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

Sébastien Lerique, Dan Dediu, Mátom Karsai, Jean-Philippe Magué

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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 $\rightarrow$ rudimentary signs
Advertisements $\rightarrow$ pre-filtered interpretations
Administrative language $\rightarrow$ “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 → fuel for redundancy
- Network heterogeneity → pressure for adaptation
- Interactional disorder

Di Paolo et al. 2018

Are core factors generating redundancy, robustness & complexity

Inspirations

Chronic otitis media in Australian Aboriginal populations

Butcher 2013

Evans
Examples

Vocal tract anatomy and articulation

Moisik & Dediu 2017

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
Inspirations

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.
Population structure & variation

Minor changes in a population can have macroscopic effects

Granovetter 1978  Bikhchandani et al. 1992
Inspirations

Population structure & variation

Minor changes in a population can have macroscopic effects

Granovetter 1978    Bikhchandani et al. 1992
Inspirations

Population structure & variation

Minor changes in a population can have macroscopic effects

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![Diagram showing population structure and variation](image-url)
Population structure & variation

Minor changes in a population can have macroscopic effects

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

Granovetter 1978
Bikchandani et al. 1992
Network spreading processes

Inspirations

Watts 2002

Structure & variation

- Bikhchandani et al. 1992
- Watts 2002

Generate

Structure

- n = 25
- p = 0.12
- \( \langle z \rangle = 3 \)
- Seed 0

Thresholds

- Dirac
- Normal
- loc = 0.18

Save
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

De Jaegher et al. 2010
Projects

Experiments

One-way communication
- Iterated Learning

Interactive communication
- Experimental Semiotics
- Perceptual coupling

Network topology
- Edge constraints
- Individual sensitivities

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

De Jaegher et al. 2010

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The problem

Language must adapt to many landscapes ≠ situations ≠ sub-communities ≠ material conditions ≠ idiosyncrasies...

Possible mechanisms

Lowest common denominator

Train window communication → rudimentary signs

Advertisements → pre-filtered interpretations

Administrative language → “syntax of abridgement”

Portable partial acts

Marcuse 1964

Di Paolo et al. 2018

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 → fuel for redundancy

Network heterogeneity → pressure for adaptation

Interactional disorder

Are core factors generating redundancy, robustness & complexity?

Di Paolo et al. 2018

Examples

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Generate Structure

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Seed

Thresholds

Dirac

Normal

loc = 0.18

Seed

↺

⧏

▶

⧐

save

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?

Experiments

One-way communication

~ Iterated Learning

Interactive communication

~ Experimental Semiotics

Minimal interactive coupling

~ Perceptual crossing

Possibly Twitter

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De Jaegher et al. 2010

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Thank you!