Reconstructing Social Networks in Uncertain Environments using Archaeological Pottery

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Research goal

- Investigate the colonization and habitation of remote and marginal environments by past foraging populations
- Managing environmental uncertainty
Environmental Uncertainty

- Lack of knowledge concerning the hazard potential of an uncontrolled environmental event
- (Un)Predictability of the hazard event

Decadal / Generational Events

Yearly / Seasonal Events

Decadal/Generational Events

Centennial / Millennial Events

Centennial / Millennial Events
Coping with Uncertain Hazard Events

- Seasonal / Yearly hazard events (Seasonal shortfalls)
  - Logistical / residential mobility (Kelly 1985)
  - Inter-group food sharing (Kaplan and Hill 1985)
  - Resource intensification (Winterhalder 1986)
  - Storage (Goland 1991)

- Decadal / Generational hazard events
  - Social Networking
    - Hxaro Trading Network (Weissner 1977; 1982)
    - Local and traditional ecological knowledge (LTK/TEK)

- Centennial / Millennial hazard events
  - Oral history
  - Wing and a Prayer (Fitzhugh et al. 2011)
Why Social Networks?

- **Advantages**
  - Transmission of multiple forms of information over local, regional and distant spatial scales
    - Environmental, demographic and political information
  - “Safety nets” of friends throughout various regions to help in times of difficulty
    - Unpredictable environmental events

- **Disadvantages**
  - Costly to maintain over long distances

Did hunter-gatherers use social networks as a strategy for mitigating environmental uncertainty?
Regional Differences - Biodiversity

South

Central and North

Photo by T. Amano

http://www.lonelyplanet.com

http://thesoulofjapan.blogspot.com

Photo by M. Walsh

Photos by M. Etnier
Regional Differences - Geologic Events

Okhotsk Plate

Pacific Plate

Hokkaido

1952

1958

1963

1969

1973

1978

1983

1918

1915

2006

2007

8 cm/yr

50°N

46°N

http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=38985
Regional Differences – Climate

Photo by B. Fitzhugh
Regional Differences – Climate

South and North

Central
Regional Differences – Occupation History

Late/Final Jomon South

Epi-Jomon South & Central

Okhotsk Central & North

Ainu All

Brown and Fitzhugh, in prep
## Regional Differences and Environmental Uncertainty

<table>
<thead>
<tr>
<th>Region</th>
<th>Characteristics</th>
<th>Environmental Uncertainty</th>
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| **South** | - High ecological diversity  
- Year-round resources  
- Limited frequency of tectonic events  
- Short distance to mainland  
- Low travel costs  
- Long-term occupation history | Low |
| **Central** | - Low ecological diversity  
- Seasonal, similar resources  
- Greater frequency of tectonic events  
- Far distance to mainland  
- High travel costs  
- Short-term occupation history | High |
| **North** | - Medium ecological diversity  
- Seasonal, similar resources  
- Greater frequency of tectonic events  
- Short distance to mainland  
- Moderate travel costs  
- Short-term occupation history | Medium |
Social Networking in the Kuril Islands

- Given the variety of environmental uncertainty between regions, what type of social networks would we expect?

From Fitzhugh, Phillips and Gjesfeld 2011
Uncertainty and Networking

- Integrated
- Network Structure
- Isolated

High Environmental Uncertainty to Low Environmental Uncertainty
Quick Summary

- Social networks are considered to be a key cultural adaptation to uncertain environments
  - Transmit various forms of information
  - Social “safety nets”

- Sites with high environmental uncertainty = Integrated Networks
  - Central region

- Sites with low environmental uncertainty = Isolated Networks
  - Southern region

How do we identify these social networks with archaeological data?
Artifact Sourcing

- **Goal:** For inorganic artifacts, identify the geologic place of origin and compare with the archaeological place of recovery
  - Using the variation in major and minor element concentrations

- If place of geologic origin ≠ place of recovery then...
  - Interpret the reason for artifact movement
    - trade and exchange
    - group mobility

- Given a large enough sample, we can attempt to reconstruct exchange patterns (social networks) based upon the movement of artifacts
Methods of Artifact Sourcing

- Inductively-Coupled-Plasma Mass-Spectrometry (ICP-MS)
  - Chemical digestion (RAS-Irkutsk)
  - Laser ablation (Field Museum)

- Portable X-ray fluorescence
  - Hokkaido University Museum
    - Non-destructive

- Mineralogical
  - X-ray diffraction
  - Petrography

Photo by E. Gjesfjeld
Ceramic Sourcing

- **Advantages to using ceramics**
  - Ubiquitous in the Kuril Islands
    - Extensive collections from the Epi-Jomon and Okhotsk periods
    - Ceramics are found on nearly all of the islands

- **Disadvantages to using ceramics**
  - Lower resolution due to geochemical heterogeneity
    - Variation in raw clay, influence of inclusions (temper)
From sourcing to social networks

- **Step #1: Infer geologic origins**
  - Pilot sample of 60 pottery specimens from 17 sites
  - PCA and Cluster Analysis
From sourcing to social networks

- **Step #2:** Identify “local” and “imported” samples
  - Local samples = most abundant samples from same site

- **Step #3:** Infer network ties between the local site and “imported” sites

- **Step #4:** Create social network graphs
  - Statnet in R
Network Graphs

Epi-Jomon Network

Okhotsk Network

SNA performed using Statnet library for R (Hancock et al. 2008)
- Epi-Jomon Network
  - Graph Density: 0.139
  - Graph Centrality: 0.303
  - Graph Scale: 116 km

- Okhotsk Network
  - Graph Density: 0.311
  - Graph Centrality: 0.305
  - Graph Scale: 321 km
What does this all mean?

• Conclusion #1: Geochemical sourcing methods are possible on ceramics from the Kuril Islands
  • Goal of the pilot study

• Conclusion #2: Preliminary network graphs suggest Epi-Jomon networks are different than Okhotsk networks
  • Reason for differences are still to be determined
    • Environmental Uncertainty?
    • Cultural differences?
    • External economic influences?
What does this all mean?

- Conclusion #3: Even though the archaeological record of hunter-gatherers is often fragmented and incomplete, anthropological questions of social relationships can still be directly investigated in archaeological research.
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Thanks!
Questions?
Mobility versus Exchange

- Why do I assume exchange? Couldn’t the same community be moving between different locations?

- Evaluate the samples in each source group based upon manufacturing attributes
  - Pottery manufacturing traditions are often specific to communities, so if the same community is traveling with their pottery, manufacturing attributes should be similar
    - Porosity
    - Temper type and abundance
    - Vessel thickness (wall, base and rim)
    - Stylistic decoration