

Voting With Your Feet

An Investigative Study of the Relationship Between
Place Visit Behavior and Preference



Jon Froehlich (UW)

UbiComp 2006, Orange County, September 27th

Co-authors: Mike Chen (IRS), Ian Smith (IRS), Fred Potter (UW)

dub
design:
use:
build:
university of washington





Saturday



3 miles



We're not just a company

Chutney's
Bistro
← 2 miles



← 3 miles
THE HOME DEPOT



Famous Dave's
Famous Dave's
Famous Dave's



SUBWAY
SUBWAY



Great Clips
Great Clips



SAFEWAY
SAFEWAY
SAFEWAY

Chutney's
Bistro
← 2 miles



BARTLETT DRUGS

UNITED STATES
POSTAL SERVICE
POSTAL SERVICE



Thai Spice



Washington State

Recommended for Jon E. Froehlich (If you're not Jon E. Froehlich, [click here.](#))

Recommendations Based on Activity

[View & edit Your Browsing History](#)

These recommendations are based on [items you own](#) and more.

view: **All** | [New Releases](#) | [Coming Soon](#)

[More results](#)

Recommendations by Category

Your Favorites [Edit](#)

- [Music](#)
- [Electronics](#)
- [Books](#)
- [Computers & PC Hardware](#)
- [Camera & Photo](#)

More Categories

- [Apparel & Accessories](#)
- [Baby](#)
- [Beauty](#)
- [Computer & Video Games](#)
- [DVD](#)
- [Gourmet Food](#)
- [Health & Personal Care](#)
- [Industrial & Scientific](#)
- [Jewelry & Watches](#)
- [Kitchen & Housewares](#)
- [Magazine Subscriptions](#)
- [Outdoor Living](#)
- [Software](#)
- [Sports & Outdoors](#)


1.  **[Context and Consciousness: Activity Theory and Human-Computer Interaction](#)**
by Bonnie A. Nardi (Editor)
Average Customer Review: ★★★★★
In Stock
Publication Date: November 21, 1995

Our Price: \$68.00 [Used & new](#) from \$47.92

[Add to cart](#) [Add to Wish List](#)

I Own It Not interested ★★★★★ Rate it

Recommended because you purchased [Plans and Situated Actions](#) and more ([edit](#))

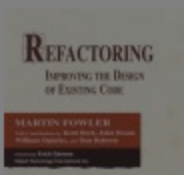
2.  **[The Ecological Approach to Visual Perception](#)**
by James Jerome Gibson
Average Customer Review: ★★★★★
In Stock
Publication Date: January 1, 1987

Our Price: \$46.45 [Used & new](#) from \$32.93

[Add to cart](#) [Add to Wish List](#)

I Own It Not interested ★★★★★ Rate it

Recommended because you purchased [Cognition in the Wild \(Bradford Books\)](#) and more ([edit](#))

3.  **[Refactoring: Improving the Design of Existing Code](#)**
by Martin Fowler, et al.
Average Customer Review: ★★★★★
In Stock
Publication Date: June 28, 1999

Our Price: \$46.79 [Used & new](#) from \$27.99

[Add to cart](#) [Add to Wish List](#)

Explicit
Implicit



TiVo's Suggestions

- | | | | |
|---|--------------------------|-----|------|
| 1 | That '70s Show | Mon | 4/10 |
| 2 | Saturday Night Live | Sun | 4/9 |
| 3 | Oscar | Mon | 4/17 |
| 4 | The Drew Carey Show | Sun | 4/9 |
| 5 | Back to School | Sat | 4/15 |
| 6 | The Owl and the Pussycat | Sat | 4/15 |
| 7 | Innerspace | Wed | 4/12 |
| 8 | Senseless | Sun | 4/9 |

Translation to Physical World

Can we view place visit behaviors as a form of expressing interest?



+



Mamma Mias

Visits to Pagliaccis Pizza

→ I like Pagliaccis Pizza?

→ I like Pizza?

→ I like Italian food?

Visits to more Italian restaurants

→ Make stronger claims?

Explicit vs. Implicit Indicators



Vs



Explicit Indicators

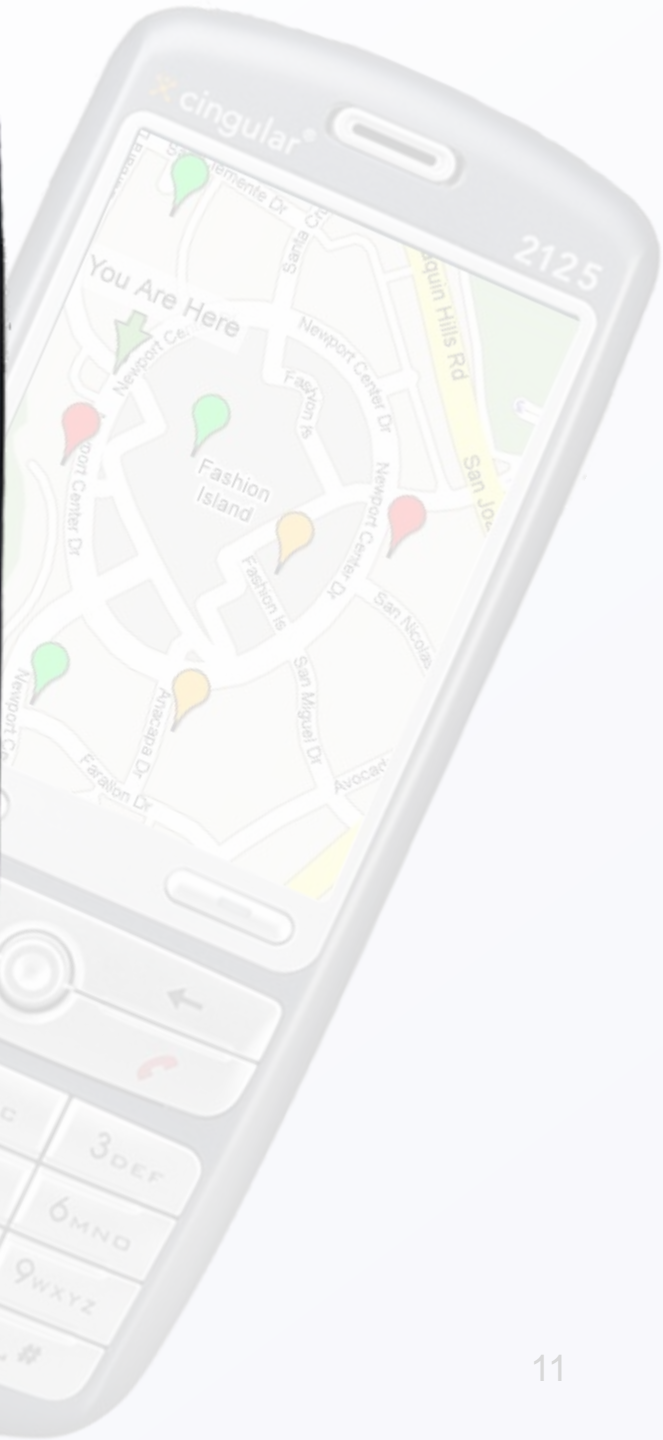
- Move about the world → Supply rating “tags”
- Requires device interaction

Implicit Indicators

- Location aware device → Observe travel patterns
- No device Interaction







Challenges

- What aspects of routine travel behavior should serve as implicit indicators of preference?
- How can we collect data to study these aspects?
- What are the potential confounds?
 - *I get dragged out to Thai a lot. And I always think that I don't like Thai but I do. I mean, whenever I'm there I'm satisfied with whatever I'm eating but the thought of going to Thai food never really strikes my fancy...*
- Participant #3
 - *[I go there] because my friends like it.*
- Participant #3
 - *[I go there] because it's nearby*
- Participant #4

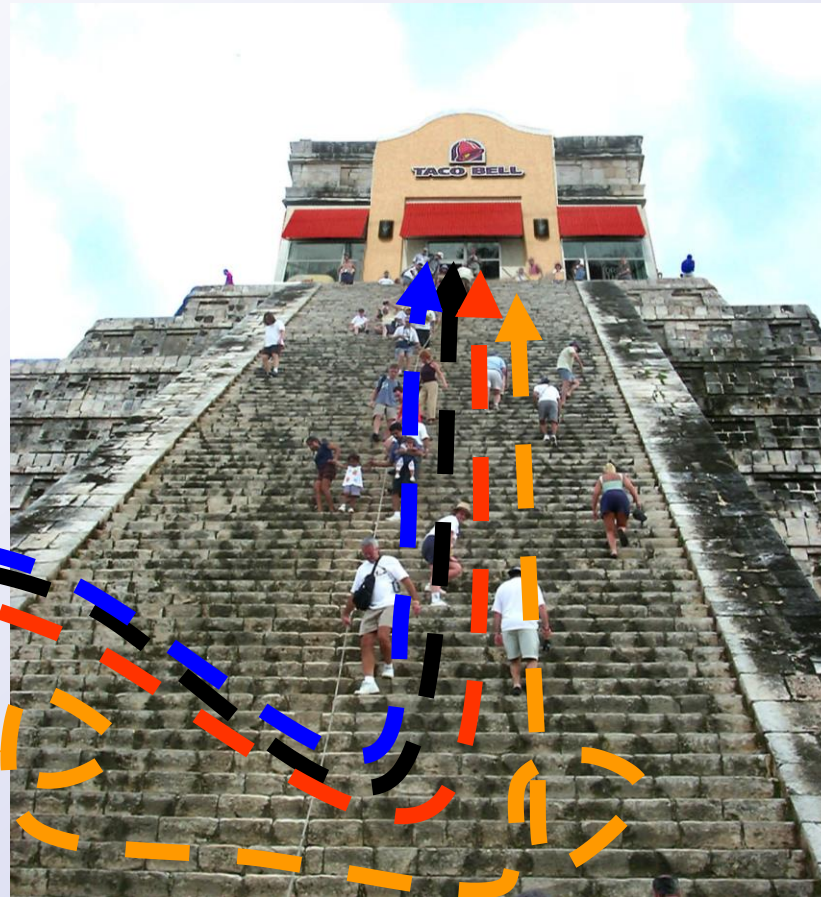
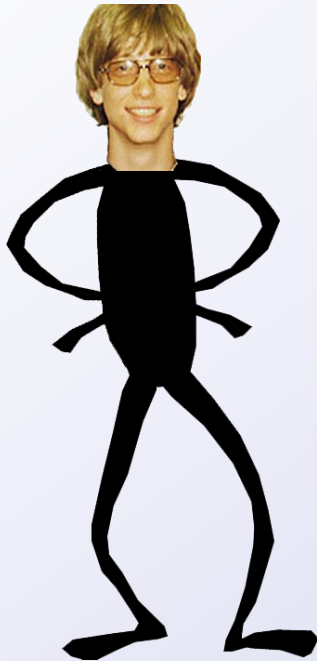
Hypothesis 1: Visit Frequency

The number of visits a person has to a place is a strong indicator of their preference



Hypothesis 2: Travel Effort

Amount of effort one must expend to get to a place is a strong indicator of preference





The Study

Study Overview

- Four week study
- Participant profile
 - 16 Participants
 - Gender balanced (8 male / 8 female)
 - Ages: 22-56 (median 29)
 - Various professions
 - Furniture designer, political consultant, bookseller, translator, ...



- Tasked with
 - Carrying mobile phone for four weeks
 - Answering 11 *in situ* surveys a day about current place
 - Completing a minimum of 3-4 web diary entries a week



- Compensation
 - \$1 per survey
 - Also compensated for interviews & paper questionnaires

Me: the My Experience tool



Fox Sports Grill on Thursday, September 8 (3 stars)

1. What was the primary reason for your rating?

2. How did you find out about this place?

3. Why did you go to this place?

4. Would you recommend this place to others? Why or why not?

5. If you were with a group, how did the group decide to go to this place?
If you were not with a group, type "N/A"

Timeline for 09/08/2005

5:32 pm (Wed) ~ 8:23 am	<i>My House</i>
8:30 am ~ 8:38 am	<i>Car</i>
9:12 am ~ 12:09 pm	<i>Net Desk - Seattle</i>
12:17 pm ~ 12:28 pm	<i>Walk</i>
12:28 pm ~ 12:46 pm	<i>Chez Dave - Union Square</i>
12:55 pm ~ 2:20 pm	<i>Walking</i>
2:20 pm ~ 3:48 pm	<i>Net Desk - Seattle</i>
3:48 pm ~ 3:50 pm	<i>Walking</i>
4:42 pm ~ 4:44 pm	<i>Rock Bottom - Seattle</i>
4:51 pm ~ 5:01 pm	<i>Walking</i>
6:35 pm ~ 6:39 pm	<i>Elephant and Castle</i>
6:46 pm ~ 7:34 pm	<i>Walking</i>
8:07 pm ~ 9:16 pm	<i>Fox Sports</i>

Two ESM Triggers

1) Context-Triggered: Mobility Sensor

- GSM signals to detect movement
- Stationary for 10 minutes → trigger survey
- No external sensor required

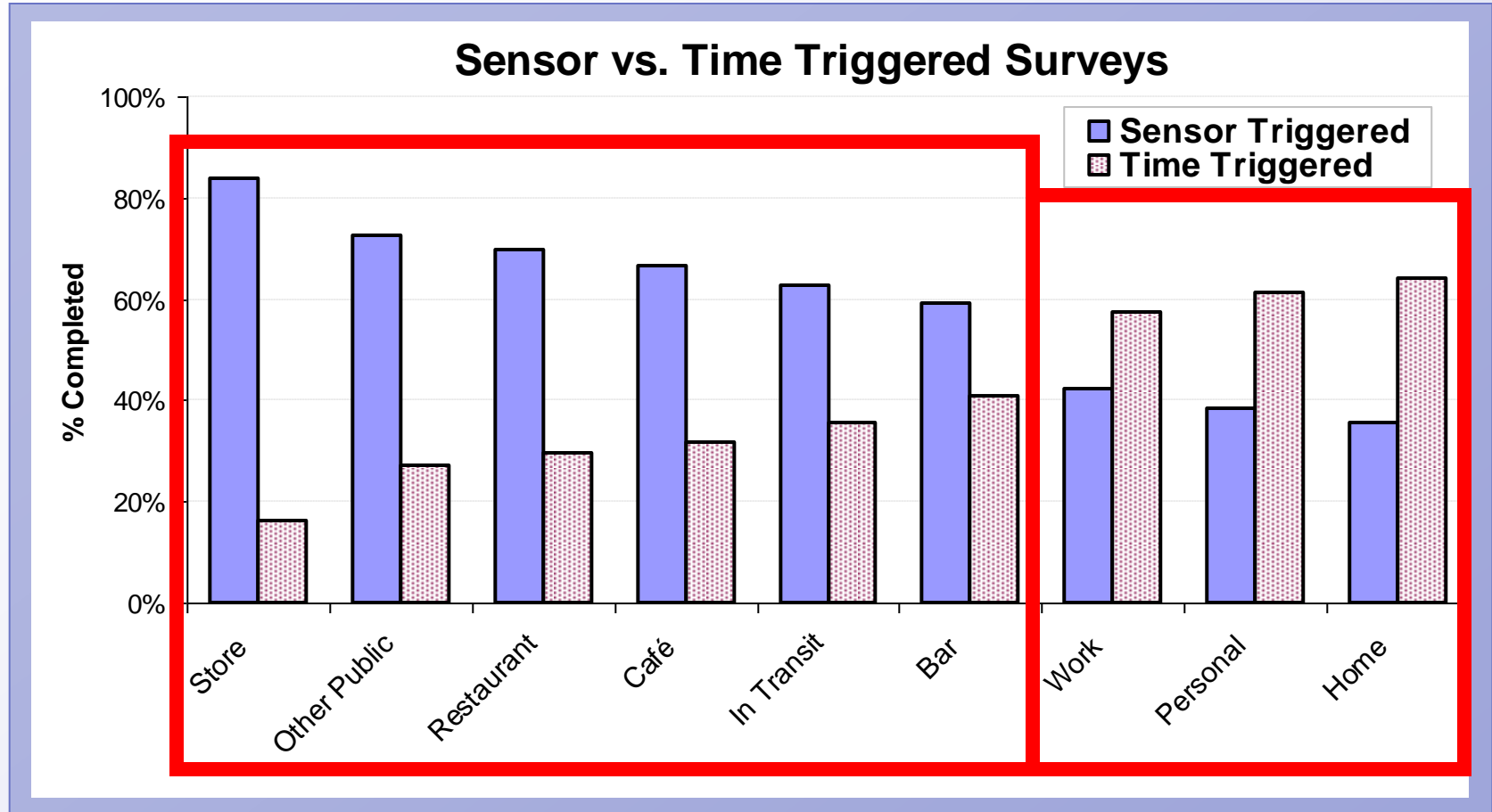


2) Random Time Trigger

- No movement sensed for 1 hr → trigger survey randomly next hour



Context-Trigger Improves Capture



Mobility triggered surveys captured a majority of the public place visits



Results

Do people vote with their feet?

High Level Statistics

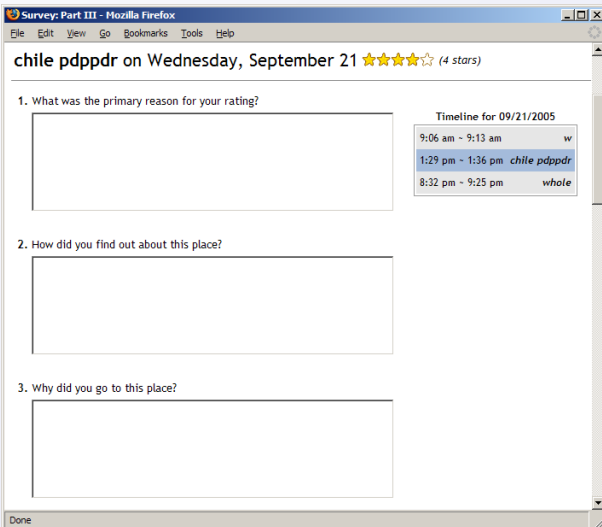


ESM

- 3,458 completed out of 4,295 (80.5%)
- 216 per person
- 28 days average
- 1.5 minute average completion time

Web Diary

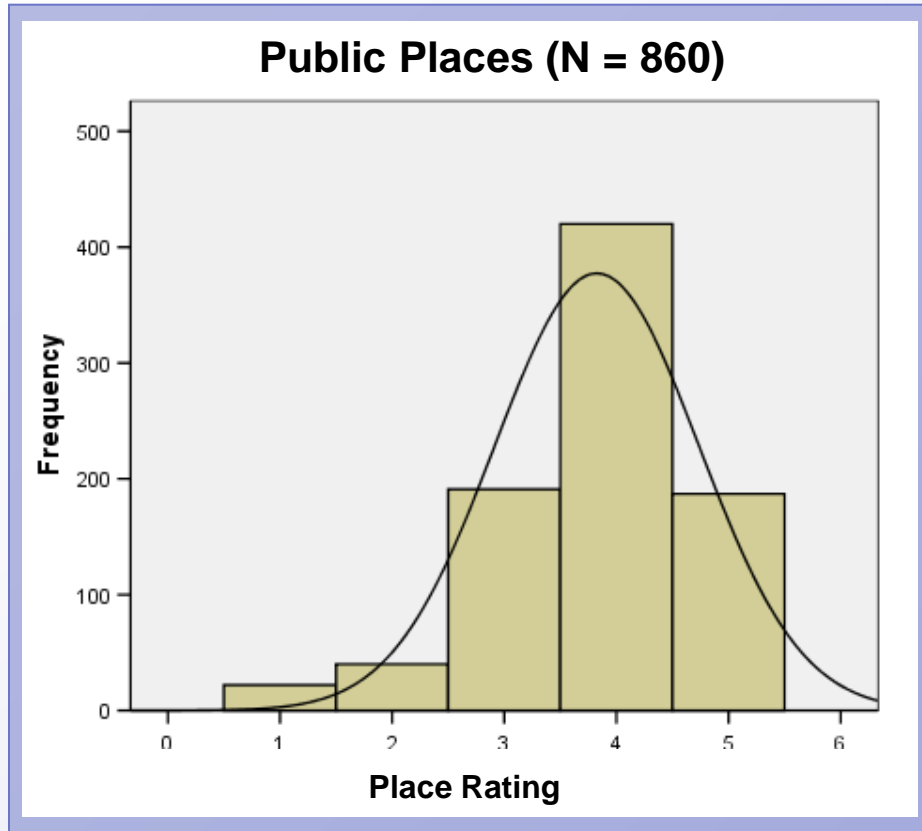
- 368 web diary sessions completed



Places

- 1,981 individual place visits logged
- 862 of which were public
 - ~2 a day per participant

Left-Skewed Distribution of Ratings



...by and large I go to places I've been to before and I already like.

-Participant #1

Most of them get pretty good ratings, 4's or 5's because I scrupulously avoid places that I've known I don't like and I always go back to the ones I do like.

- Participant #12

Distribution of ratings indicates that people tend to go where they like

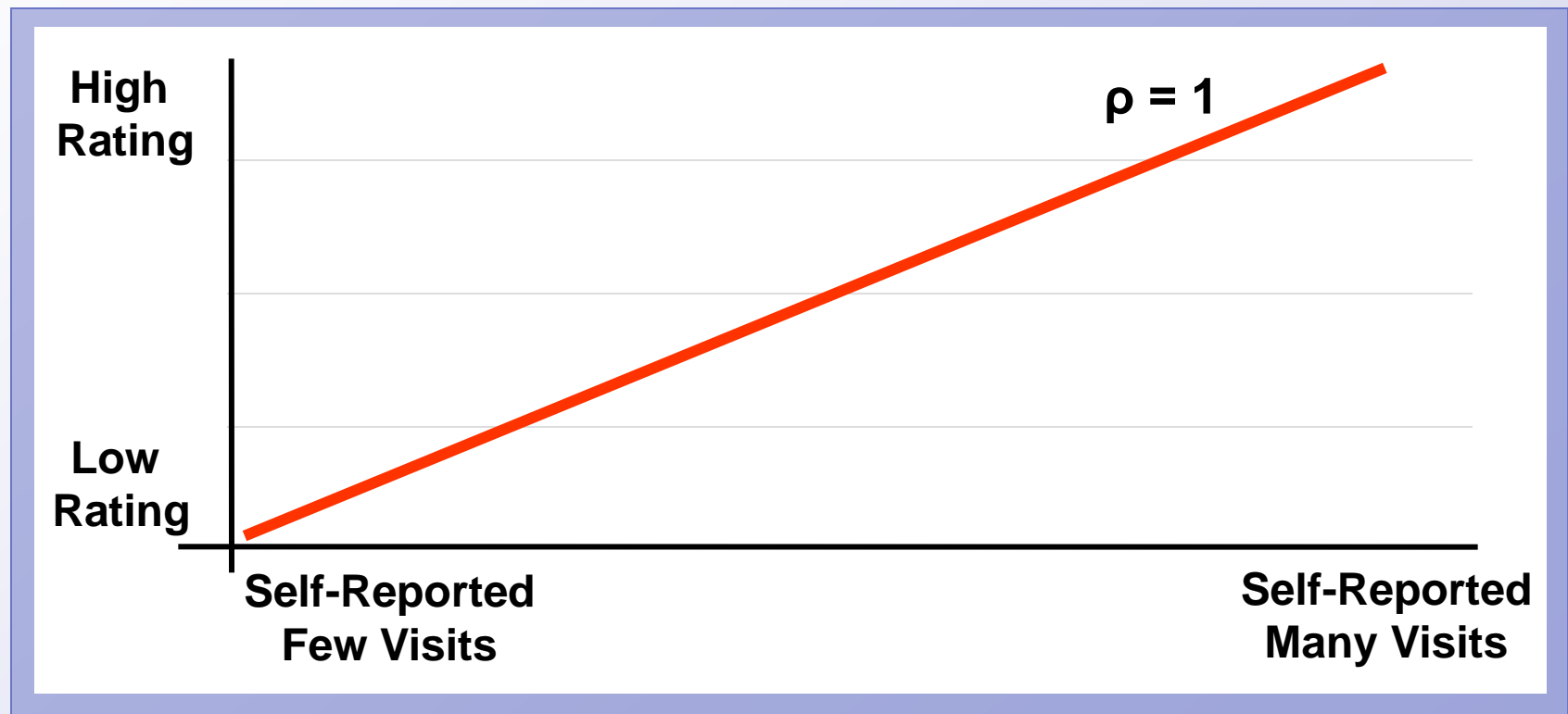
Hypothesis 1: Visit Frequency

I go to the same places a lot... And they're generally my favorite places.

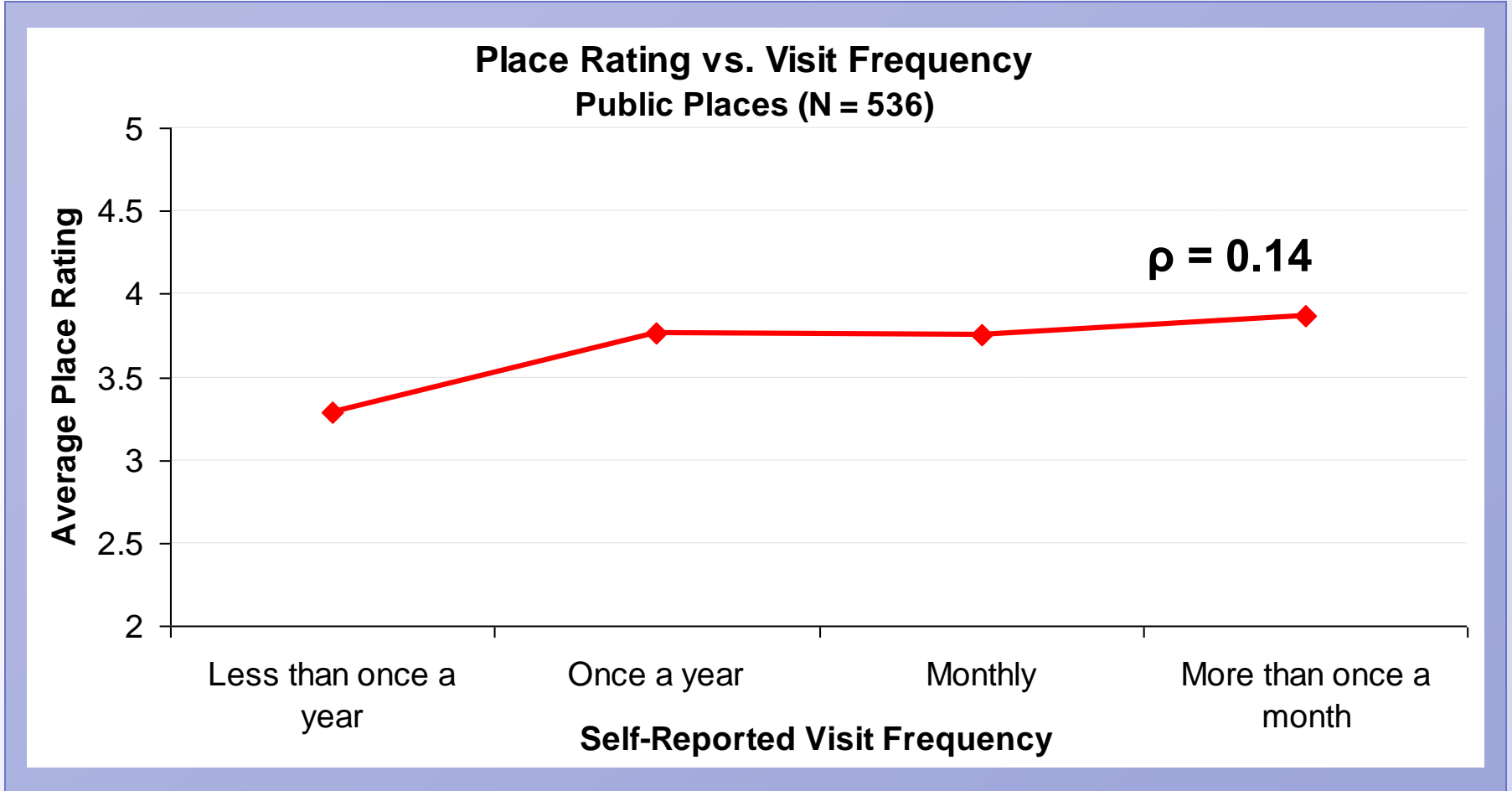
-Participant #6

My philosophy is if you like it, you go back. And, if you don't, you just mark that one off the check list, and you'll never go back and check it out again.

-Participant #5

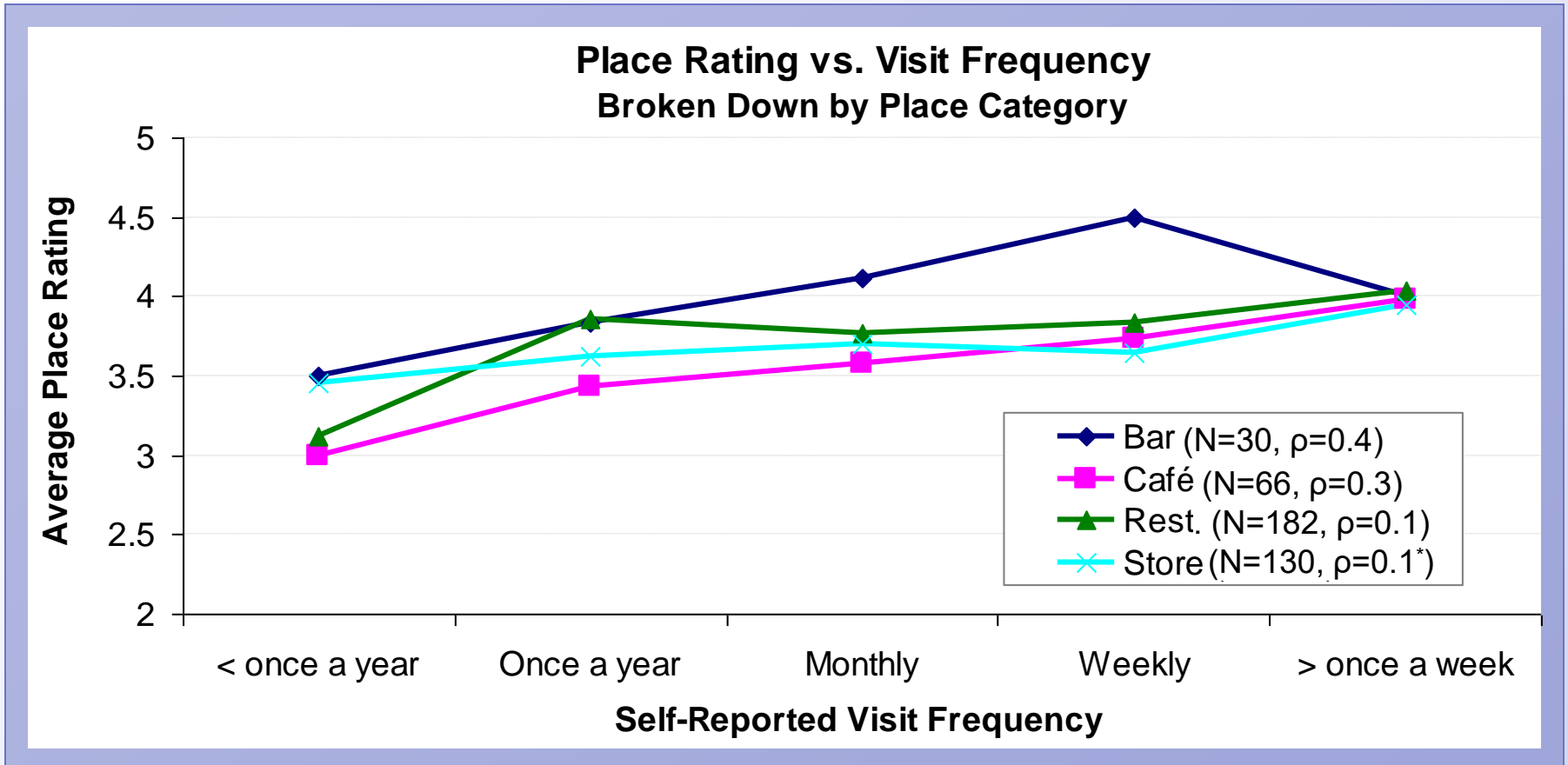


Place Rating vs. Visit Frequency



Visit frequency is weakly correlated with place rating

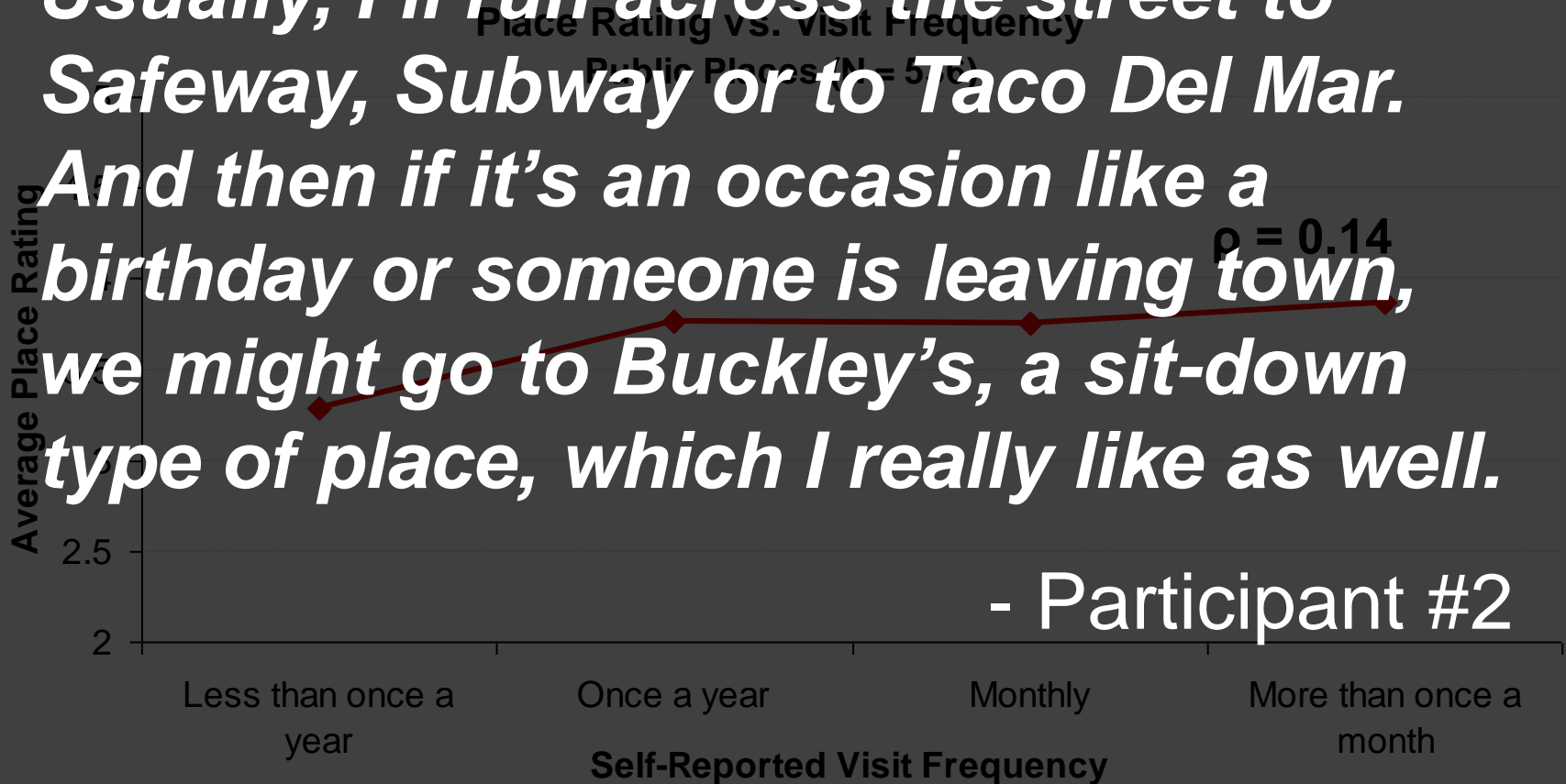
Place Rating vs. Visit Frequency



Breaking “public places” into categories reveals stronger correlations

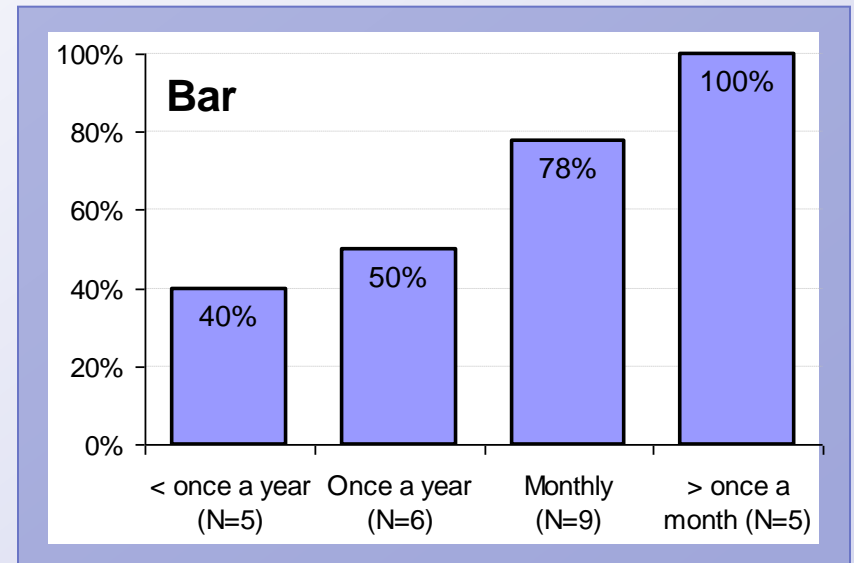
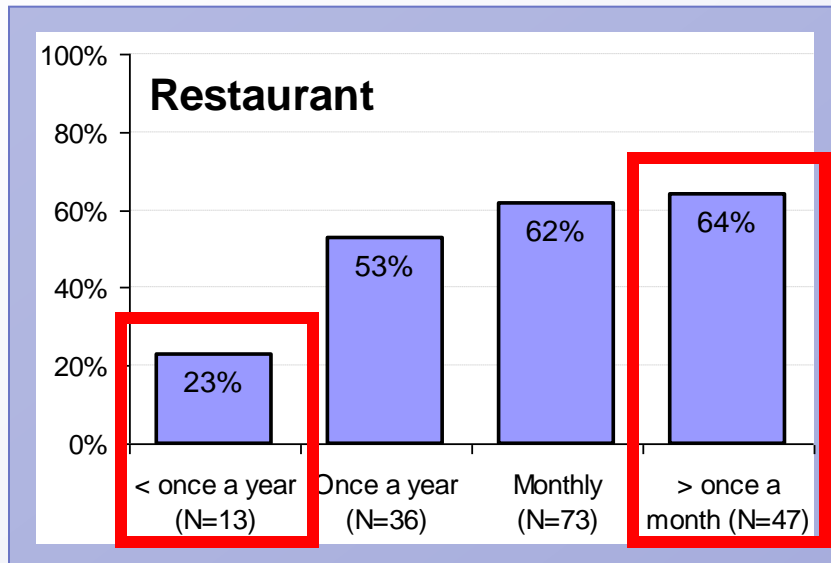
Place Rating vs. Visit Frequency

Usually, I'll run across the street to Safeway, Subway or to Taco Del Mar. And then if it's an occasion like a birthday or someone is leaving town, we might go to Buckley's, a sit-down type of place, which I really like as well.



Visit frequency is weakly correlated with place rating

Visit Frequency: Places Rated > 3



Participants were more likely to rate a place > 3 if they visited it monthly or more

Despite low correlations, visit frequency suggests high ratings for bars & restaurants

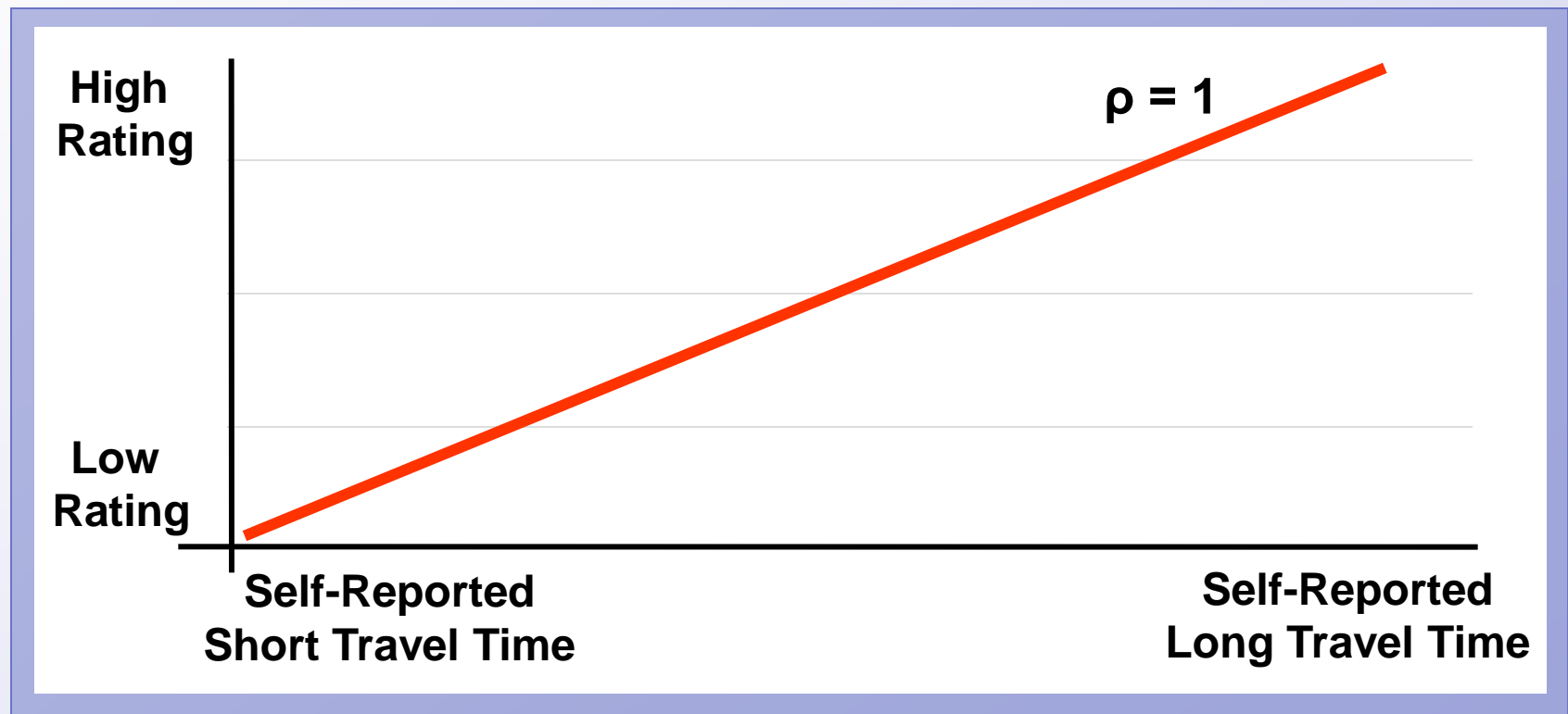
Hypothesis 2 : Travel Time

I will drive all the way out there if I have this craving for good Mexican food. I will pass Azteca and every other of chain and go directly out there.

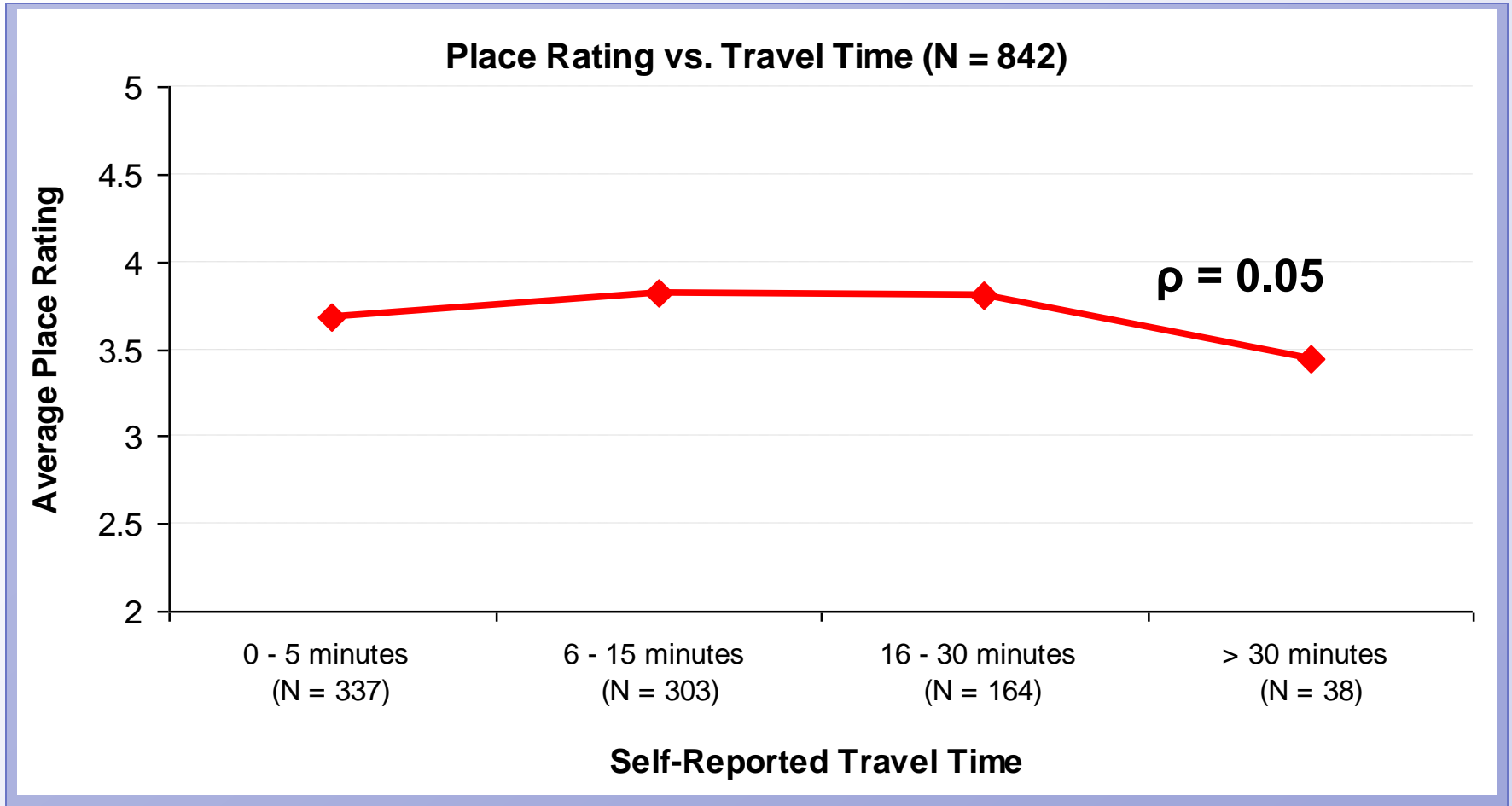
-Participant #12

It's a bit of a drive so we go out there and make the whole evening of it. We go there, then we hit the Cross Roads movie theatre, then go home.

-Participant #4

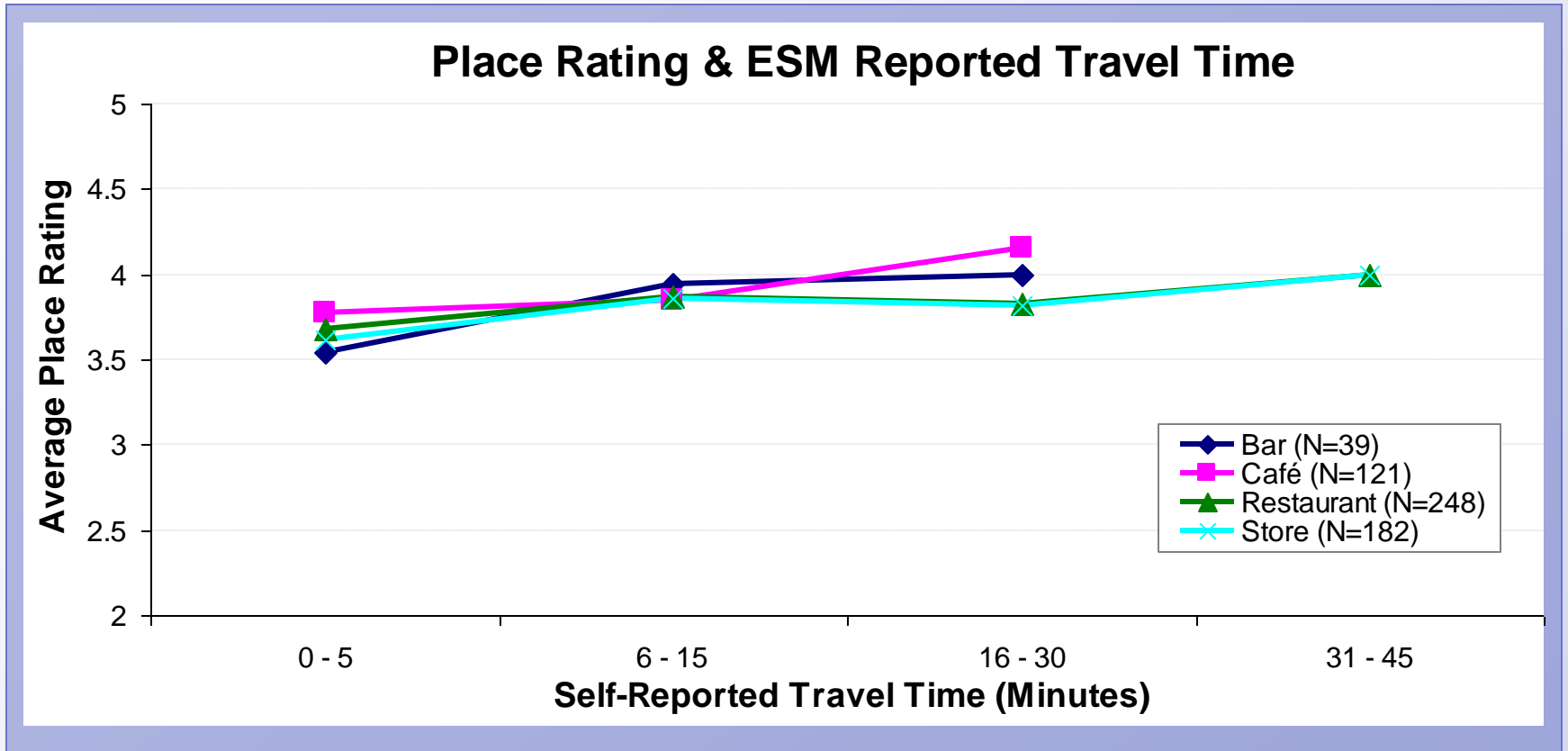


Place Rating vs. Travel Time



Place rating has nearly no correlation with travel time

Place Rating vs. Travel Time



Breaking “public places” into separate categories has little impact

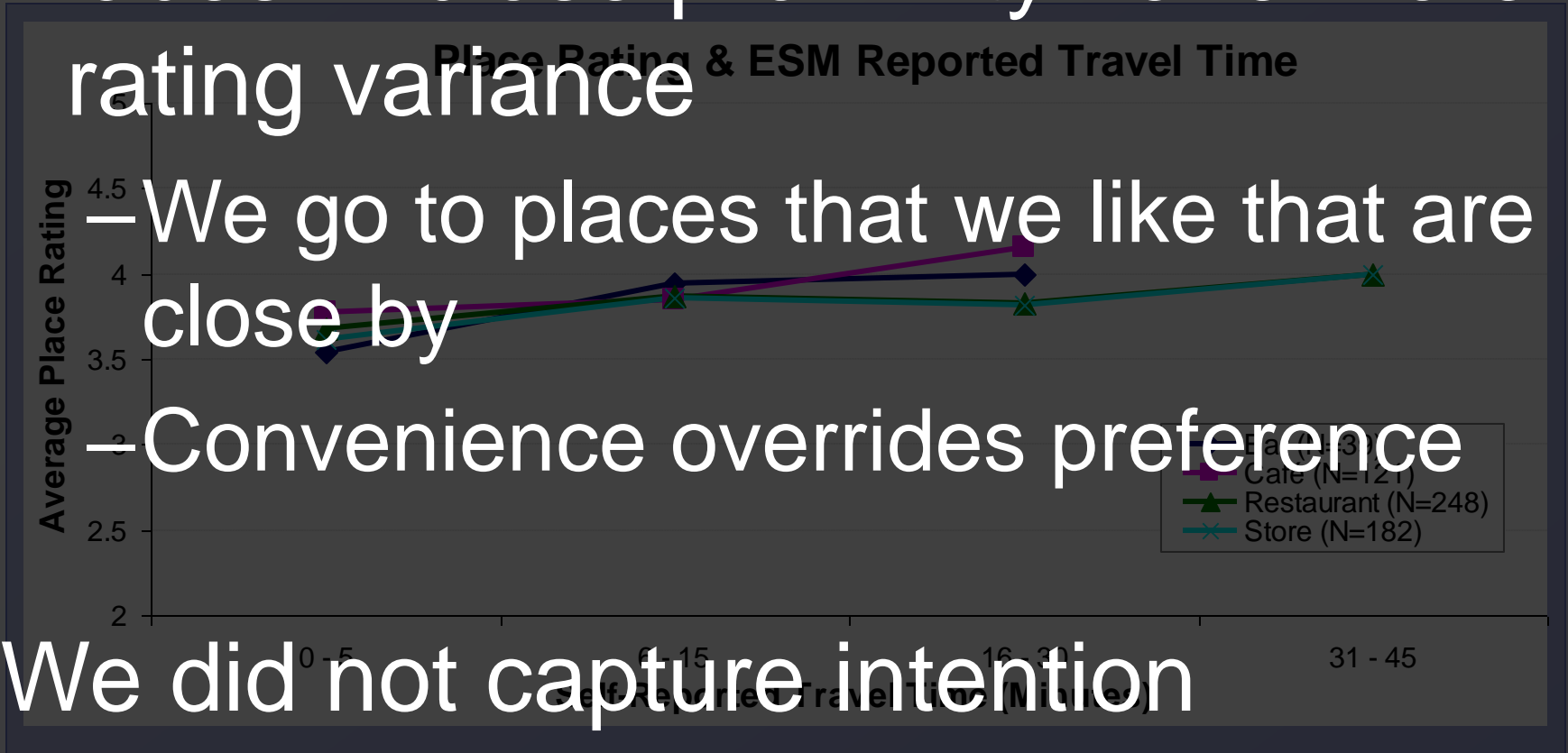
Place Rating vs. Travel Time

Places in close proximity have more rating variance

— We go to places that we like that are close by

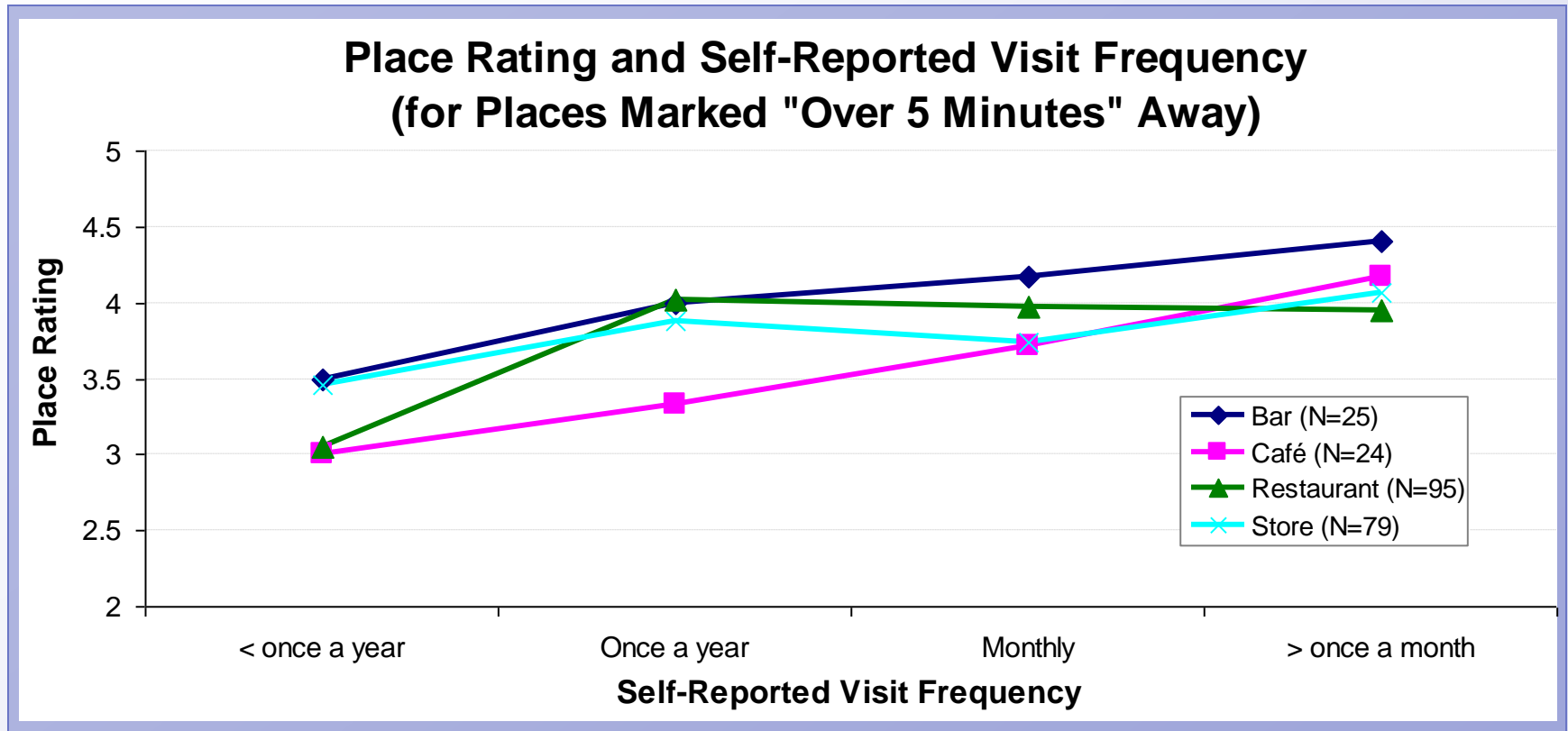
— Convenience overrides preference

We did not capture intention



Breaking “public places” into separate categories has little impact

Visit Frequency & Travel Time



Combining visit frequency and travel time strengthens correlation

Future Work

- Other implicit indicators
 - Domain knowledge
 - Dwell time
 - Temporal patterns
- Negative interest indicators
- Longitudinal study with GPS
 - Correlate ratings with data stream
- Build “suggest a place” prototype



Summary

- First study investigating relationship between place visit behavior & preference
 - Visit frequency found to be a modest indicator
 - Travel time alone was a weak indicator
 - Combining factors improved results
 - Confounds may be minimized using domain knowledge

Questions?



Acknowledgements

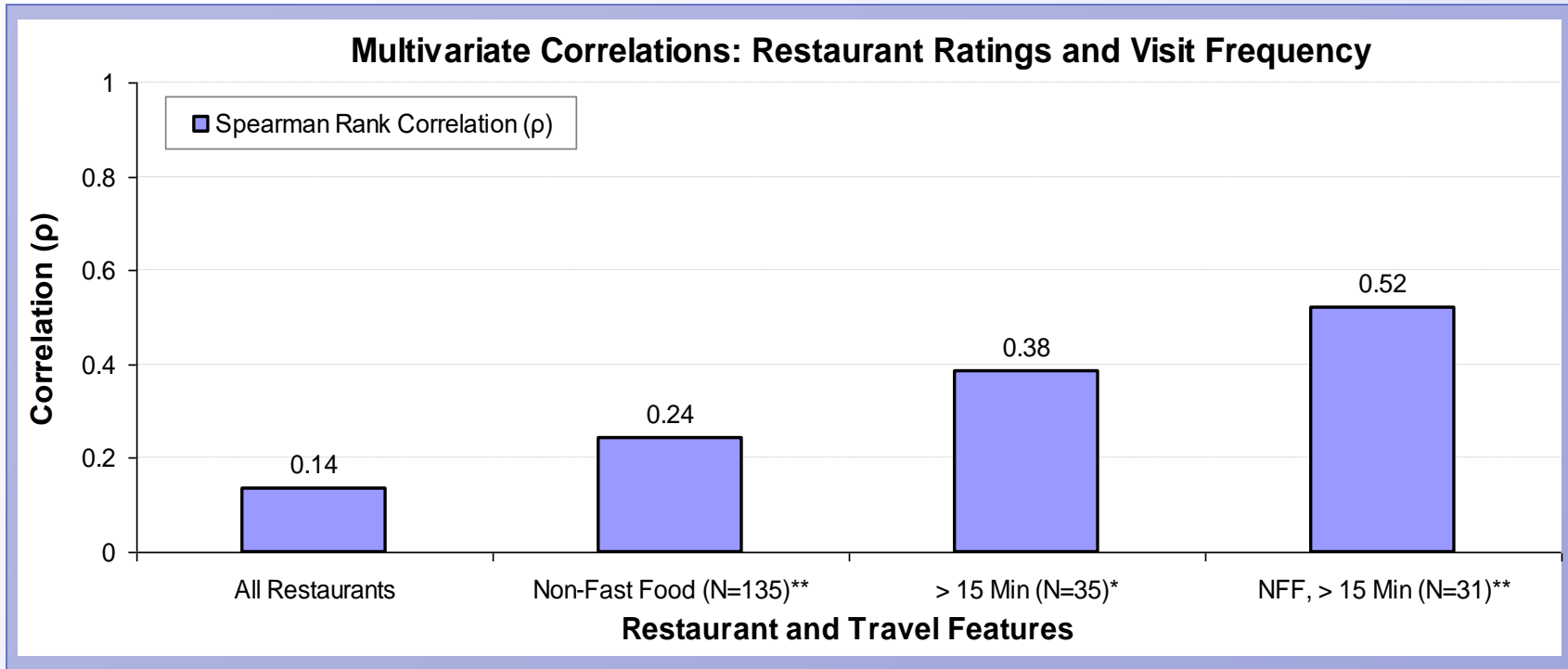
- Intel Research, Seattle for funding the study
- University of Washington Statistics Consulting Group for their assistance/feedback
 - Yingdeng Jiang, Paul Sampson, and Liang Xu
- For their reviews/edits
 - Jonathan Carlson, Sunny Consolvo, Beverly Harrison, Cassandra Hearn, Kate Everrit, James Landay, & Scott Saponas



Backup Slides

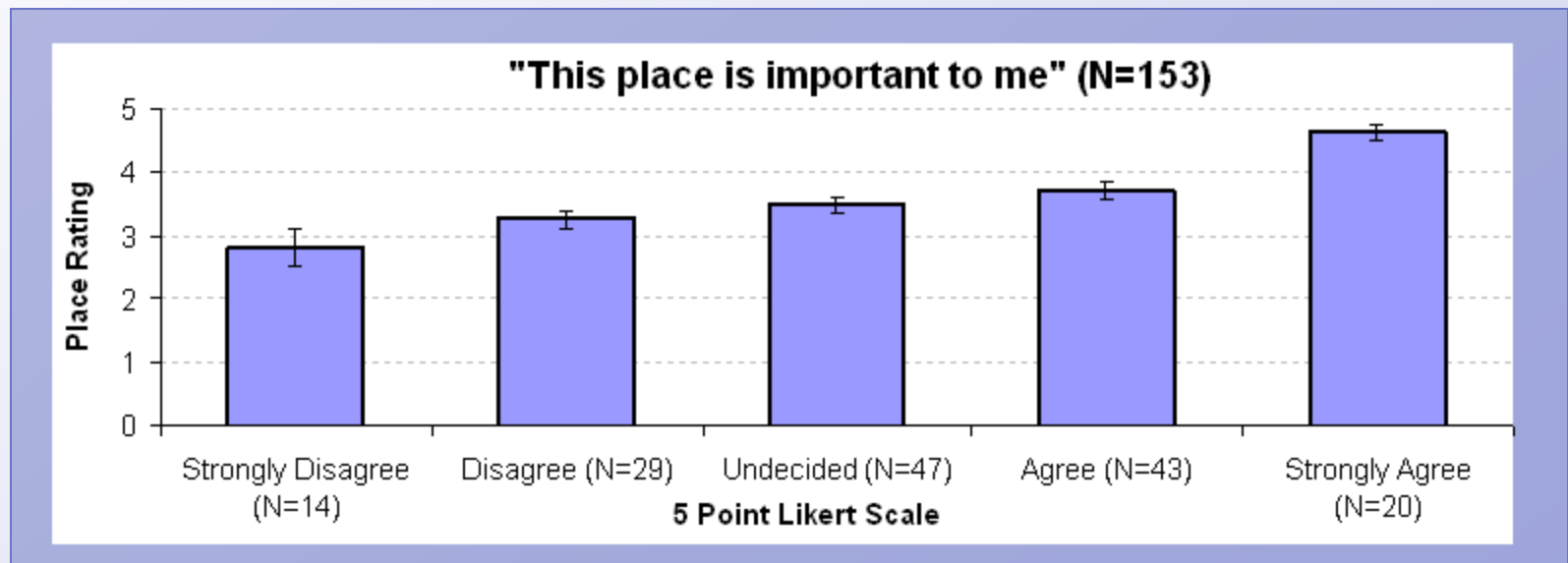
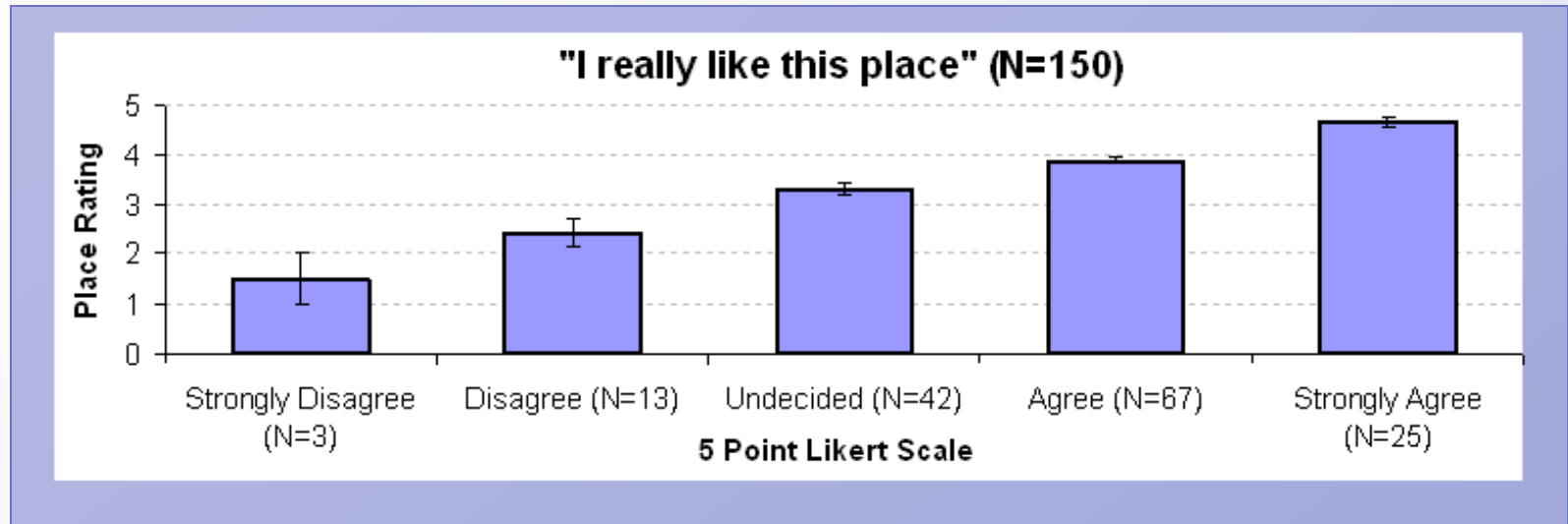


Future Work: Applying Domain Knowledge

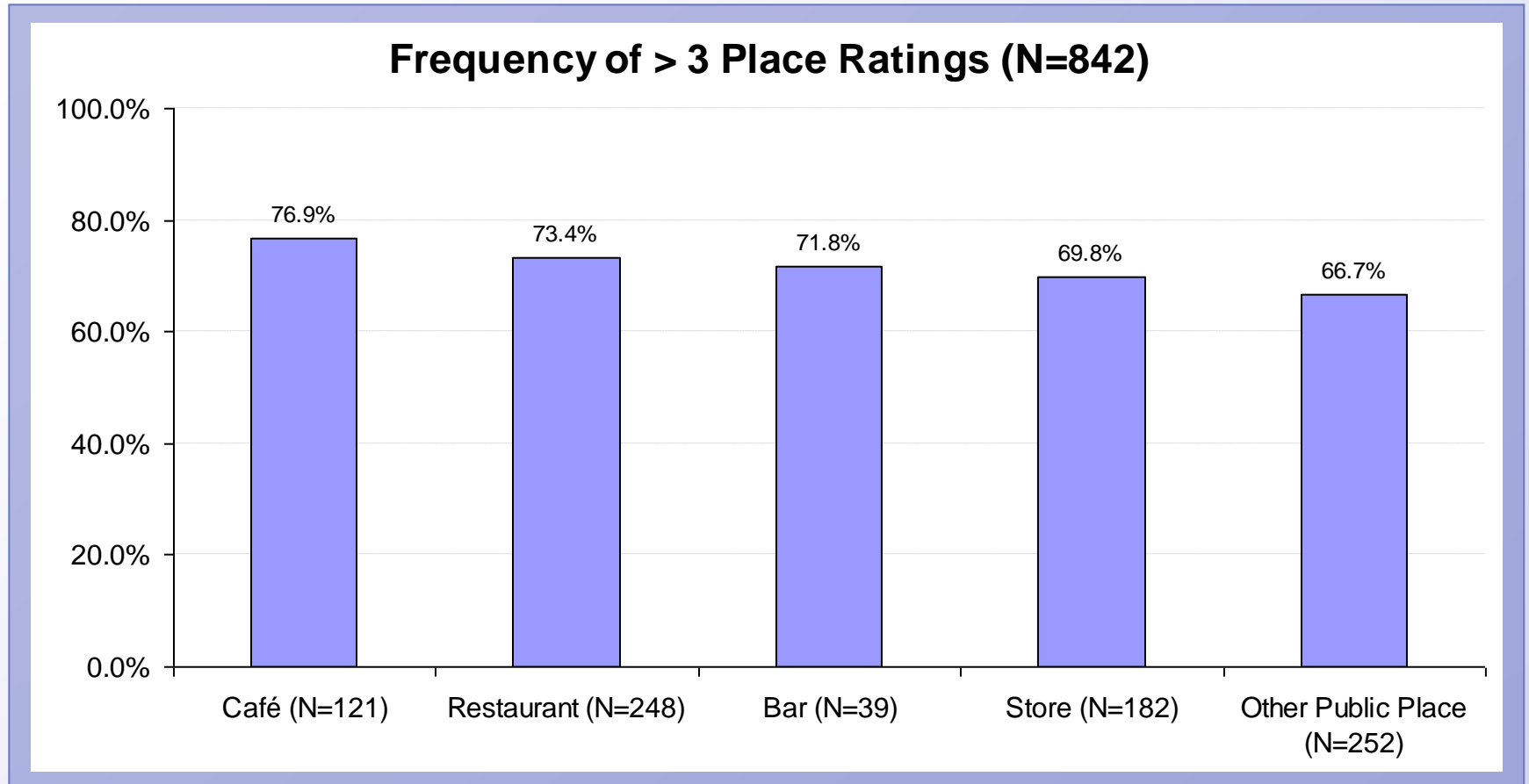


Applying domain knowledge decreases “noise” in the data

Understanding the Rating



Frequency of 3+ Ratings



Social Effects

Normally, I go places because other people want to go there.

-Participant #1

I think for me visually, I can probably see that it's going to be a 3 before I cross the doors' threshold. So, I would avoid it from that particular perspective. Not unless I was meeting somebody there.

-Participant #5

Confounds

Convenience

Factoring out places that were reported to be within 5 minutes improved results

Social Factor

The presence of others did not have a significant impact on ratings, it was who made the decision that was important

Analysis

Two relevant statistical analyses

- Spearman rank correlation
 - Measures relationship between ordinal data
 - No assumptions about underlying freq. distribution
- Chi-squared frequency distribution
 - Looks at distribution frequency of variables
 - Result shows if distribution significantly different than chance

Travel Time: Places Rated > 3

