Individual variation, network heterogeneity and linguistic complexity: which way does the relationship go?

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Individual variation, network heterogeneity and linguistic complexity: which way does the relationship go?

Sébastien Lerique, Dan Dediu, Márton Karsai, & Jean-Philippe Magué
The problem

Language must adapt to many ≠ landscapes ≠ situations ≠ sub-communities ≠ material conditions ≠ idiosyncracies... in a complex network
Possible mechanisms

Lowest common denominator

“Train window” communication → rudimentary signs
Advertisements → pre-filtered interpretations
Administrative language → “syntax of abridgement”  Marcuse 1964
Portable partial acts  Di Paolo et al. 2018
Possible mechanisms

Super redundant-robust-complex

- Repairing breakdowns
- Articulating something
- Meaning something
- Negotiating turns & interaction

...can each be done in many ways...

Redundancy turns into complexity when not needed
Hypothesis

Standing variation in all aspects of language $\rightarrow$ fuel for redundancy
Network heterogeneity $\rightarrow$ pressure for adaptation
Interactional disorder \cite{Di Paolo et al. 2018}

Are core factors generating redundancy, robustness & complexity
Examples

Chronic *otitis media* in Australian Aboriginal populations  Butcher 2013

More diversity than expected  Evans & Levinson 2009

Japanese business-card exchange rules  Cuffari *et al.* 2015
Evolutionary biology

- **Niche construction** → speakers construct their environment
- **Developmental plasticity** → learners adapt to their context
- **Evolution of development** → more constraints and opportunities

Adaptation to different environments is dealt with dynamic, recursive and complex processes.
Inspirations

Population structure & variation

Minor changes in a population can have macroscopic effects
Granovetter 1978     Bikhchandani et al. 1992
Population structure & variation

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0 2 3 4
1 5 6
2 7 8
3 9 10
4 11 12

0 1 2 3
4 5 6
7 8 9
10 11 12

Seed = 0
Projects

Simulations

When competing, how many nodes/edges are necessary for global adoption?

What are the effects of node diversity, network topology, placement of seed nodes or constrained edges?
Projects

Experiments

One-way communication
- Iterated Learning
Interactive communication
- Experimental Semiotics
Minimal interactive coupling
- Perceptual crossing

Playing with:
- Network topology
- Edge constraints
- Individual sensitivities

Possibly Twitter
25% GMT+0/1 tweets in French

De Jaegher et al. 2010

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- Lowest common denominator
- “Train window” communication → rudimentary signs
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Marcuse 1964
Di Paolo et al.

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  can each be done in many ways

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Hypothesis

Standing variation in all aspects of language → fuel for redundancy
Network heterogeneity → pressure for adaptation
Interactional disorder

Di Paolo et al. 2018

Examples

- Vocal tract anatomy and articulation
- Chronic otitis media in Australian Aboriginal populations
  More diversity than expected
- Japanese business-card exchange rules
  Moisik & Dediu 2017
  Butcher 2013
  Evans & Levinson 2009
  Cuffari et al. 2015

Inspirations

- Evolutionary biology → speakers construct their environment
- Developmental plasticity → learners adapt to their context
- Evolution of development → more constraints and opportunities
- Adaptation to different environments is dealt with dynamic, recursive and complex processes

- Population structure & variation
  Minor changes in a population can have macroscopic effects
  Granovetter 1978
  Bikhchandani et al. 1992

- Network spreading processes
  Watts 2002

Projects

Simulations

When competing, how many nodes/edges are necessary for global adoption?

Experiments

One-way communication ~ Iterated Learning
Interactive communication ~ Experimental Semiotics
Minimal interactive coupling ~ Perceptual crossing

Thank you!