

# Tyler Zarus Knowlton

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## Current Address

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## Contact Information

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## Research Interests

**Broad:** psycholinguistics; language acquisition; semantics; the language-thought relationship  
*Specific:* quantification; natural logic; lexical decomposition; syntactic bootstrapping; linguistic universals and learnability; object-files and ensembles; the meaning-cognition interface

## Employment

Postdoctoral Research Fellow 2021-  
Mind Center for Outreach, Research, and Education ([MindCORE](#))  
*Advisory committee:* [Anna Papafragou](#), [John Trueswell](#), and [Florian Schwarz](#)  
**University of Pennsylvania**, Philadelphia, PA

## Education and Training

Ph.D. in Linguistics 2016-21  
*Thesis:* [The psycho-logic of universal quantifiers](#)  
*Advisors:* [Jeffrey Lidz](#) and [Paul Pietroski](#)  
**University of Maryland**, College Park, MD

Lab Manager, Vision and Cognition Lab 2015-16  
PI: [Justin Halberda](#), Department of Psychological & Brain Sciences  
**Johns Hopkins University**, Baltimore, MD

B.A. in Cognitive Science (with honors) 2011-15  
Minors in Linguistics, Philosophy, and Psychology  
**Johns Hopkins University**, Baltimore, MD

## Grants, Fellowships, and Awards

[NSF Doctoral Dissertation Improvement Grant](#), “Doctoral Dissertation Research:  
The mental representation and acquisition of the universal quantifiers” 2020  
(NSF #BCS-2017525) (with [Jeffrey Lidz](#))

[Graduate Student Service Award](#) 2020  
University of Maryland, College of Arts and Humanities

[Howard Lasnik Award for Distinguished Teaching by a Graduate Student](#) 2020  
University of Maryland, Linguistics Department

[Jerrold J. Katz Young Scholar Award](#) 2019  
CUNY Conference on Human Sentence Processing

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| Jacob K. Goldhaber Travel Grant<br>University of Maryland  | 2018 |
| Fellow, NSF-NRT Training Program, “NRT-DESE: Flexibility in Language Processes and Technology: Human- and Global-Scale” (NRT #1449815) | 2017 |
| Phi Beta Kappa<br>Johns Hopkins University   | 2015 |
| Provost’s Undergraduate Research Award<br>Johns Hopkins University   | 2014 |

## Publications

### Books

Lidz, J. & **Knowlton, T.** (under contract) *A course in first language acquisition*. Oxford University Press.

### Refereed Journal Articles

**Knowlton, T.**, Trueswell, J., & Papafragou, A. (under review) *Non-conservative quantifiers are unlearnable*. Language.

Perkins, L., **Knowlton, T.**, Williams, A., & Lidz, J. (under review) *Thematic content, not number matching, drives syntactic bootstrapping*. Language Learning and Development.

Odic, D., **Knowlton, T.**, Wellwood, A., Pietroski, P., Lidz, J., & Halberda, J. (2024) *Observers efficiently extract the min and max element in perceptual magnitudes sets: evidence for a bipartite format*. Psychological Science.

**Knowlton, T.**, Halberda, J., Pietroski, P., & Lidz, J. (2023) *Individuals versus ensembles and “each” versus “every”: linguistic framing affects performance in a change detection task*. Glossa Psycholinguistics.

**Knowlton, T.**, Pietroski, P., Williams, A., Halberda, J., & Lidz, J. (2023) *Psycholinguistic evidence for restricted quantification*. Natural Language Semantics.

**Knowlton, T.**, Trueswell, J., & Papafragou, A. (2023) *Keeping quantifier meaning in mind: connecting semantics, cognition, and pragmatics*. Cognitive Psychology.

**Knowlton, T.**, Pietroski, P., Halberda, J., & Lidz, J. (2022) *The mental representation of universal quantifiers*. Linguistics and Philosophy.

**Knowlton, T.**, Hunter, T., Odic, D., Wellwood, A., Halberda, J., Pietroski, P., & Lidz, J. (2021) *Linguistic meanings as cognitive instructions*. Annals of the New York Academy of Sciences.

## Refereed Conference Proceedings (mentees underlined)

**Knowlton, T.** & Schwarz, F. (forthcoming) *“Every” provides an implicit comparison class when “each” does not*. Proceedings of the 47th annual Penn Linguistics Conference.

Ongchoco, J., **Knowlton, T.**, & Papafragou, A. (2023) *Language shifts the representation of sounds in time: from auditory individuals to auditory ensembles*. Proceedings of the Annual Meeting of the Cognitive Science Society.

**Knowlton, T.**, Trueswell, J., & Papafragou, A. (2022) *New evidence for the unlearnability of non-conservative quantifiers*. Proceedings of the 23rd Amsterdam Colloquium.

**Knowlton, T.**, Trueswell, J., & Papafragou, A. (2022) *A mentalistic semantics explains “each” and “every” quantifier use*. Proceedings of the Annual Meeting of the Cognitive Science Society.

**Knowlton, T.** & Gomes, V. (2022) *Linguistic and non-linguistic cues to acquiring the strong distributivity of “each”*. Proceedings of the Linguistic Society of America.

**Knowlton, T.** & Lidz, J. (2021) *Genericity signals the difference between “each” and “every” in child-directed speech*. Proceedings of the 45th annual Boston University Conference on Language Development.

**Knowlton, T.**, Pietroski, P., Williams, A., Halberda, J., & Lidz, J. (2021) *Determiners are “conservative” because their meanings are not relations: evidence from verification*. Proceedings of Semantics and Linguistic Theory 30.

## Volumes Edited

**Knowlton, T.**, Schwarz, F., & Papafragou, A. (Eds.) (2023) *Proceedings of the second Experiments in Linguistic Meaning (ELM 2)*. Linguistic Society of America.

## Presentations

### Invited Talks

**Knowlton, T.** (2024) *Quantifiers and learnability: uncovering the natural logic behind natural language*. Cognitive Development Center Seminar Series, Central European University.

**Knowlton, T.** (2023) *Universal quantifiers: logically equivalent, psychologically distinct*. Linguistics & Cognitive Science Colloquium, University of Delaware.

**Knowlton, T.** (2023) *Universal quantifiers, objects, and ensembles: a case study in psychosemantics*. 19th Workshop on Syntax, Semantics and Phonology, Nantes Université.

**Knowlton, T.** (2023) *The poverty of the stimulus in the animal kingdom (humans included)*. 19th Workshop on Syntax, Semantics and Phonology (pre-workshop course), Nantes Université.

**Knowlton, T.** (2023) *Different determiners invite different ways of restricting and representing the domain*. The New York Philosophy of Language Workshop, New York University.

- Knowlton, T.** (2023) *What conservativity tells us about Universal Grammar*. Linguistics Colloquium, University of Maryland.
- Knowlton, T.** (2022) *Non-conservative quantifiers are unlearnable (and what that means for semantic theory)*. The Psycholinguistics Workshop, University of Massachusetts Amherst.
- Knowlton, T.** (2022) *Every universal is first-orderizable, but only “each” is first-ordered*. Cognitive Semantics and Quantities Workshop, University of Amsterdam.
- Knowlton, T.** (2021) *The psycho-logic of “each” and “every”*. LingLangLunch, Brown University.
- Knowlton, T.** (2021) *The psycho-logic of universal quantifiers*. Linguistics Colloquium, University of Southern California.
- Knowlton, T.** (2019) *The psychological treatment of (universal) quantification*. Integrated Language Sciences and Technology Seminar, University of Pennsylvania.
- Knowlton, T.** (2018) *Are natural language quantifiers first- or second-order?* McDonnell Network Focused Workshop on “The Development of Set and Quantifier Representations”, Johns Hopkins University.

## Conference Talks

- Knowlton, T.** & Schwarz, F. (2023) *“Every” provides an implicit comparison class when “each” does not*. The 47th annual Penn Linguistics Conference (PLC), University of Pennsylvania.
- Knowlton, T.**, Trueswell, J., & Papafragou, A. (2023) *Non-conservative quantifiers are unlearnable*. Linguistic Society of America (LSA) Annual Meeting, Denver, CO.
- Knowlton, T.**, Trueswell, J., & Papafragou, A. (2022) *New evidence for the unlearnability of non-conservative quantifiers*. Workshop on Biases in Language and Cognition, 23rd Amsterdam Colloquium (AC), Amsterdam, Netherlands.
- Gomes, V., **Knowlton, T.**, Papafragou, A., & Trueswell, J. (2022) *Differentiating universal quantifiers by differentiating their domains*. Boston University Conference on Language Development (BUCLD) 47, Boston University.
- Knowlton, T.**, Trueswell, J., & Papafragou, A. (2022) *A mentalistic semantics explains “each” and “every” quantifier use*. 44th Annual Meeting of the Cognitive Science Society (CogSci), Toronto, Canada.
- Cesana-Arlotti, N., **Knowlton, T.**, Lidz, J., & Halberda, J. (2022) *Universal quantification without language? Ten-month-old infants represent the exhaustivity of a relation in visually presented events*. Symposium on The Language of Thought, 3rd Joint Conference of the Society for Philosophy and Psychology and the European Society of Philosophy and Psychology (SPP/ESPP), Milan, Italy.
- Cesana-Arlotti, N., **Knowlton, T.**, Lidz, J., & Halberda, J. (2022) *On the origins of universal quantification: 10-month-old infants represent the exhaustivity of multi-agent intentional actions*. XXIII International Congress of Infant Studies (ICIS) Biennial Congress, Ottawa, Canada.
- Knowlton, T.** & Gomes, V. (2022) *Linguistic and non-linguistic cues to acquiring the strong distributivity of “each”*. Linguistic Society of America (LSA) Annual Meeting, Washington, DC.
- Knowlton, T.**, Halberda, J., Pietroski, P., & Lidz, J. (2021) *Evaluating “each”- (but not “every”-) sentences encourages encoding individual properties*. 34th CUNY Conference on Human Sentence Processing, University of Pennsylvania.

- Knowlton, T.** & Lidz, J. (2021) *Bootstrapping universal quantifiers: the role of genericity*. Linguistic Society of America (LSA) Annual Meeting, San Francisco, CA.
- Knowlton, T.** & Lidz, J. (2020) *Genericity signals the difference between “each” and “every” in child-directed speech*. Boston University Conference on Language Development (BUCLD) 45, Boston University.
- Knowlton, T.**, Pietroski, P., Williams, A., Halberda, J., & Lidz, J. (2020) *Memory for cardinality supports a non-relational account of conservativity*. Experiments in Linguistic Meaning (ELM) 1, University of Pennsylvania.
- Cesana-Arlotti, N., **Knowlton, T.**, Lidz, J., & Halberda, J. (2020) *An investigation of the origins of logical quantification: infants’ (and adults’) representations of exhaustivity in collective or individual complex actions*. Symposium on Learning ‘hard words’, XXII International Congress of Infant Studies (ICIS) Biennial Congress, Glasgow, Scotland.
- Knowlton, T.**, Pietroski, P., Williams, A., Halberda, J., & Lidz, J. (2020) *Conservative meanings with only one set: evidence from verification*. 33rd CUNY Conference on Human Sentence Processing, University of Massachusetts Amherst.
- Knowlton, T.**, Pietroski, P., Halberda, J., & Lidz, J. (2019) *The mental representation of universal quantifiers: evidence from verification*. 32nd CUNY Conference on Human Sentence Processing, University of Colorado Boulder.
- Knowlton, T.**, Halberda, J., Pietroski, P., & Lidz, J. (2018) *Acquiring the universal quantifiers: every part together or each part on its own?* Boston University Conference on Language Development (BUCLD) 43, Boston University.

#### Conference Posters / Lightning Talks (mentees underlined)

- Huang, S.-Z., **Knowlton, T.**, & Schwarz, F. (2024) *Cross-linguistic comparisons on distributive universal quantification: “each”/“every” vs. “mei”*. Linguistic Society of America (LSA) Annual Meeting, New York, NY.
- Ongchoco, J., **Knowlton, T.**, & Papafragou, A. (2023) *Language Shifts the Representation of Sounds in Time: From Auditory Individuals to Auditory Ensembles*. 45th Annual Meeting of the Cognitive Science Society (CogSci), Sydney, Australia.
- Knowlton, T.** & Schwarz, F. (2023) *“Every” provides an implicit comparison class when “each” does not*. 36th Annual Conference on Human Sentence Processing (HSP), University of Pittsburgh.
- Cesana-Arlotti, N., Icard, T., **Knowlton, T.**, Lidz, J., Pietroski, P., & Halberda, J. (2023) *The slower they swim, the faster they fly! Can preverbal infants learn antitonic functions?* Budapest CEU Conference on Cognitive Development (BCCCD) 23, Budapest, Hungary.
- Knowlton, T.**, Trueswell, J., & Papafragou, A. (2022) *Non-conservative quantifiers are unlearnable*. Boston University Conference on Language Development (BUCLD) 47, Boston University.
- Knowlton, T.**, Trueswell, J., & Papafragou, A. (2022) *A psycho-semantic explanation of “each” and “every” quantifier use*. Experiments in Linguistic Meaning (ELM) 2, University of Pennsylvania.
- Cesana-Arlotti, N., **Knowlton, T.**, Lidz, J., & Halberda, J. (2022) *Universal quantification without language? Ten-month-old infants represent the universality of visually presented properties*. Experiments in Linguistic Meaning (ELM) 2, University of Pennsylvania.

- Knowlton, T.**, Trueswell, J., & Papafragou, A. (2022) *Psycho-semantic representations explain “each” and “every” quantifier use*. 35th Annual Conference on Human Sentence Processing (HSP), University of California, Santa Cruz.
- Cesana-Arlotti, N., **Knowlton, T.**, Lidz, J., & Halberda, J. (2021) *An investigation of the origins of logical quantification: infants’ (and adults’) representations of exhaustivity in collective or individual complex actions*. Society for Philosophy and Psychology (SPP) 47th Annual Meeting, Princeton University.
- Cesana-Arlotti, N., **Knowlton, T.**, Lidz, J., & Halberda, J. (2021) *Representing the exhaustivity of collective and individual actions: an investigation of universal quantification in adults and infants*. 12th Dubrovnik Conference on Cognitive Science, Virtual.
- Knowlton, T.**, Pietroski, P., Williams, A., Halberda, J., & Lidz, J. (2020) *Determiners are ‘conservative’ because their meanings are not relations: evidence from verification*. Semantics and Linguistic Theory (SALT) 30, Cornell University.
- Cesana-Arlotti, N., **Knowlton, T.**, Lidz, J., & Halberda, J. (2020) *An investigation of the origin of logical quantification: infants’ and adults’ representations of collective and distributive actions in complex visual scenes*. 42nd Annual Meeting of the Cognitive Science Society, Virtual.
- Cesana-Arlotti, N., **Knowlton, T.**, Lidz, J., & Halberda, J. (2020) *Who’s chasing whom? Adults’ and infants’ engagement of quantificational concepts (“each” and “all”) when representing visual chasing events*. Vision Sciences Society (VSS) 20th Annual Meeting, Virtual.
- Cesana-Arlotti, N., **Knowlton, T.**, Lidz, J., Pietroski, P., & Halberda, J. (2019) *Concepts of universal quantification (“each” and “all”) may support infant and adult understanding of collective and distributive actions*. Cognitive Development Society (CDS) 2019 Biennial Meeting, Louisville, KY.
- Knowlton, T.**, Halberda, J., Pietroski, P., & Lidz, J. (2019) *A novel memory task reveals early understanding of quantifier meanings*. Society for Research in Child Development (SRCD) 2019 Biennial Meeting, Baltimore, MD.
- Knowlton, T.**, Pietroski, P., Halberda, J., & Lidz, J. (2019) *Representational format and universal quantifiers*. Linguistic Society of America (LSA) Annual Meeting, New York, NY.
- Perkins, L., **Knowlton, T.**, Williams, A., & Lidz, J. (2018) *Matching number vs. linking roles: using 3-participant scene percepts to understand infants’ bootstrapping*. Boston University Conference on Language Development (BUCLD) 43, Boston, MA.
- Knowlton, T.**, Perkins, L., Williams, A., & Lidz, J. (2018) *Getting a grip on infants’ event representations: participant number in TAKE and PICK-UP*. XXI International Congress of Infant Studies (ICIS) Biennial Congress, Philadelphia, PA.
- Knowlton, T.**, Wong, A., Halberda, J., Pietroski, P., & Lidz, J. (2018) *Different determiners, different algorithms: two majority quantifiers in Cantonese bias distinct verification strategies*. 31st CUNY Conference on Human Sentence Processing, University of California, Davis.
- Knowlton, T.**, Halberda, J., Pietroski, P., & Lidz, J. (2017) *Sentences, centers, and sets: set selection and the meanings of more and most*. Cognitive Development Society (CDS) Biennial Meeting, Portland, OR.
- Knowlton, T.**, Halberda, J., Pietroski, P., & Lidz, J. (2017) *Distinguishing first- from second-order specifications of each, every, and all*. Mid-Atlantic Colloquium of Studies in Meaning (MACSIM) 7, Georgetown University.

**Knowlton, T.**, Halberda, J., Pietroski, P., & Lidz, J. (2017) *Set selection and storage reflect differences in quantifier meanings*. McDonnell Network Plenary Workshop on “The Ontogenetic Origins of Combinatorial Thought”, University of California, San Diego.

Perkins, L., **Knowlton, T.**, Hirzel, M., Dudley, R., Williams, A., & Lidz, J. (2017) *Linguistic and conceptual structure in verb learning*. McDonnell Network Plenary Workshop on “The Ontogenetic Origins of Combinatorial Thought”, University of California, San Diego.

## Teaching and Mentorship

### Teaching Experience

#### *University of Pennsylvania*

Instructor of Record: [Language, Cognition, and Culture](#) (LING1720) Spring 2024  
Designed and taught undergraduate seminar

Coordinator: Cognition, Language, And Perception Seminar (CLAPS) Fall 2022  
Lead ~15 person graduate seminar

#### *University of Maryland*

Instructor of Record: [Language and Thought](#) (LING449T) Spring 2020  
Designed and taught undergraduate seminar

TA: Grammar and Meaning (LING410; Instructor: Valentine Hacquard) Fall 2019  
Responsible for grading, office hours, reviewing p-sets in class, once teaching ~25 student lecture

TA: Child Language Acquisition (LING444; Instructor: Jeffrey Lidz) Spring 2019  
Responsible for grading, office hours, helping write exams, once teaching ~20 student lecture

TA: Language and Mind (LING240; Instructor: Tonia Bleam) Fall 2018  
Responsible for grading, office hours, review sessions, twice teaching ~50 student lecture

TA: Introductory Linguistics (LING200; Instructor: Tonia Bleam) Spring 2018  
Responsible for weekly discussion section of ~30 students, grading, office hours

### Mentorship Experience

#### *University of Pennsylvania*

Cognitive science independent study co-mentor 2022-23

- Supervised 2 undergraduate thesis projects
- Mentee J. Ongchoco won the 2023 Robert J. Glushko Outstanding Undergraduate Award in Cognitive Science

MindCORE [Step-Ahead Mentorship Program](#) 2021-22

- Supervised 1 undergraduate student

#### *University of Maryland*

Undergraduate mentor, [Project on Children’s Language Learning](#) 2018-21

- Supervised 7 undergraduate research assistants

High school summer intern mentor, [Project on Children’s Language Learning](#) 2019

- Mentee S. Chervenak won “Best Paper in Behavioral Sciences” from the Washington Academy of Science for his presentation at the Blair Magnet School STEM Fair

#### *Johns Hopkins University*

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|--|---------|
| Undergraduate mentor, <a href="#">Vision and Cognition Lab</a> | 2015-16 |
| – Supervised 5 undergraduate research assistants               |         |

## Academic Activities

### Service

#### *University of Pennsylvania*

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|---|---------|
| Organizing committee, <a href="#">ELM3</a> (Experiments in Linguistic Meaning)            | 2023-24 |
| Admissions committee, <a href="#">DivE In</a> (Diversity and Equity Initiative) Weekend   | 2023    |
| Volunteer, <a href="#">The 9th MACSIM</a> (Mid-Atlantic Colloquium of Studies in Meaning) | 2023    |
| Proceedings co-editor, <a href="#">ELM</a> (Experiments in Linguistic Meaning)            | 2022-23 |
| Student mentor, <a href="#">DivE In</a> (Diversity and Equity Initiative) Weekend         | 2022    |
| Host, <a href="#">Behind the CV: Stories from Faculty</a>                                 | 2022    |
| MindCORE <a href="#">Outreach Committee</a>   | 2021    |
| Organizing committee, <a href="#">ELM2</a> (Experiments in Linguistic Meaning)            | 2021-22 |

#### *University of Maryland*

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| Linguistics Colloquium Committee  | 2019-21 |
| Organizing committee, <a href="#">Mayfest 2020: Hindsight</a> (postponed due to COVID-19)   | 2019-20 |
| Co-organizer, Developmental Science Workshop entitled<br><i>Endless Possibilities: The Development of Possibility and Necessity in Cognition, Language, and Society</i> | 2018-19 |
| Chair, <a href="#">Language Science Outreach Committee</a>  | 2018-19 |
| Planning committee, <a href="#">Winter Storm 10</a> (graduate student skills workshop)  | 2017-18 |
| Co-chair, Linguistics Graduate Student Association  | 2017-18 |
| Career fair coordinator, <a href="#">Language Science Outreach Committee</a>  | 2016-18 |
| Planning committee, <a href="#">Winter Storm 9</a> (graduate student skills workshop)   | 2016-17 |
| Organizing committee, SALT27 (Semantics And Linguistic Theory)  | 2016-17 |

### Ad Hoc Reviewing

#### *Manuscripts*

- Cognitive Science
- Discourse Processes
- First Language
- Journal of Memory and Language (x3)



Journal of Semantics  
Language Learning and Development (x3)  
Natural Language Semantics  
PLOS One

*Proposals*

National Science Foundation Doctoral Dissertation Research Improvement Grant

*Conference Abstracts/Papers*

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|---|---------|
| Budapest CEU Conference on Cognitive Development                        | 2023-24 |
| Procedural and Computational Models of Semantic and Pragmatic Processes | 2023    |
| European Summer School in Logic, Language and Information               | 2023    |
| Penn Linguistics Conference   | 2022    |
| Experiments in Linguistic Meaning                                       | 2022-24 |
| Annual Conference on Human Sentence Processing                          | 2022-24 |
| Annual Meeting of the Cognitive Science Society                         | 2020-24 |

**Professional Memberships**

Society for Human Sentence Processing  
Cognitive Science Society  
Society for Research in Child Development  
International Congress of Infant Studies  
Cognitive Development Society  
Linguistic Society of America