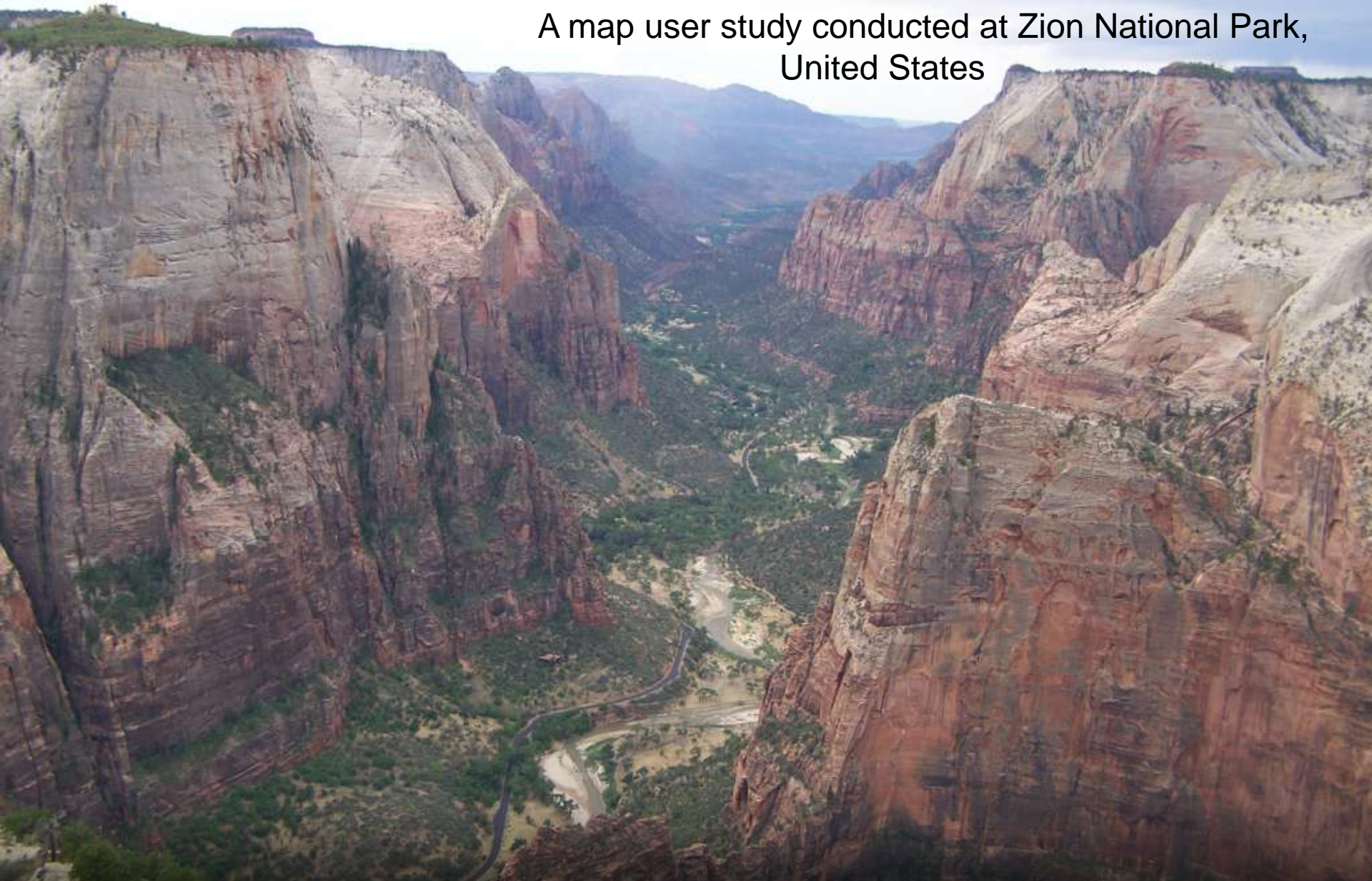


Evaluating the Effectiveness of 2D vs. 3D Trailhead Maps

A map user study conducted at Zion National Park,
United States

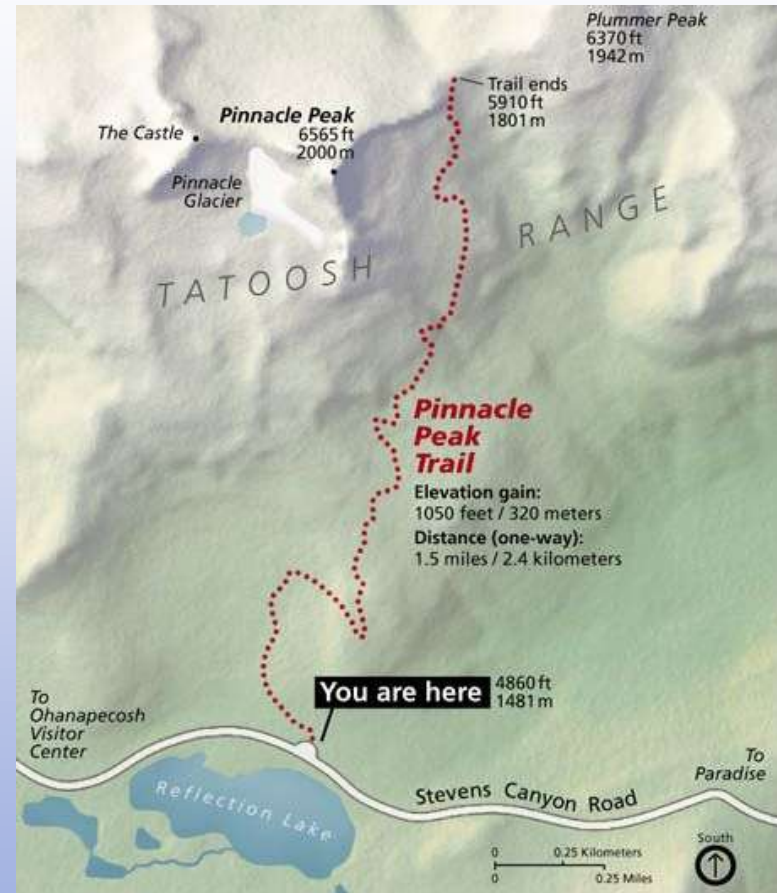
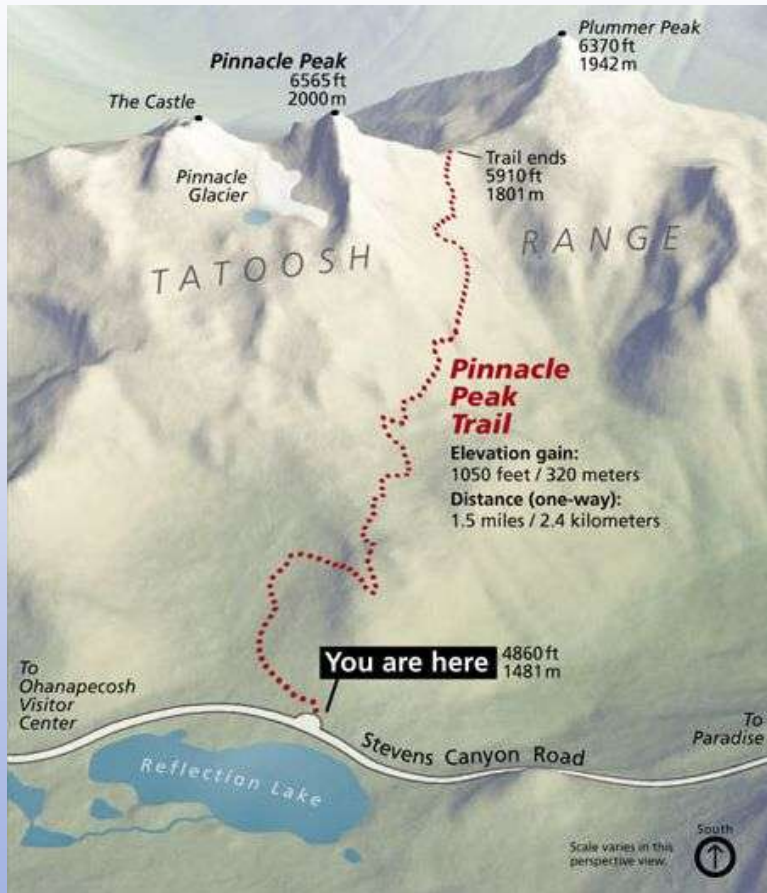


Evaluating National Park Service 3D Trailhead Maps



Tom Patterson
US National Park Service
Harpers Ferry Center

Retrospect: Vall de Núria, Spain, 2004

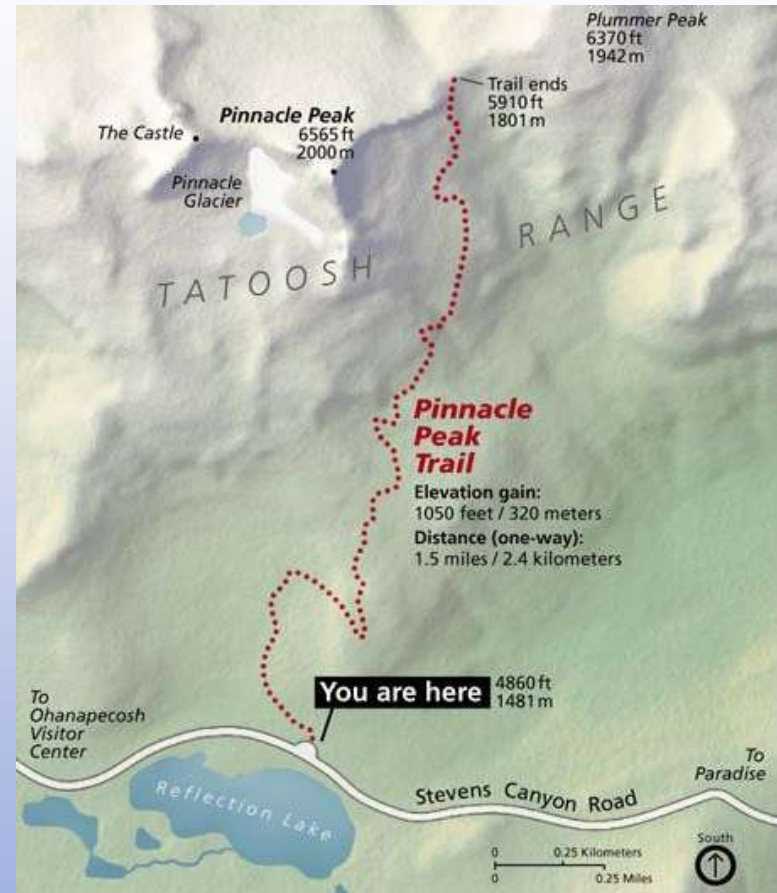
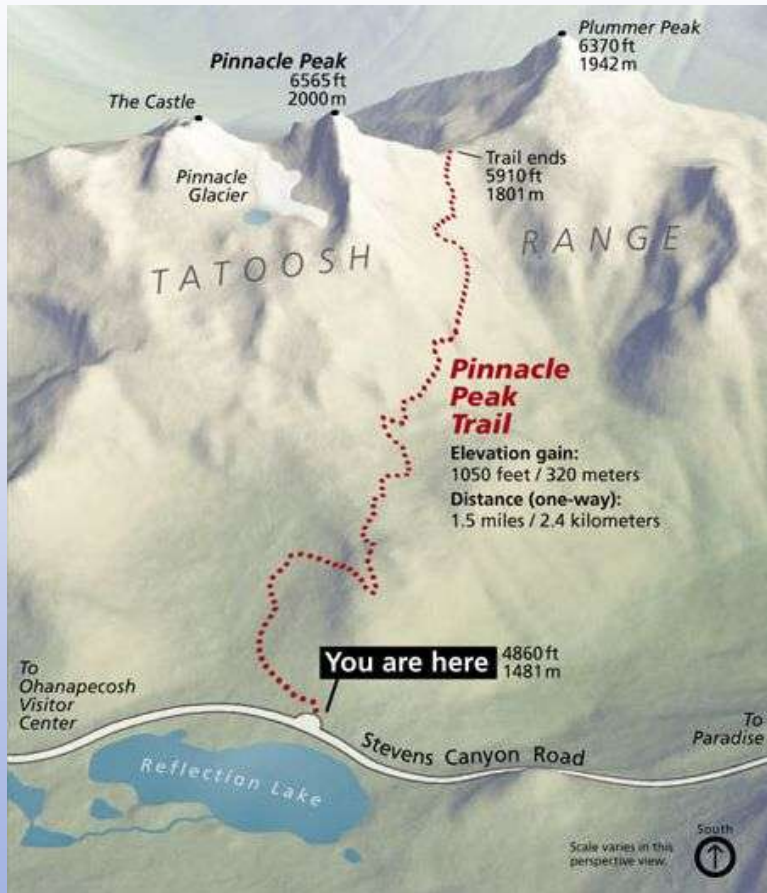


Maps: Patterson, 2004

To find out which map type:

- is more effective for cartographic communication?
- Imprints itself better as a mental map in the mind of park visitors?
- is more attracting for park visitors?
- is preferred by the hikers?
- allows the users better to orientate themselves and find their actual position on the map more accurately?

Methodology: *equivalent test maps*



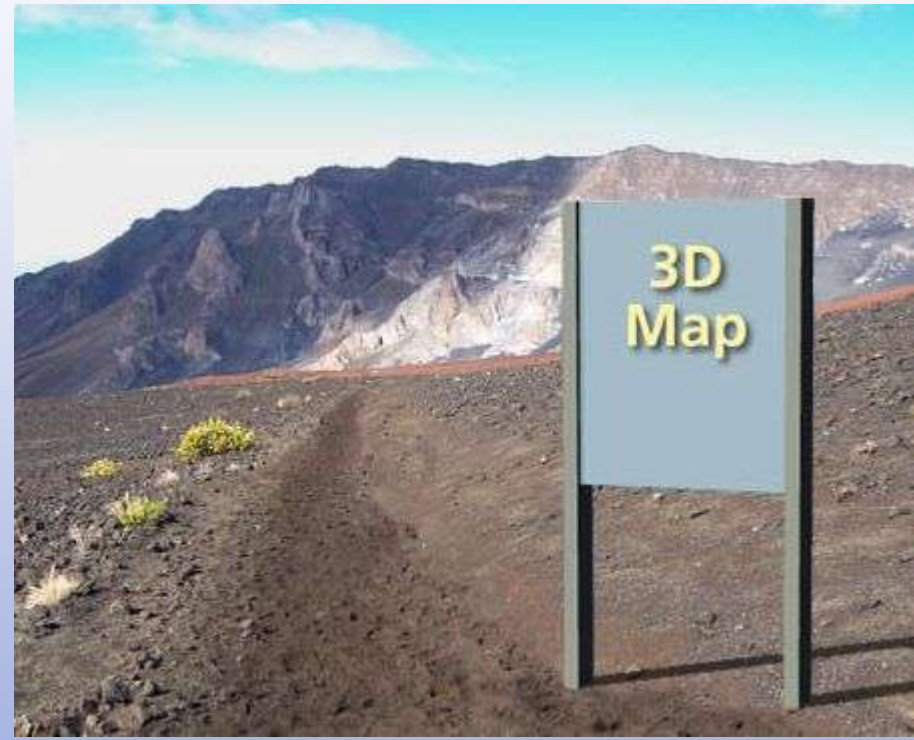
Maps: Patterson, 2004

Methodology: *comparative evaluation*

Tuesday 9:00 a.m.



Wednesday 9:00 a.m.



Images: Patterson, 2004

Methodology: *data collection*



Trailhead monitoring

Questionnaire alongside trails

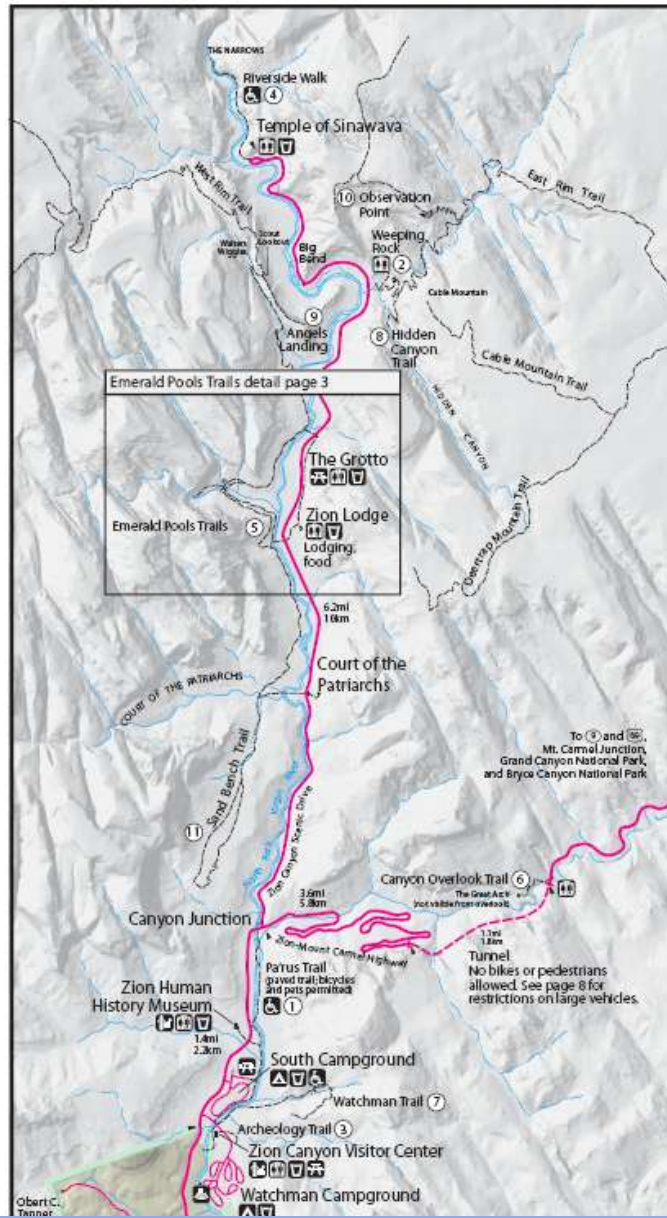


Which National Park to choose?



Which trails to study?

Zion Canyon



Trail Guide

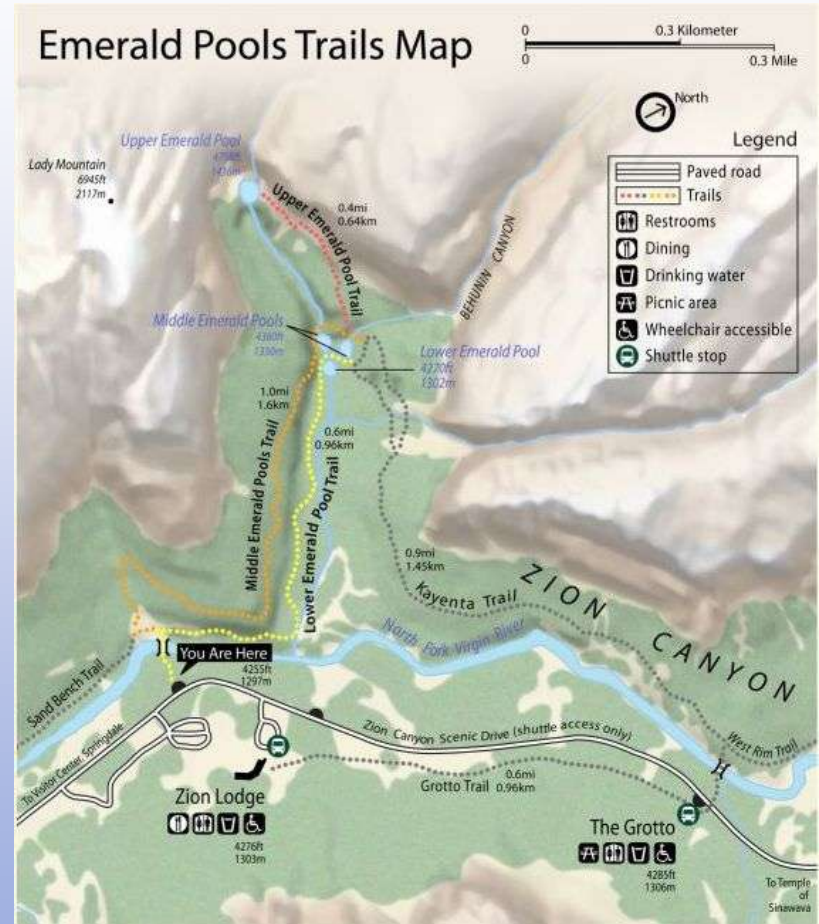
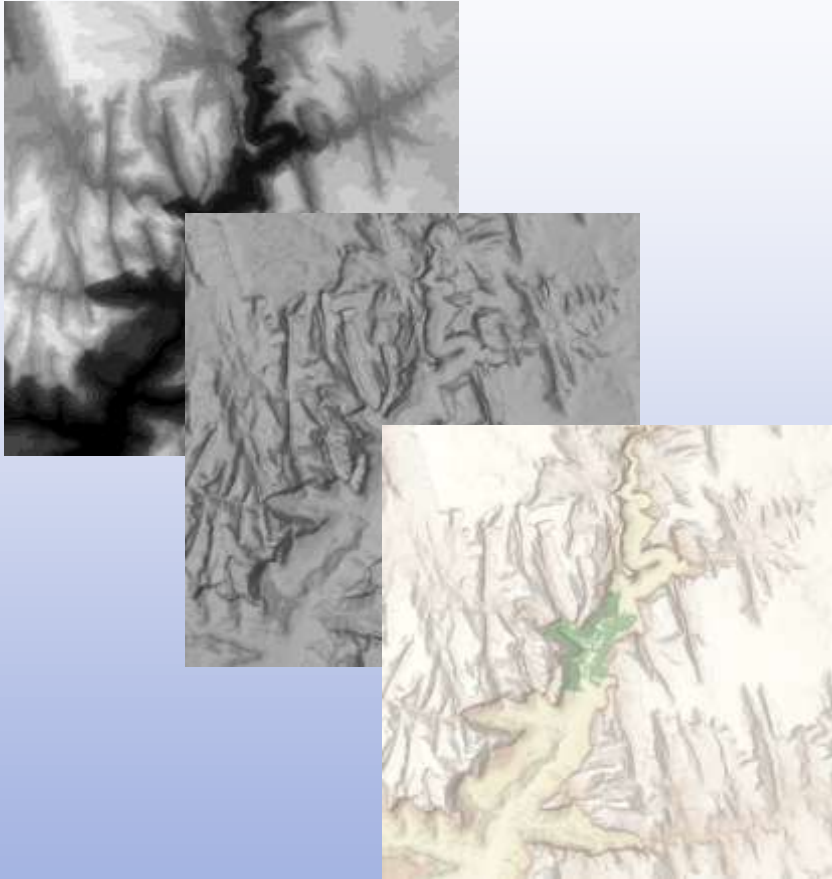
www.nps.gov

Winter Hiking

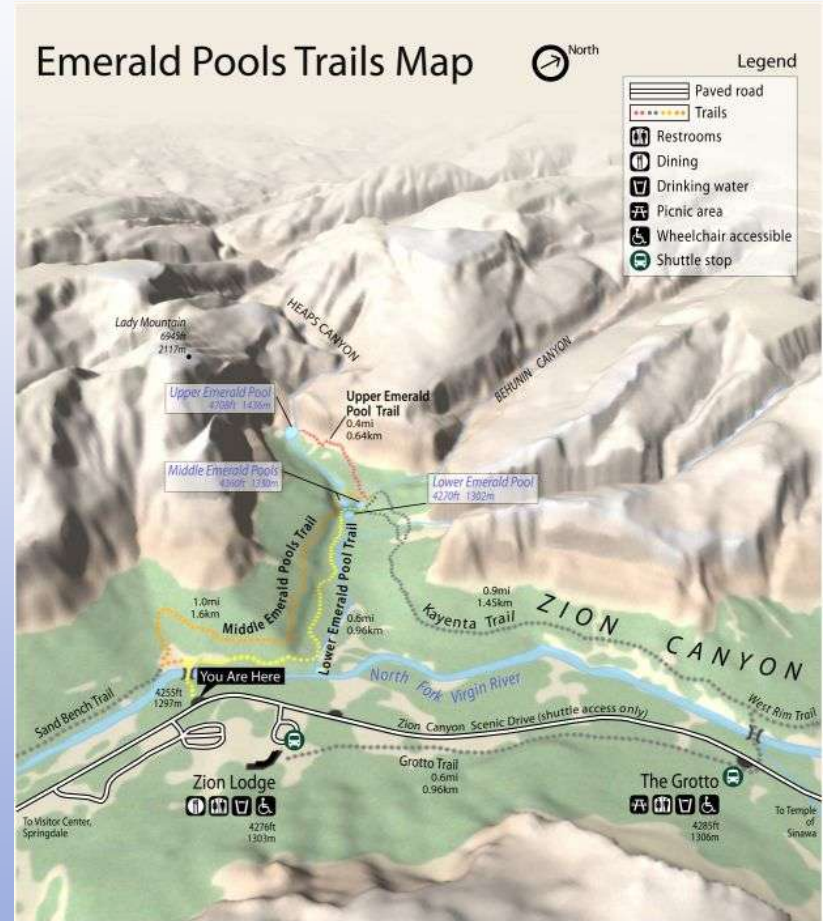
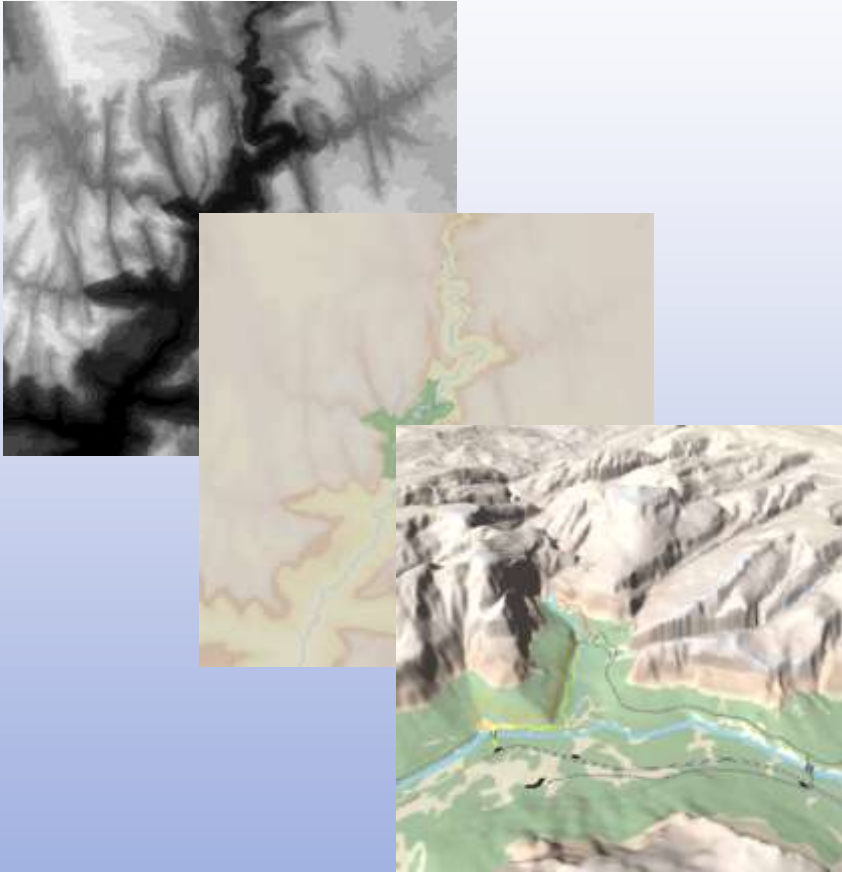
Hikers should be flexible and turn back if trail conditions are unsafe. Trails can be snow covered and icy. Stay on established trails and watch your footing, especially near drop-offs. Always stay back from edges. Watch children closely. Ice, snow, loose sand, or pebbles on stone are very slippery. Be careful of edges when using cameras or binoculars. Never throw or roll rocks; there may be hikers below.

Trail & Trailhead	Round Trip (mi/km)	(avg. time)	Ascent (ft/m)	Description	Map Location
Zion Canyon					
Pa'rus Trail Zion Canyon Visitor Center	3.5/5.6	1-1/2 hrs.	50/15	Easy Paved trail follows Virgin River from South Campground to Canyon Junction.	1
Weeping Rock Weeping Rock	0.5/0.8	1/2 hour	98/30	Short but steep Minor drop-offs. Paved trail ends at alcove with dripping springs. Trailside exhibits. May be icy, closures possible.	2
Archeology Trail Zion Canyon Visitor Center	0.4/0.6	1/2 hour	80/24	Short but steep Trail climbs a small hill to the outlines of small prehistoric storage buildings. Trailside exhibits.	3
Riverside Walk Temple of Sinawava	2.0/3.2	1-1/2 hrs.	57/17	Easy Minor drop-offs. Paved trail follows Virgin River along bottom of narrow canyon. Trailside exhibits. May be closed because of falling ice.	4
Lower Emerald Pool Zion Lodge	1.2/1.9	1 hour	69/21	Easy Minor drop-offs. Paved trail to lower pool and waterfalls. May be closed because of ice on trail or falling from above. See page 3 for other trail options.	5
Canyon Overlook East of long tunnel.	1.0/1.6	1 hour	163/50	Moderate Long drop-offs. Rocky, uneven trail ends at viewpoint of lower Zion Canyon and Pine Creek Canyon. May be snow covered and icy.	6
Watchman Zion Canyon Visitor Center	2.7/4.3	2 hours	368/ 112	Moderate Minor drop-offs. Ends at viewpoint of lower Zion Canyon and Oak Creek Canyon. May be muddy.	7
Hidden Canyon Weeping Rock	2.0/3.2	3 hours	850/ 259	Strenuous Long drop-offs. Not for anyone fearful of heights. Ends at narrow canyon. May be snow covered and icy.	8
Angels Landing The Grotto	5.0/8.0	4 hours	1488/ 453	Strenuous Long drop-offs and narrow trail. Not for anyone fearful of heights. Last 0.5 mi (0.8 km) follows steep, narrow ridge; chains have been added. May be snow covered and icy.	9
Observation Point Weeping Rock	8.0/12.9	5 hours	2148/ 655	Strenuous Climbs through Echo Canyon. Trail gives access to other East Rim plateau trails: Cable Mountain and Deertrap Mountain. Snow and ice likely.	10
Sand Bench Zion Lodge	3.6/5.8	3 hours	500/152	Moderate Loop trail passes ancient landslide and Streaked Wall. Good views of lower Zion Canyon and the Three	

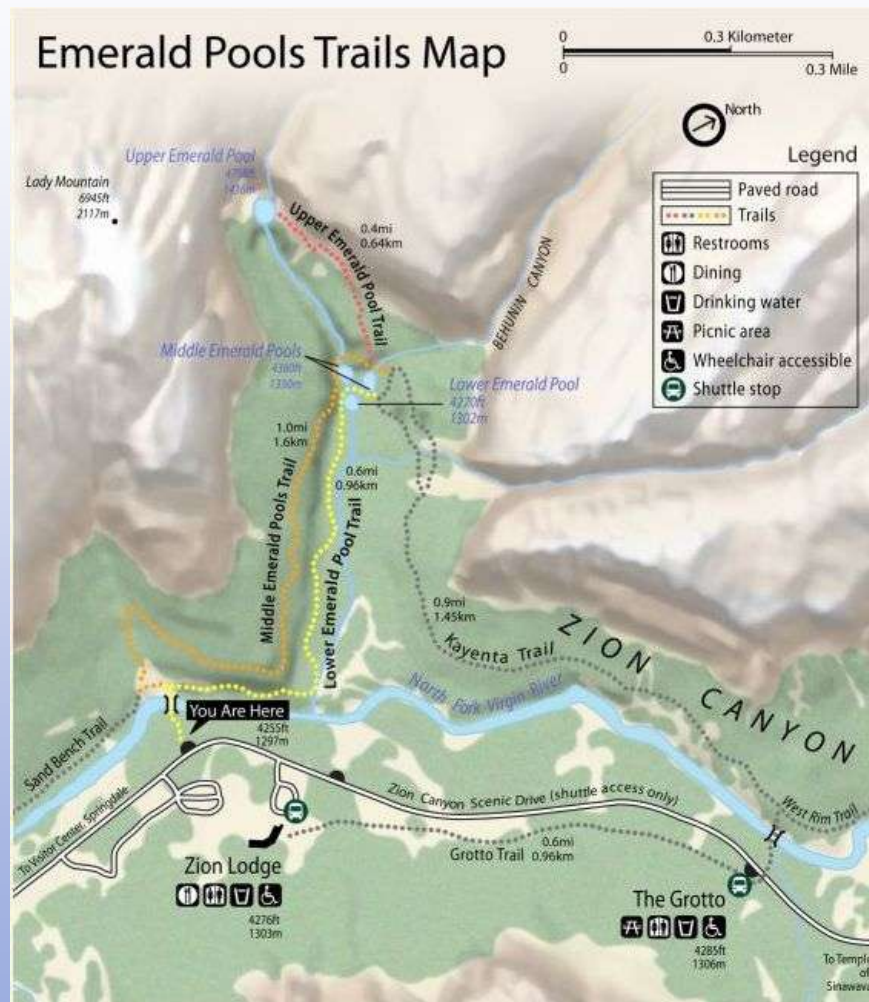
Map production: *conventional maps*



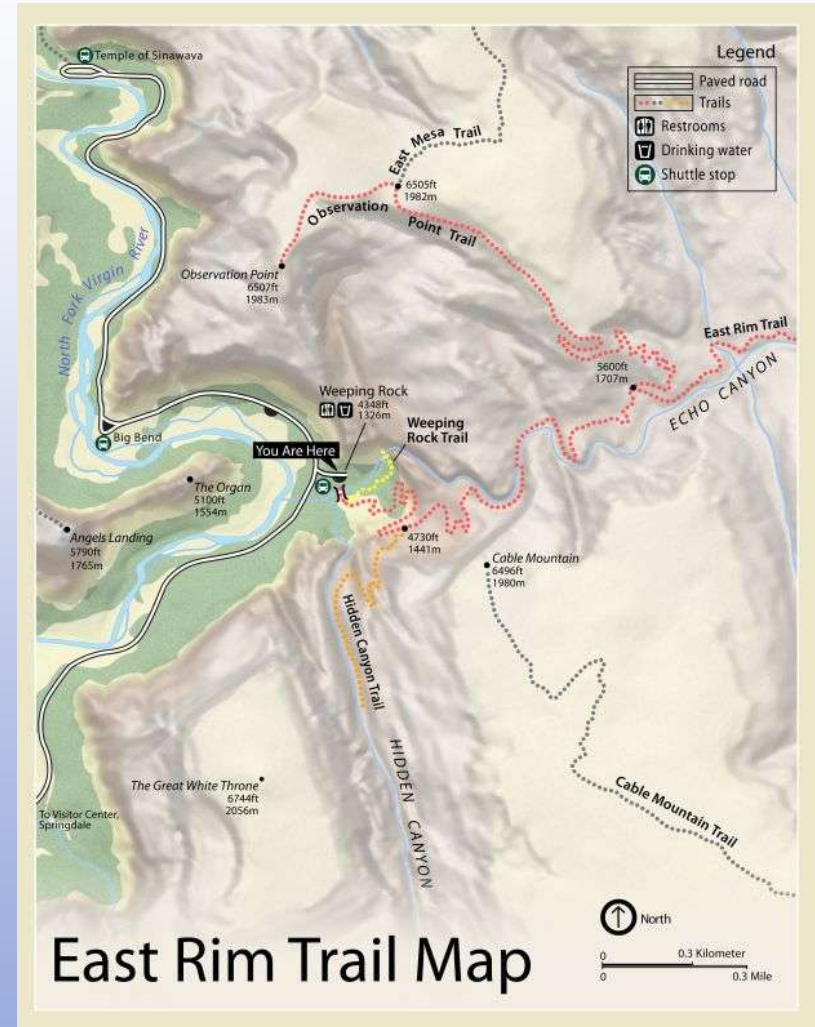
Map production: *perspective maps*



Emerald Pools Trails maps



Observation Point Trail maps



Structure of questionnaire

EMERALD POOLS TRAIL MAP SURVEY

___ View ___

Part 1 – Background				
1. What is your age? (Topic Area 1: Individual Characteristics)	15 to 25	26 to 40	41 to 60	over 60
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Gender? (Topic Area 1: Individual Characteristics)	Female	Male		
	<input type="checkbox"/>	<input type="checkbox"/>		
3. Are you hiking alone? (Topic Area 2: Trip/Visit Characteristics)	Yes, alone	No, in a group		
	<input type="checkbox"/>	<input type="checkbox"/>		
3a. If in a group, how many people are you hiking with?				
4. How often have you gone hiking in the last 12 months? (Topic Area 1: Individual Characteristics)				
<input type="checkbox"/> Almost daily				
<input type="checkbox"/> At least once every week				
<input type="checkbox"/> At least once every month				
<input type="checkbox"/> A few times				
<input type="checkbox"/> Once in the last 12 months				
<input type="checkbox"/> This is the first time since 12 months				
5. Including this hike, how often have you hiked in Zion National Park this year? (Topic Area 3: Activities and use of park Resources)				
<input type="checkbox"/> Once				
<input type="checkbox"/> 2-3 times				
<input type="checkbox"/> 4-5 times				
<input type="checkbox"/> More than 5 times				
6. How often do you use maps when hiking? (Topic Area 2: Trip/Visit Characteristics)				
Frequently	Occasionally	Rarely	Never	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. Is English your native language? (Topic Area 2: Trip/Visit Characteristics)	Yes	No		
	<input type="checkbox"/>	<input type="checkbox"/>		
7a. If no, what is your native language?				
8. Are you primarily left or right handed? (Note: This question is being asked because in some cases there are differences in the perception of space between left and right handed people, which may influence how they interact with different map types.) (Topic Area 1: Individual Characteristics)	Right handed	Left handed	Neither	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9. Did you bring your own map or a navigation device on the hike? (Topic Area 2: Trip/Visit Characteristics)				
Yes, map	Yes, GPS	Yes, Compass	No	If you have a map or other navigation device, go to Part 4.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

4 parts – 31 questions

- Part 1: Background (9)
- Part 2: Questions about trailhead map (6)
- Part 3: Questions about knowledge transfer (11)
- Part 4: Positioning and preferences (5)

Trailhead monitoring

- Data monitored:
 - Time
 - Number of passersby
 - Group type
 - Is map viewed
 - Time of map reading



Outcomes: *A few numbers*

Study period: 4. – 21. September
2006

Monitoring: 340 Groups or single
hikers

Interviews: 188 questionnaires, 185
valid

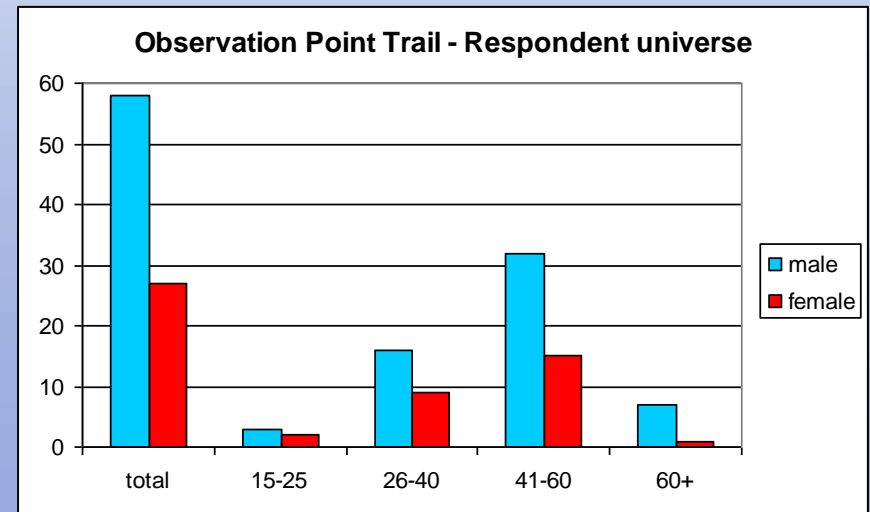
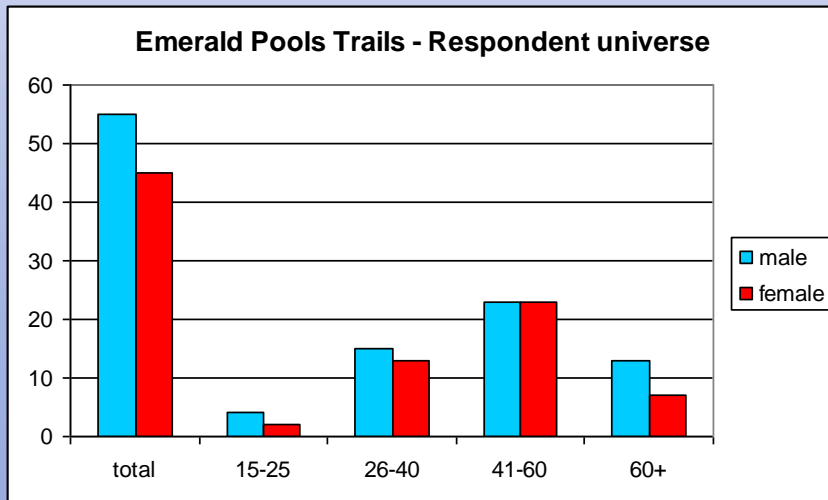
20 non-respondents

Response rate => 90 %

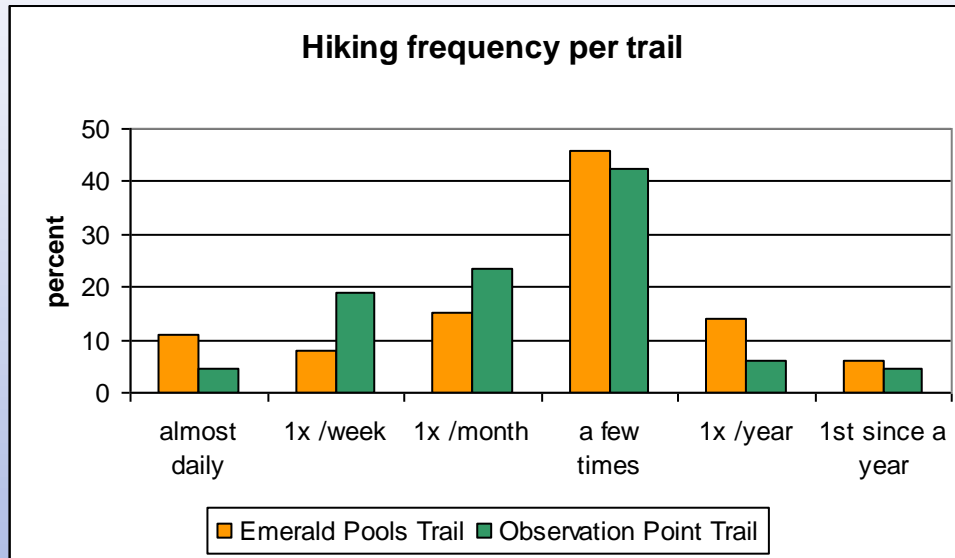


Interviews: *Respondent universe*

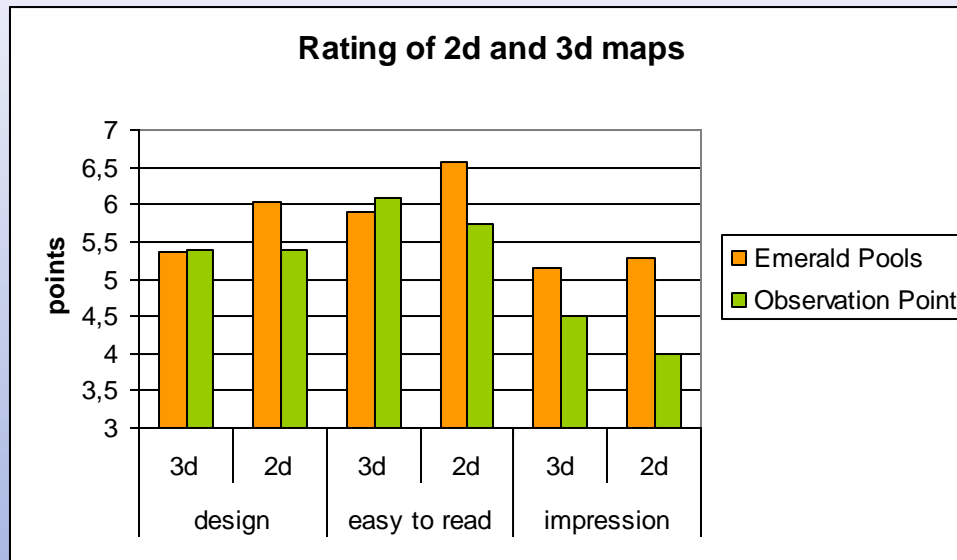
- 185 interviews
- 72 women (39 %)
- 113 men (61 %)



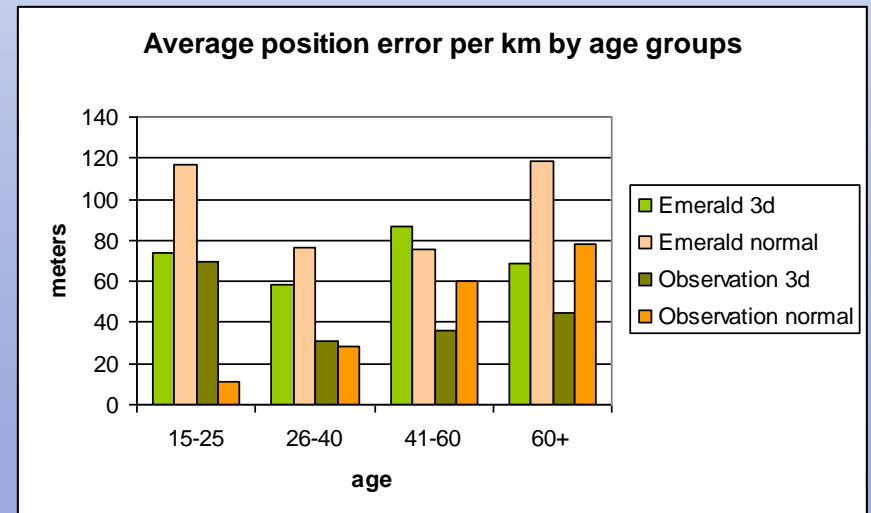
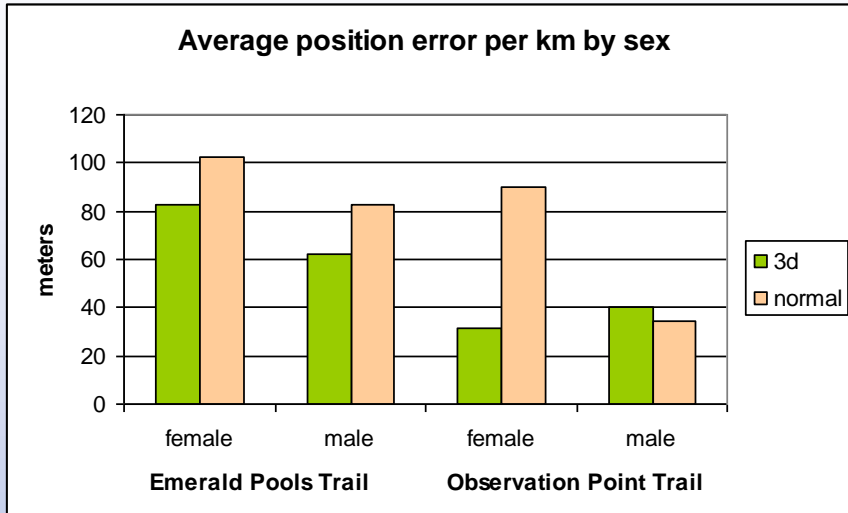
Findings: *Hiking experience*



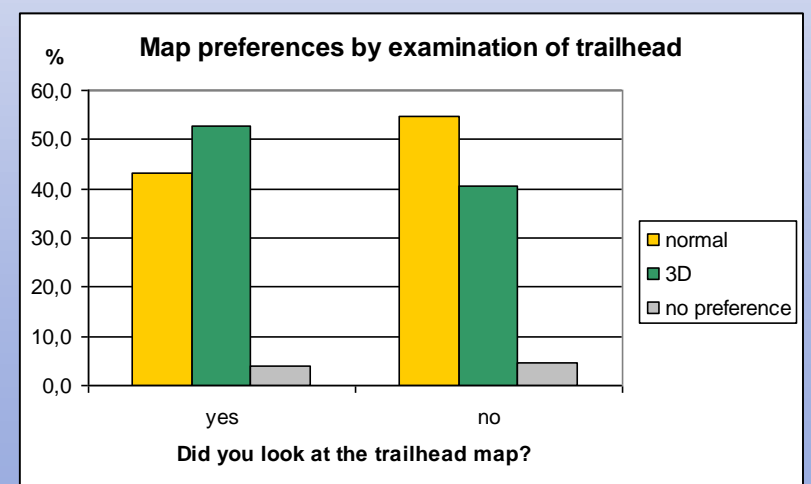
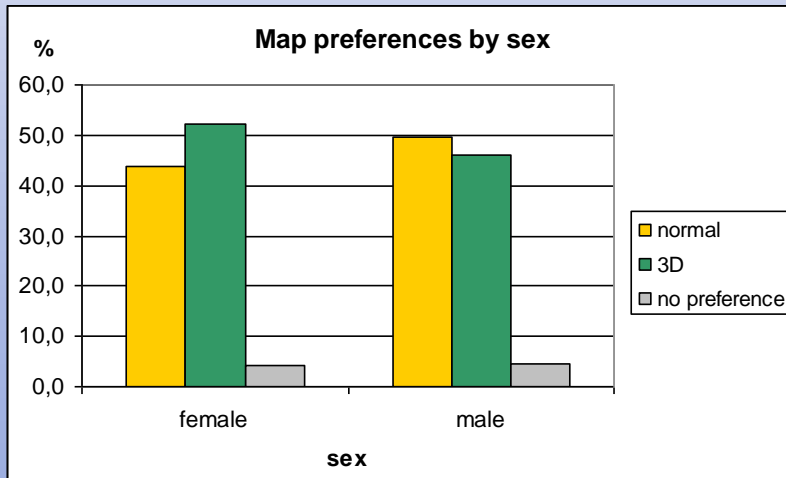
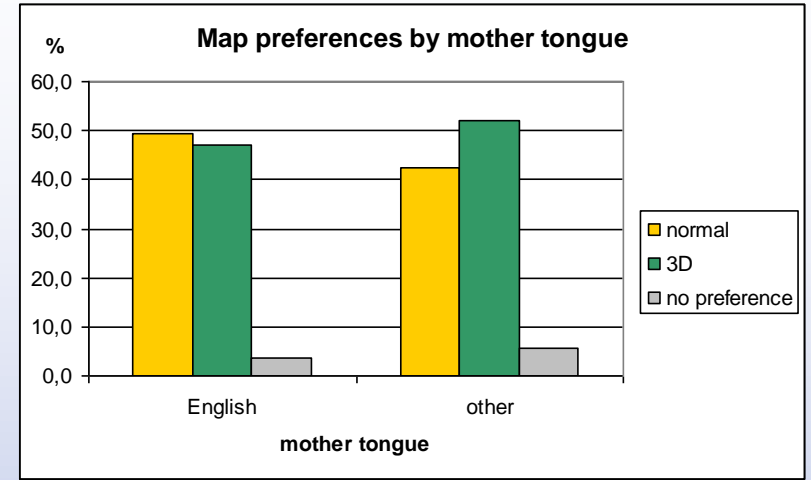
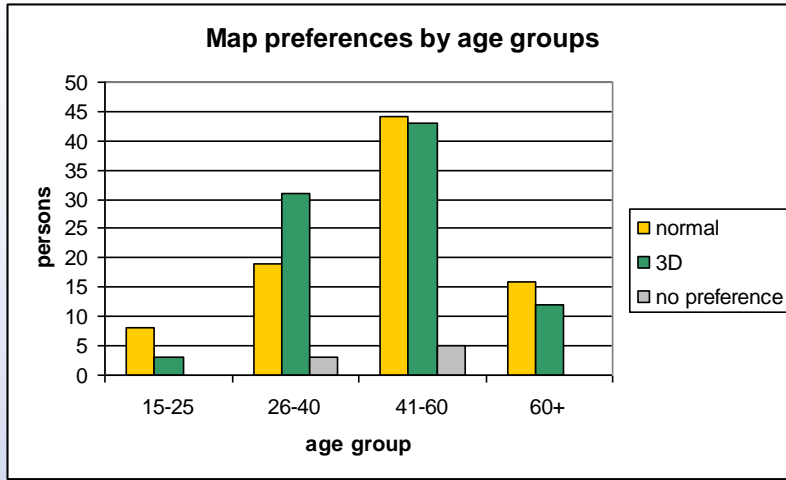
Findings: *Rating of maps*



Findings: *Positioning*



Findings: *Map preferences*



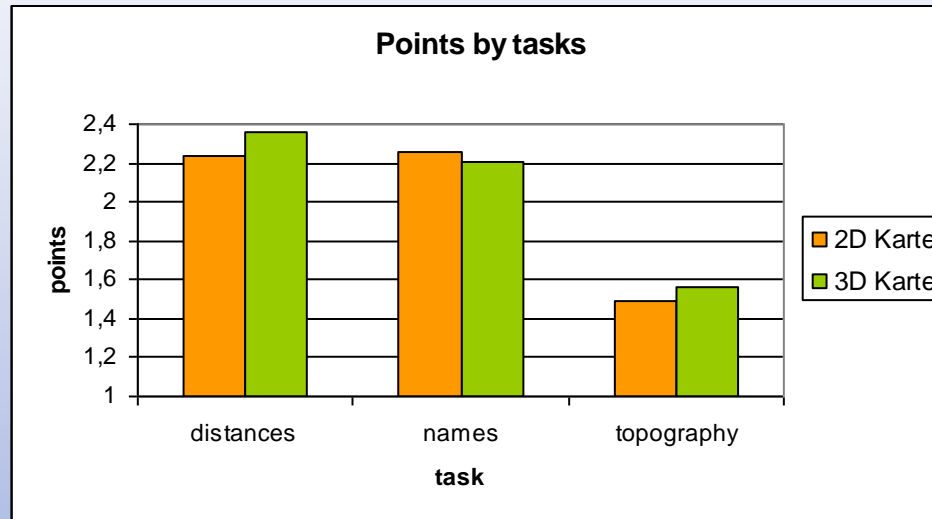
Findings: Better depiction of reality

Which map type depicts reality better				
By gender	2D	none	3D	Significance
Females	23,9 %	2,8 %	73,2 %	1% level
males	20,4 %	2,7 %	77,0 %	1% level
By age groups	2D	none	3D	Significance
15-25	54,5 %	0 %	45,5 %	Attention: small sample size
26-40	15,1 %	3,8 %	81,1 %	1% level
41-60	21,7 %	3,3 %	75 %	1% level
60+	21,4 %	0 %	78,6 %	1% level
Left- or right-handed	2D	none	3D	Significance
Right-handed	23,8 %	2,4 %	73,8 %	1% level
Left-handed	5 %	5 %	90 %	1% level
By mother tongue	2D	none	3D	Significance
English	21,2 %	3 %	75,8 %	1% level
other	23,1 %	1,9 %	75 %	1% level

Findings: Accuracy

Which map type is more accurate				
By gender	2D	none	3D	Significance
Females	25,4 %	22,5 %	52,1 %	1% level
males	38,9 %	18,6 %	42,5 %	1% level
By age groups	2D	none	3D	Significance
15-25	36,4 %	9,1 %	54,5 %	Attention: small sample size
26-40	30,2 %	17,0 %	52,8 %	1% level
41-60	34,4 %	18,3 %	46,2 %	1% level
60+	35,7 %	35,7 %	28,6 %	1% level
Left- or right-handed	2D	None	3D	Significance
Right-handed	34,8 %	20,7 %	44,5 %	1% level
Left-handed	25 %	15 %	60 %	1% level
By mother tongue	2D	None	3D	Significance
English	33,3 %	18,9 %	47,7 %	1% level
other	34,6 %	23,1 %	42,3 %	1% level

Findings: *Knowledge transfer*



Findings: *Attraction at trailhead*

- 3D:
 - 50 % look at map
 - 50 % passersby

- 2D:
 - 44,9 % look at map
 - 55,1 % passersby

Findings: *Viewing time*

- 3D map:
average 47,2 seconds
- 2D map:
average 44,1 seconds

Summary

- 3D maps enable hikers to more accurately identify their location on the landscape compared to 2D maps, especially for older people (over 60 years of age) and women.
- Hikers viewing the trailhead exhibit preferred 3D trailhead maps (53%) over 2D maps (43%).
- Older respondents, men, and native English speakers generally prefer 2D maps.
- Younger respondents, women, and nonnative English speakers generally prefer 3D maps.
- On the Emerald Pools trails, less experienced hikers rated the 2D map easier to read.
- On the Observation Point Trail, more experienced hikers rated the 3D map easier to read.
- Readers of 3D maps had a better understanding of distances, topography, and environment, while readers of 2D maps could better recall place names.
- Respondents on both trails generally agreed that 3D maps depict reality better.
- 3D maps attract more trailhead readers than do 2D maps, and are viewed on average for a few seconds longer than 2D maps.

Full report available for download at

www.nps.gov/hfc/carto/zion_map_study.pdf