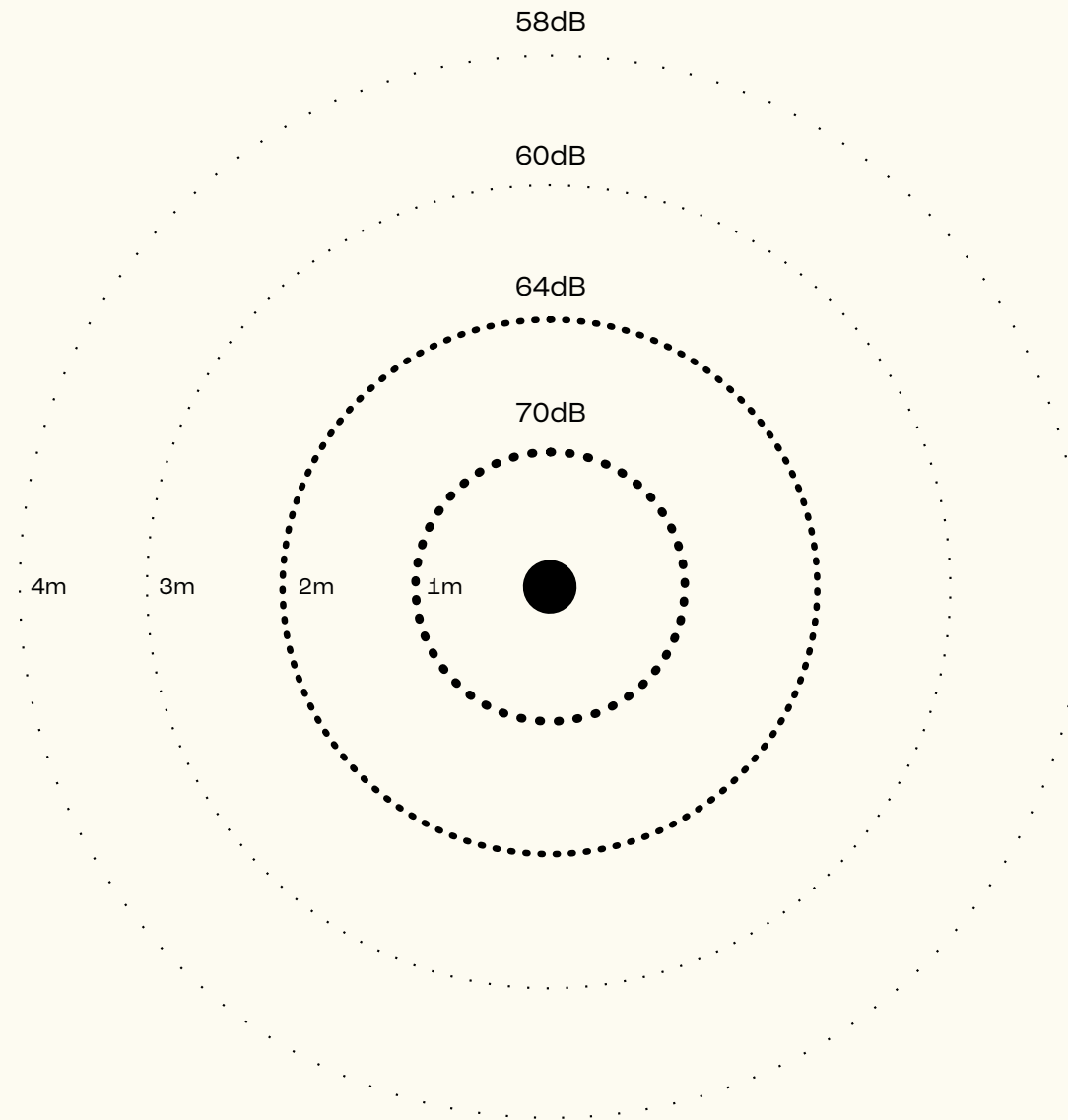
Wavelength in Water = 48.05 ft



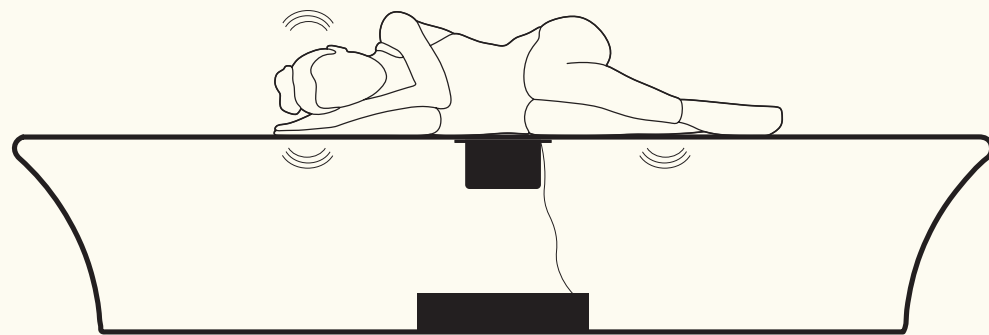
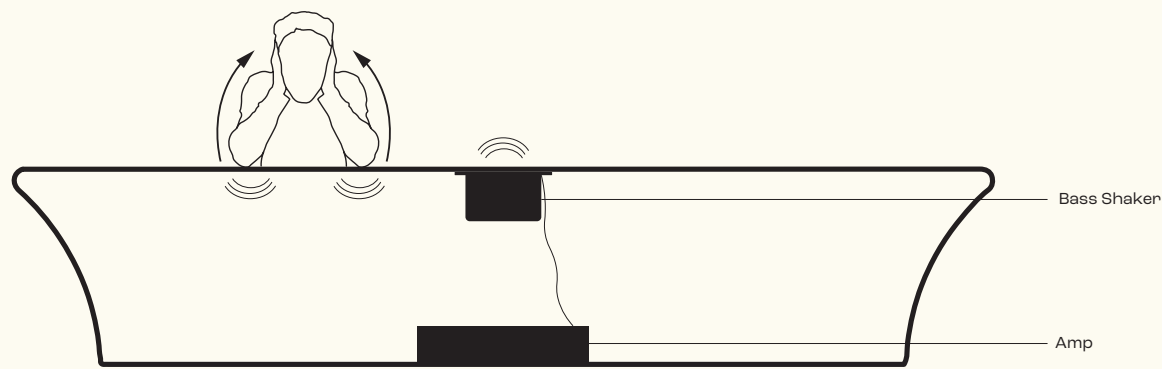
Wavelength in Steel = 168.5 ft

Sound Decay

If played at 70 decibels, the sound will exceed outdoor background noise when visitors are within 4 meters of the Inframent.

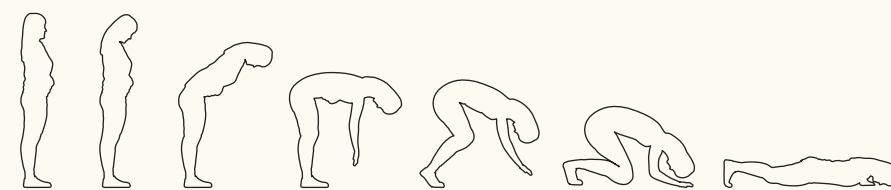


The physical vibrations of the instrument encourage visitors to touch the surface and feel the motion of the ground. Bone-transducing touch-points close to the ears, like elbows, are ideal to hear and feel the vibrations as they move through the human body.

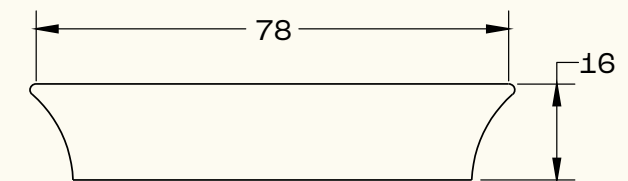
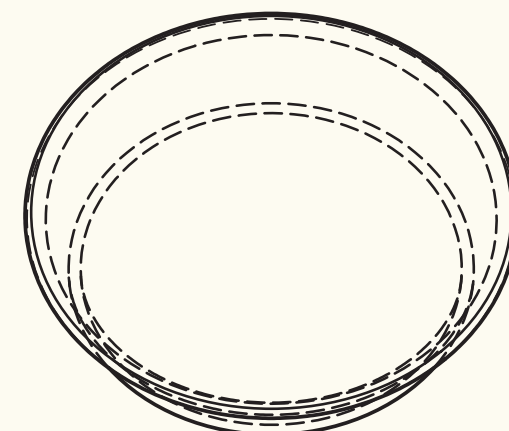
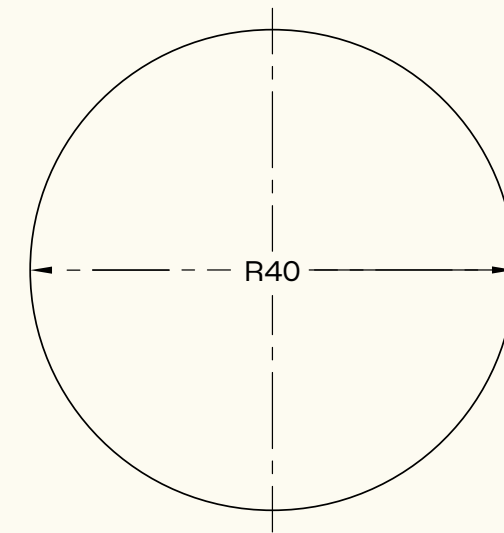
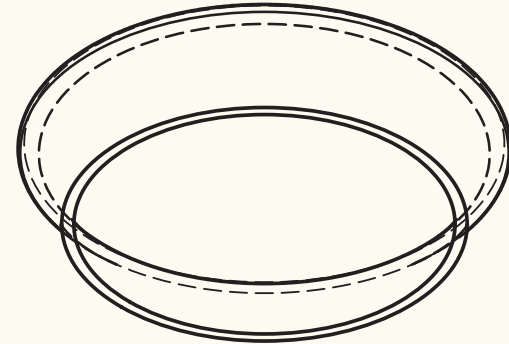


### Prostration

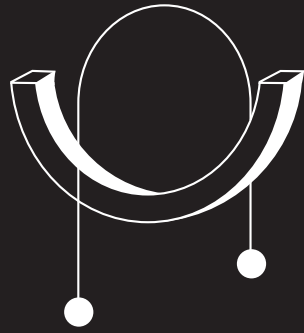
Visitors can kneel next to the instrument with elbows placed on the surface or lie on the surface to feel the sound, moving from an upright position to one similar to religious prostration.



The construction consists of an oxidized steel base and platform that encases a bass-shaker and amplifier. The bass transducer is attached to the top surface from inside the steel case. The rusted patina of the reclaimed steel blends into Yellowstone's textured landscape.







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#### Special thanks to

Jeff Moore, University of Utah Geology Department

Milad H. Mozari, Multi-disciplinary Design, University of Utah.

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