



Living in Pasteur's Quadrant

Unlocking the potential of translational science through effective dissemination strategies

Kathy Hirsh-Pasek

Temple University and Brookings Institution

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We live in silos



And our lack of communication across disciplines has had real consequences!

For example, though everyone is now talking about early development!



Child care

Brain-based education

High quality preschool

30-million word gap

The Grade Level Reading Campaign

STEM STEAM STEM



We cringe when we hear what they
are saying

There are well over one-million so called, “educational apps” that will help you learn everything from math, to a second language, to logic



Hirsh-Pasek et al., 2015 *Psychological Science in the Public Interest*

My career has focused on...

- Conducting basic research in the science of learning that crosses silos
- Developing platforms for scientific outreach within the science of learning and to new fields beyond

A talk in two parts

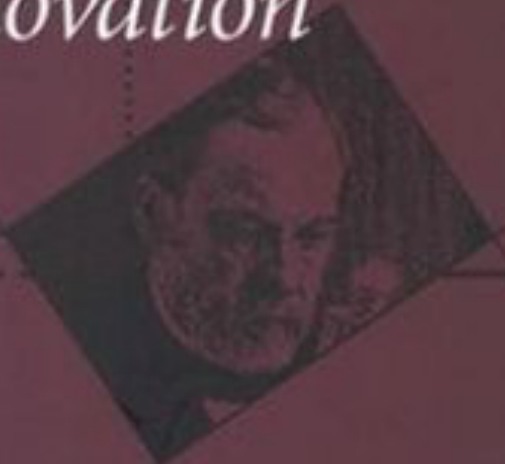
- Where basic research meets applied science
 - Entering Pasteur's Quadrant with language learning
- Leaping beyond Pasteur's quadrant into the world at large
 - An exercise in silo busting and playful learning

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PASTEUR'S QUADRANT

*Basic Science
and Technological
Innovation*



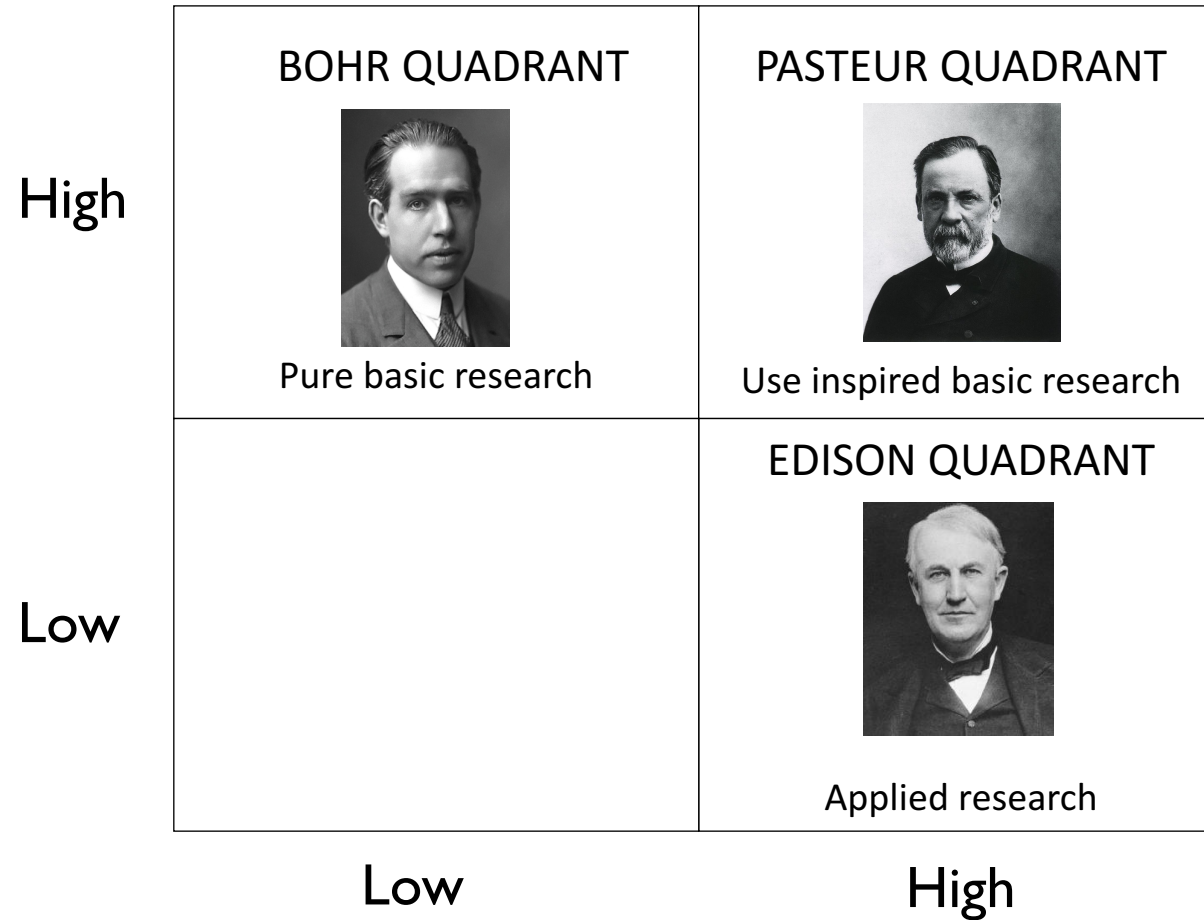
Donald E. Stokes

In 1997, political scientist Donald Stokes wrote a very influential book.

Offering a new solution to the tension that arises between basic science and more applied research.

Stokes' Vision

Quest for fundamental understanding?



Consideration of use?

PASTEUR'S QUADRANT: ANOTHER TAKE FOR THE #METOO MOVEMENT!

Quest for fundamental understanding?

High



Marie Curie



Virginia Apgar

Low



Hedy Lamarr

Low

High

Consideration of use?

A PSYCHOLOGY VERSION MIGHT LOOK LIKE THIS!

Quest for fundamental understanding?

High

Low

TITCHENER QUADRANT



Pure basic research

BRONFENBRENNER QUADRANT



Use inspired basic research

ANASTASI QUADRANT



Applied research

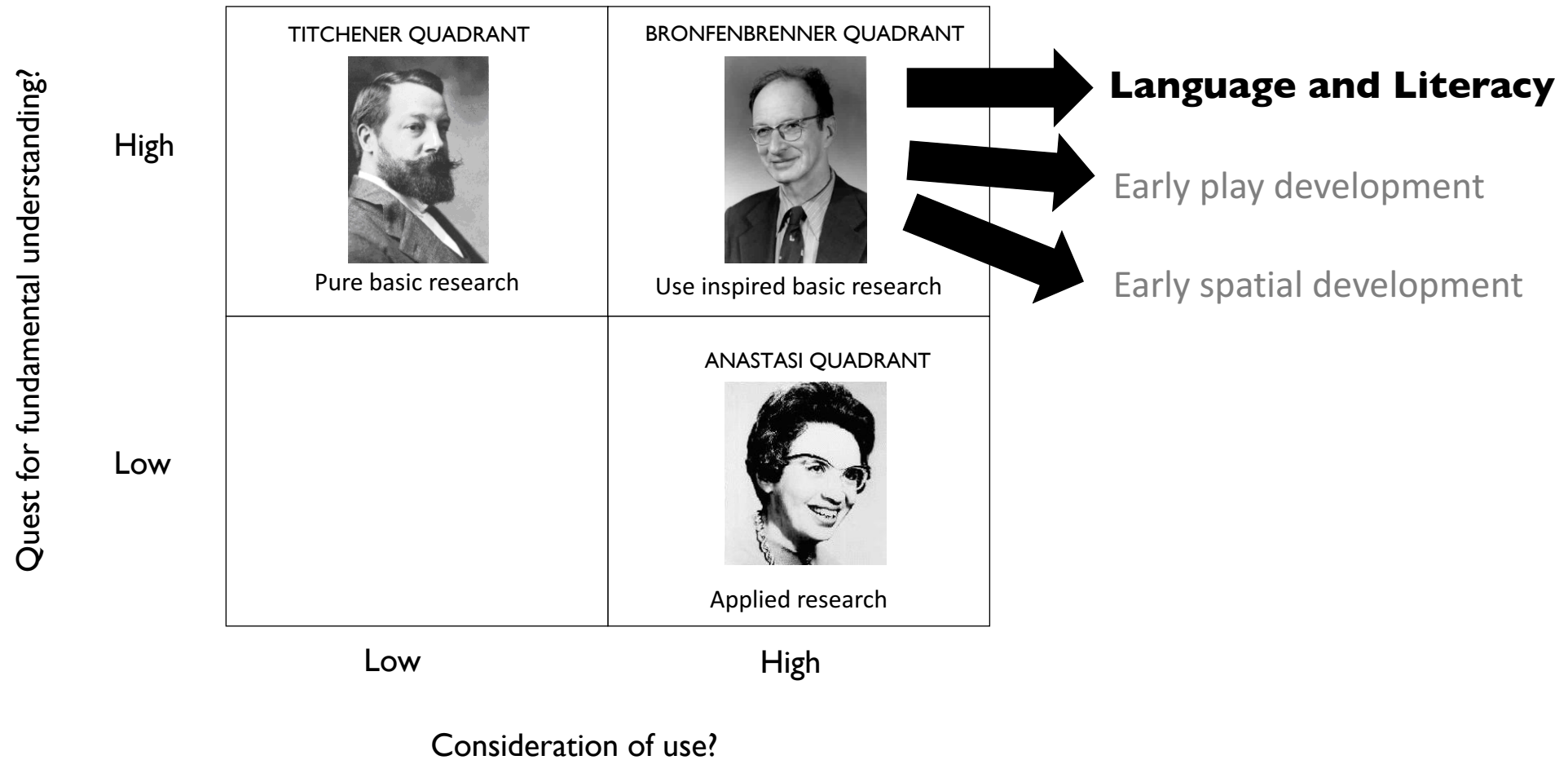
Low

High

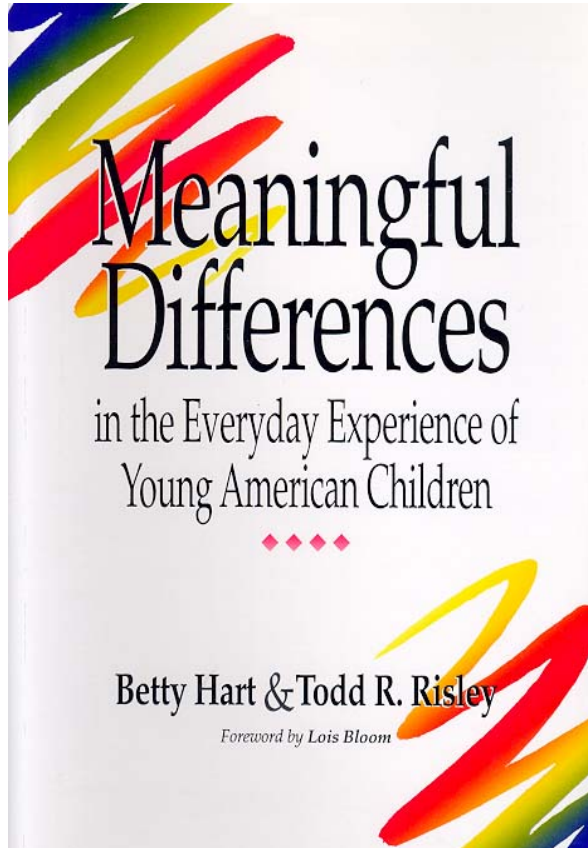
Consideration of use?

the diversion into practical channels of energy which would otherwise have been expended in the service of the laboratory must be regarded as a definite loss to pure science

A PSYCHOLOGY VERSION MIGHT LOOK LIKE THIS!



Our recent work on early language started with Hart and Risley (1995)

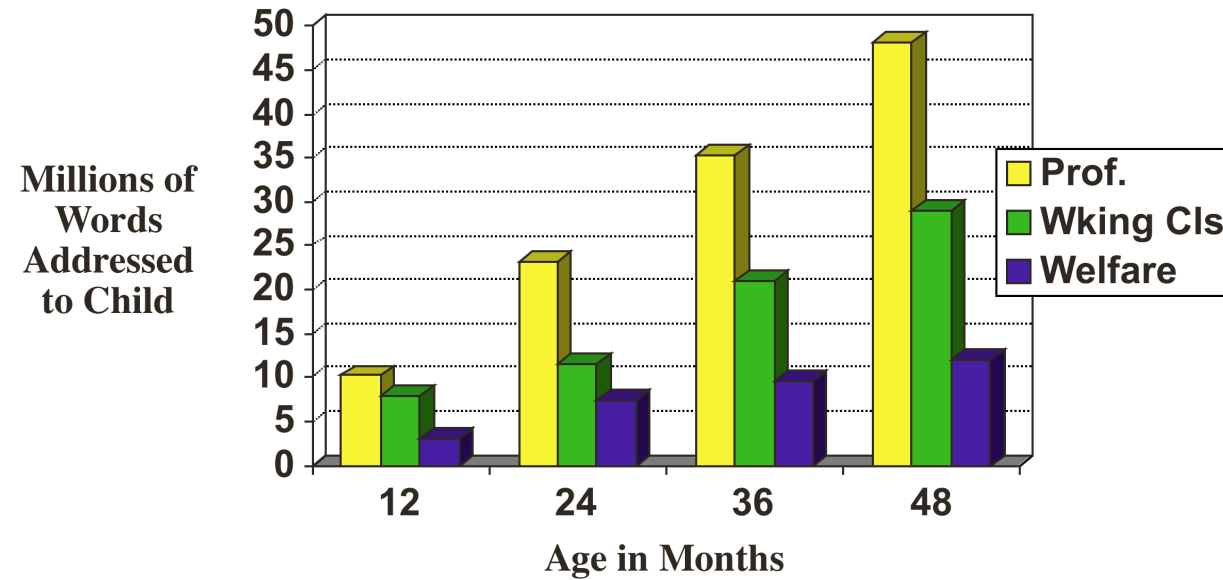


Examined language input to children from...

- Welfare
- Working class
- Professional families

(see also Hoff, 2002, 2003; Pancsofar & Vernon-Feagans, 2010)

Results?



Number of words heard per hour by children in each group:

Welfare - 616

Working Class - 1,251

Professional - 2,153

This finding is widely known as the **30 million word gap** and it has a number of far reaching consequences

Children's recorded vocabulary size?

Professional - 1,116

Working Class - 749

Welfare - 525

And...

- Verbal IQ correlates with school achievement
- Reading is parasitic on language
- Language encodes concepts!
- Language skill predicts health care outcomes



But is it all about *number of words* that pass children's ears?

Given the latest interventions, you might think so...



But Hart and Risley (1995) also said that is it not just quantity!
Parent talk that is *contingent and responsive* to child talk is more important than just number of words – quality counts too! (Tamis LeMonda et al., 2014; Dunham & Dunham, 1996; Hart & Risley; Mol & Newuman, 2014).

Sometimes that message gets lost in popular translation

So –

On the heels of a number of our colleagues...

Goldin Meadow et al. (2014); Rowe (2012); Cartmill et al. (2013);
Tamis-LeMonda et al. (2014)

And building from Adamson and Bakeman's prior work on joint engagement...

We decided to revisit the questions about both the quality AND quantity of early communication and its impact on later language learning.

We asked two questions:

1. Do low-income US children who are successful language learners experience a higher quality of communication than their less able peers?
2. How important is the *quantity* of language children hear relative to the *quality* of the communication foundation?

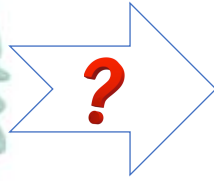
Adamson, Bakeman, Deckner, & Nelson, 2012; Aksan, Kochanska, & Ortmann, 2006; Hirsh-Pasek, Adamson, Bakeman, Owen, Golinkoff, Pace, Yust, & Summa. *Psychological Science*, 2015.

Secondary data analysis from the NICHD Study of Early Child Care and Youth Development...

A longitudinal study of children from 0-16 years, from varied ethnicities and income groups... we designed a study to evaluate quantity vs quality..



Examining the Quality and Quantity of Communication during parent-child interaction



High language scores

Mid language scores

Struggling language scores

N = 60 low-income children

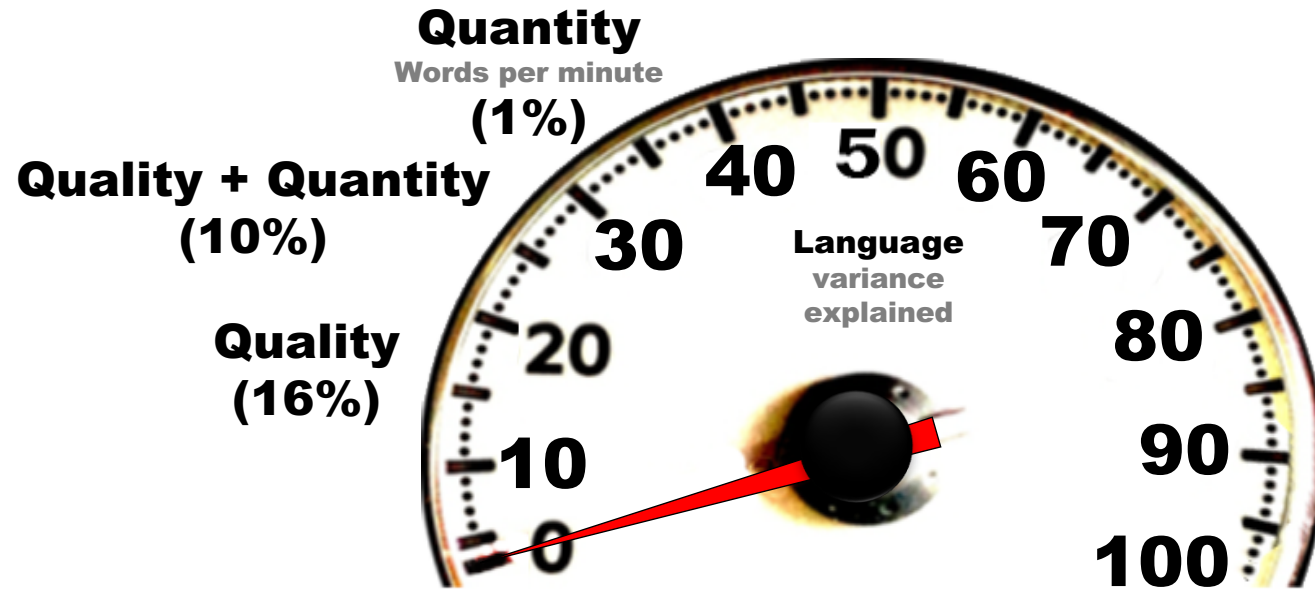


Quality =

- 1) Playful routines and rituals**
- 2) Fluid and connected exchanges (verbal and non-verbal)**
- 3) Symbol infused joint engagement (gesture and words)**

Quantity = number of mother's words per minute

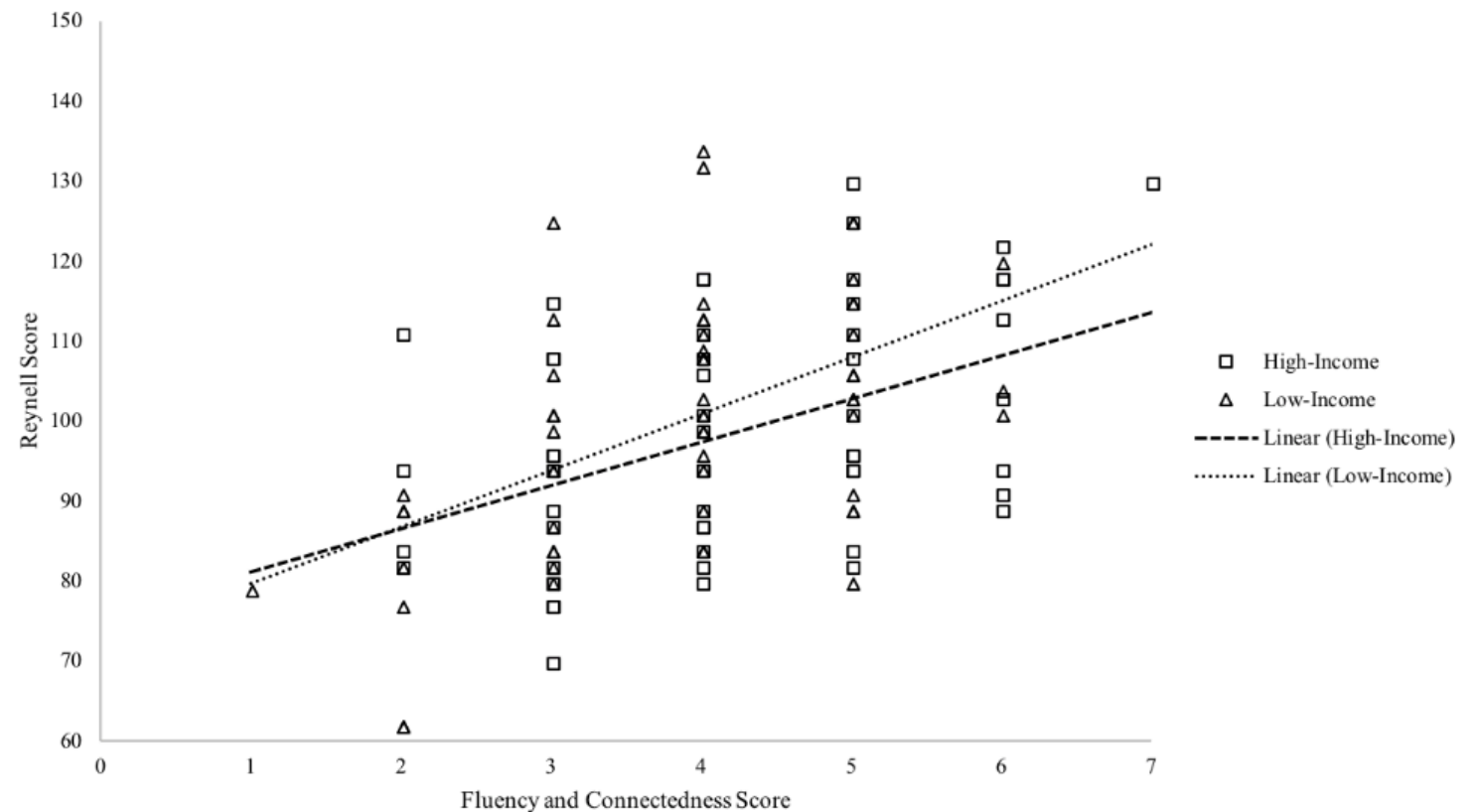
Findings and Implications



1. Quantity of input (amount) and Quality of Foundation for Communication are both important for language growth but “communication foundation” matters more.
2. In our study, it’s not about poverty.
3. Fluid and connected conversations – “Conversational duets” require serve and return, and return and return and return. ...it can’t be a solo performance.
4. It’s “filling the gap” + “building the foundation” – a new metaphor for intervention

Sneak peek at new data with upper income families (Masek et al., in prep).

- Where we largely see the same patterns that we saw in low-income families.
- What this suggests is that contingency is a critical driver of language outcomes even beyond its importance for low-income families.



Conversational duets – whether during play or reading storybooks -

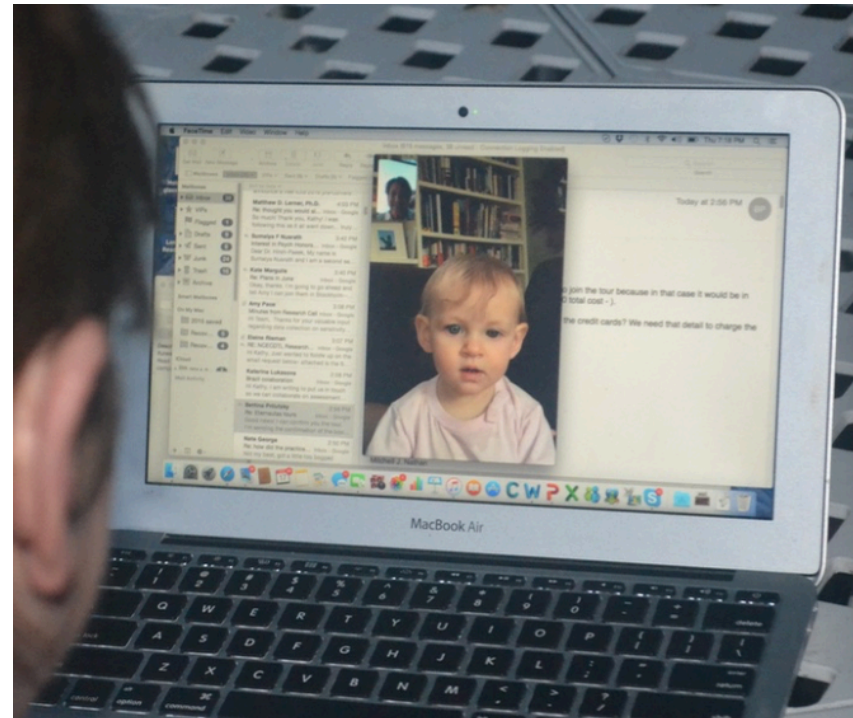
-in which what the adult says and does is **CONTINGENT on the child's focus**

Are the interactions that fuel language growth

And likely grow attention and the ability to engage at school



Our video chat study examined Quality as contingent interaction by looking at language learning in video chats



Roseberry, S., Hirsh-Pasek, K., & Golinkoff, R.M. (2013) Skype me! Socially contingent interactions help toddlers learn language. *Child Development*

If contingent responding matters, then we would expect children to learn new words from live and Skype conversations?

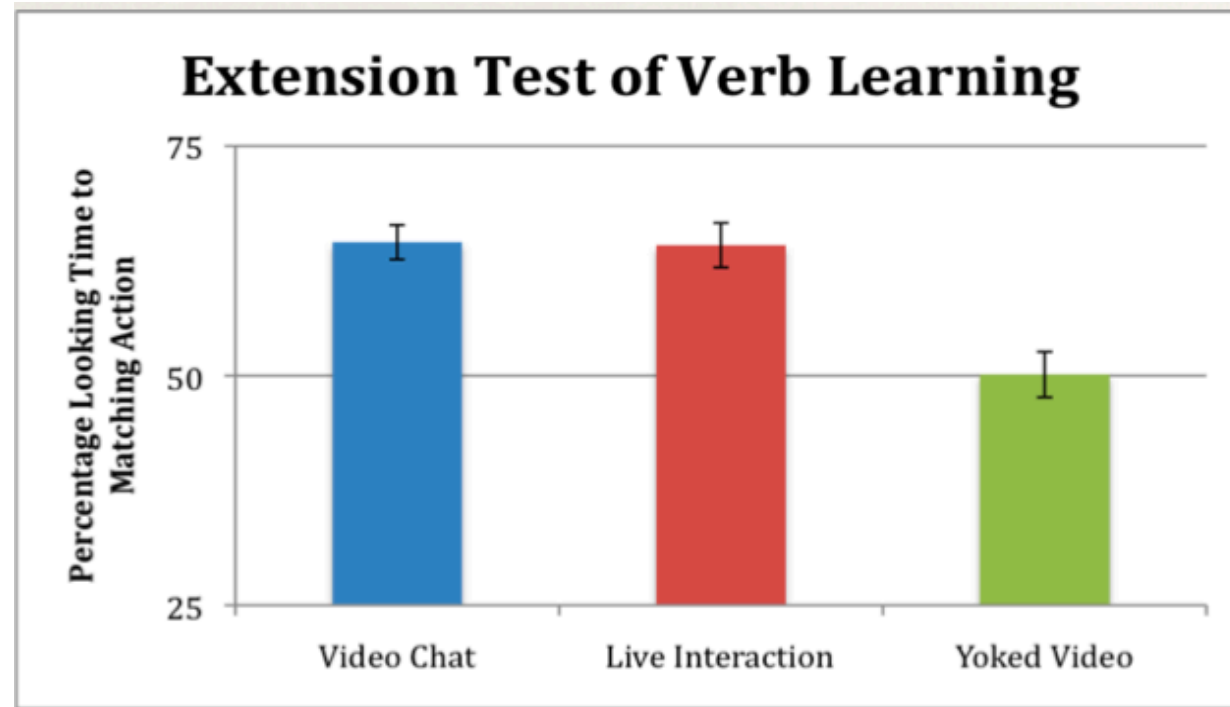


And less from televised conversations

Indeed, children learn just as well in video chats as they do in live interaction! Contingency matters!



Sarah
Roseberry



Roseberry, S., Hirsh-Pasek, K., & Golinkoff, R.M. (2014) Skype me! Socially contingent interactions help toddlers learn language. *Child Development*

Social Contingency – temporal and meaningful – is preserved in video chats....

- But what happens if we disrupt the contingency?
- Random cell phone calls and text messages disrupt contingent conversation!



**Do these interruptions derail
children's word learning?**

To test this question, we

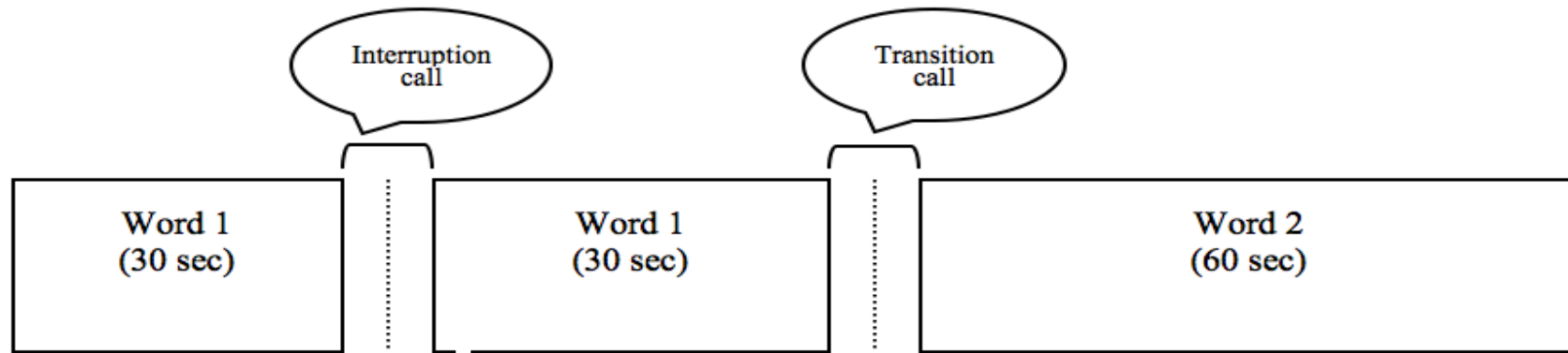
-Asked Moms to teach two novel verbs

- the same words as in Roseberry Skype study

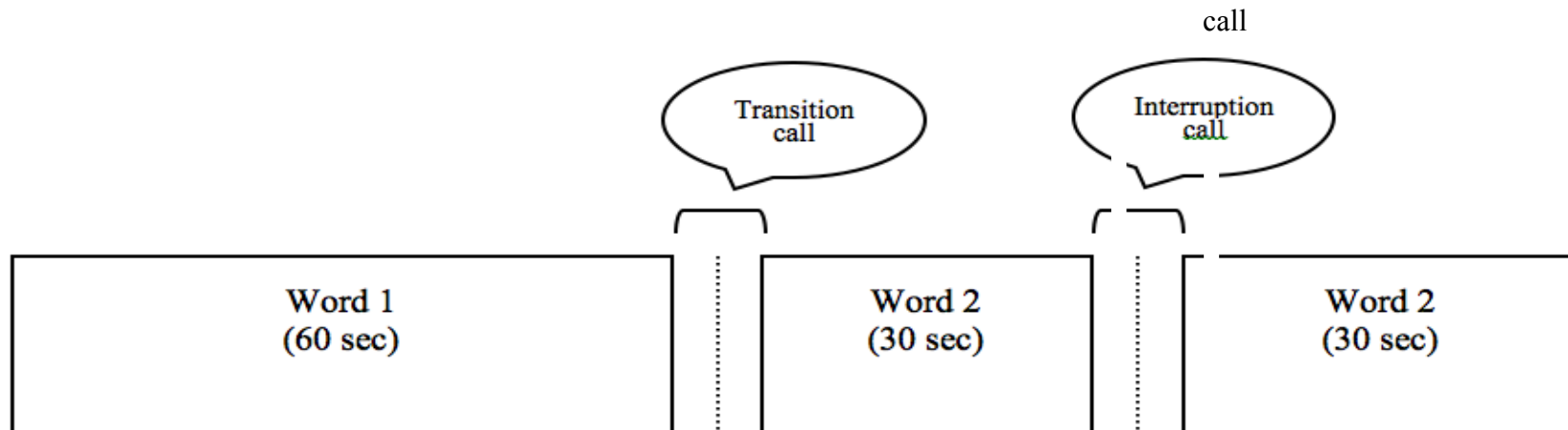
-And in a within subject design, they taught the two words to their children

Method: Design Overview

In one condition mom received a phone call in the middle of the 1st word



In the other condition, mom received a phone call during the second 2nd word



N = 38 dyads ($M_{\text{child}} = 27.2$ months)

Word learning assessed via Intermodal Preferential Looking Paradigm

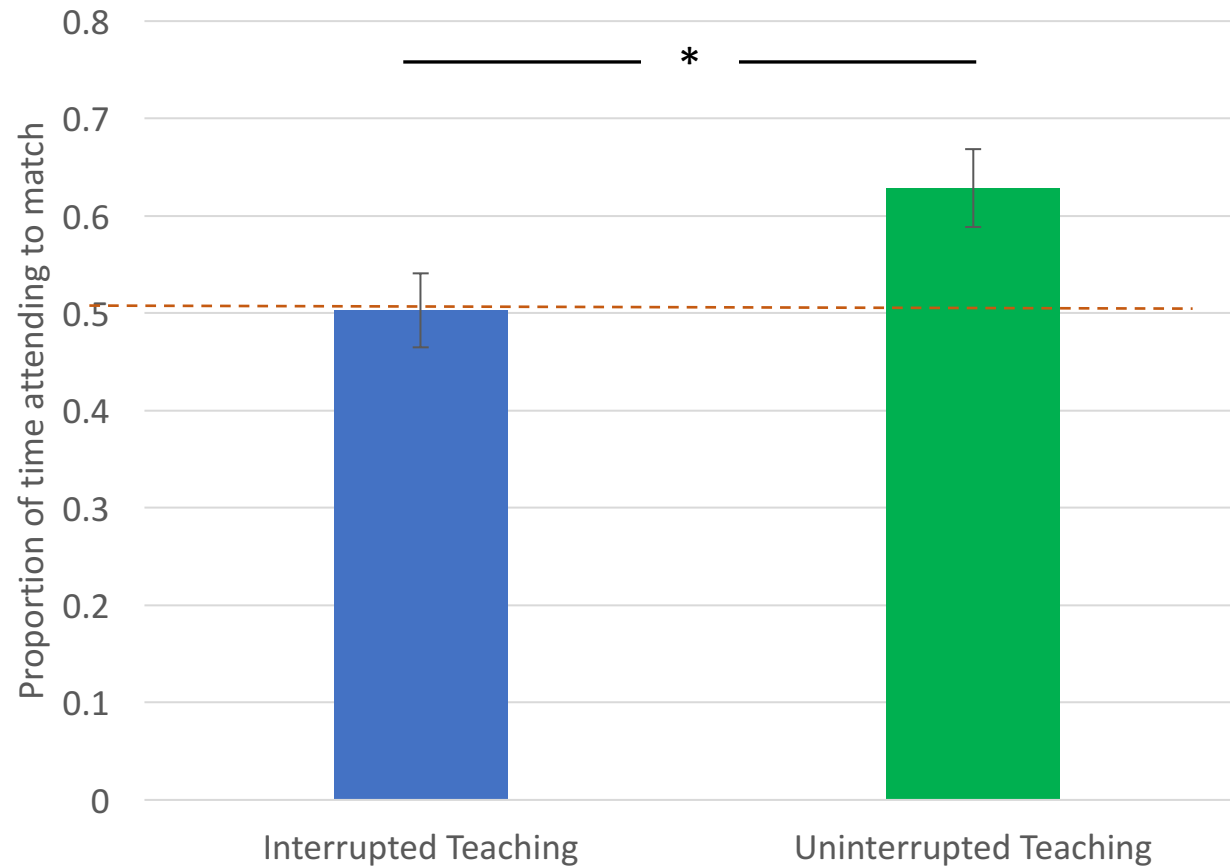
Find blicking!



Do interruptions affect word learning?



Jessa Reed



Significantly longer looking to target *only* when the teaching was **not interrupted**, $F(1, 34) = 5.96, p = 0.02$.

The interruption



Contingency matters for language learning!



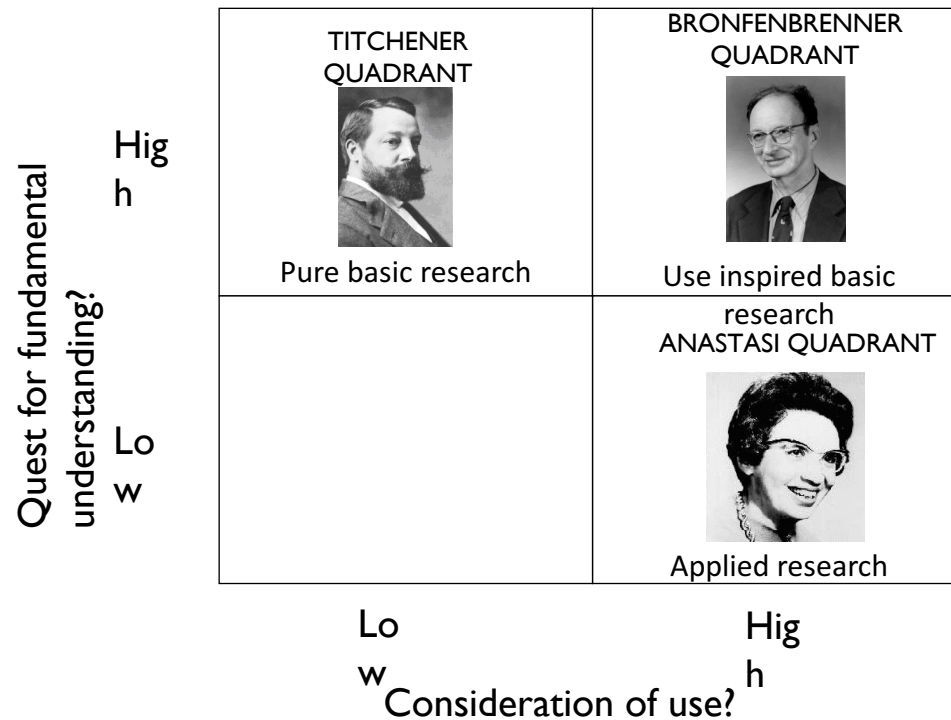
- And new data by Romeo et al. (2018) suggests that contingent interactions (but not the quantity of interactions) actually changes

We have established in the basic science

- That contingency is a key “quality” ingredient for language learning.



But can we use what we learned to raise language levels in teachers and parents of very young children?



The Duet Project did just that

- In a series of 5 animated video clips presented to Early Head Start Teachers and Parents (through home visitors), we used the science to create an intervention designed to....



1. Foster Awareness/Knowledge
2. Empower Caregivers
3. Increase Quality/Quantity of Interactions
4. Improve Outcomes – Language and School Readiness

This community based participatory research was conducted with our community collaborators at



With Alper, Luo, Adamson, Bakeman, Owen, Pace, Masek, Paterson, Mogul, Yu

Duet Project

Very preliminary findings

- **Study 1:** A **very low** income sample (27/41 earning less than 25K annually) with **very low** numbers (N= 15 control, 9 intervention) showed a 5.8 point increase in the Preschool Language Scale for those in the Experimental Group vs the Business- as-Usual Control Group ($p < .01$) after only 7 weeks of intervention once a week. Promising.
- **Study 2:** 12 Early Head Start teachers from 6 classrooms (N= 7 experimental, 5 Control). Experimental teachers maintained hi language use in classrooms. Control teachers did not and actually decrease language use in their classrooms.

We also came to understand that the measures available for looking at language outcomes did not reflect the latest science so we came up with our own for the 3 to 6 year old set.



Reflecting the science of the field we tested over 600 children around the country who varied by SES and language (English, bilingual English Spanish) on multiple categories

	PRODUCT	PROCESS
VOCAB	KNOWN NOUNS	
	KNOWN VERBS	FAST MAPPING NOUNS
	PREPOSITIONS	FAST MAPPING ADJECTIVES
	CLAUSAL CONNECTORS (e.g., <i>after</i>)	
GRAMMAR	WH-QUESTIONS	
	PAST AUXILIARY AND COPULA (e.g., "Where <i>was</i> the hat?")	SYNTACTIC BOOTSTRAPPING OF NOVEL VERBS
	PREPOSITIONAL PHRASES	CONVERTING ACTIVE TO PASSIVE (e.g., "Who got <i>koobed</i> ?")
	EMBEDDED CLAUSES	



Results to date suggest....

- It works! Showing beautiful progressions on language growth (N=673) for the monolingual test
- There are significant SES differences in both the products or outcomes of language learning (vocabulary and grammar) and in the processes of learning language (e.g., fast mapping).
- Vocabulary, syntax and process are linked across the course of development
- In the bilingual test (English/Spanish) Products are linked *within* but not *across* languages (N= 364) but Processes (how you learn) are linked across languages

We have shown then....

- That quality of the interaction matters as much if not more than quantity of words for language growth
- And that we can move from basic science to applied science (to considerations of use in Stoke's model)
 - In terms of using our science
 - In terms of measuring our outcomes



But if we really want to...

- reduce the 30-million word gap, we need to leap beyond Pasteur's quadrant and across the silos to include journalism and policy.



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Leaping from Pasteur's (and Bronfenbrenner's) quadrant raises additional challenges....

- **WHEN** has the field amassed enough “gold standard” data to share it with the public?
- **HOW** can we best share the body of evidence in ways that protect the integrity of the science while informing practice?



On WHEN to share gold standard findings....

We are often reticent to put our findings into the marketplace of ideas. But we actually know a lot based on strong bodies of data that **can** inform the public.

For example, we suggested principles that can be derived across a number of areas that enjoy general consensus.

The collage consists of three overlapping images:

- Journal Cover:** The cover of "Psychological Science in the Public Interest" features a blue background with a brain scan image. The title is in white and yellow text. It lists the editor Elaine F. Walker and several members of the editorial board.
- Research Paper:** A page from "DEVELOPMENTAL NEUROPSYCHOLOGY" (Volume 39, Number 5) titled "Six Principles of Language Development: Implications for Second Language Learners". The authors listed are Haruka Konishi, Junko Kanero, Max R. Freeman, Roxelyn and Richard Pepper, Roberta Michnick Golinkoff, and Kathy Hirsh-Pasek. The paper is published by Routledge/Taylor & Francis Group.
- Curriculum Framework:** The cover of the "California Preschool Curriculum Framework, Volume 1". It has a yellow background with colorful icons representing various educational themes like a globe, a play button, and a pencil.

Perhaps it is time to derive working principles in a number of areas

On HOW to share our wares:

Creating “edible science” that is accessible, digestible and usable

- Through dissemination of **information**
- Through dissemination of **experiences**
 - A new way to share the science of learning



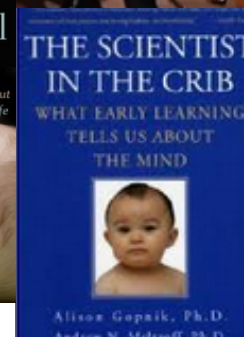
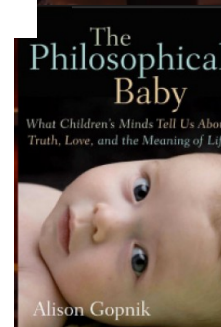
On disseminating information

The Bad News: Dissemination \neq publishing a journal article!
Estimated: article read by 17 people (King et al. (2006) suggests the more optimistic numbers for the journal *Pediatrics*)

The Other Bad News: Gatekeepers are gone. In the olden days, if you had a new finding, the news would cover the story.

Journalists help us disseminate in traditional ways and we can join them through

- Blogs, TED talks, tweets, books and a host of other outlets that portray our psychological findings.
- How do we ensure that properly nuanced findings reach this audience and move above the “noise?”
- And what is our responsibility to work with journalists to get the information to the public?



Collaborating with journalists and understanding how our jobs interrelate is a good thing, not a bad thing!

We are also trying a new way to share the science by disseminating experiences

Tell me and I forget; teach me and I may remember; involve me and I will learn

Confucius



Our newest adventure in “edible science” that is accessible, digestible and usable!

In collaboration with Brenna Hassinger-Das, Andres Bustemante, Molly Schleisinger and

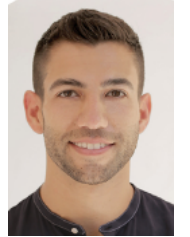


The idea?

- To marry the learning sciences with architectural design in public spaces in ways that create playful learning opportunities for families and children
- To naturally increase the quality of the caregiver-child (2-gen) interaction in ways that sparks cognitive and social development through play!

Indulge us with a video of one of these projects to make our point.
Introducing

URBAN THINK SCAPE
TRANSFORMING CITYSCAPES INTO
OPPORTUNITIES FOR PLAYFUL LEARNING



- <https://developingchild.harvard.edu/innovation-application/innovation-in-action/urban-thinkscape/>

Funding by:



Hassinger-Das, Bustamante, Hirsh-Pasek & Golinkoff,
(submitted), Hassinger-Das et al. in prep

Example 2: The Ultimate Block Party

- 28 science inspired activities in Central Park, NY in 2010
- Over 10 million people reached; 50,000 at event itself!
- Results showed increase in parents' attitudes to the play-learning connection, which is a vital component in public awareness. (Grob, Schleisinger, Hirsh-Pasek & Golinkoff, 2017).



Example 3: The Supermarket Study

Ridge, Ilgaz, Weisberg, Hirsh-Pasek & Golinkoff (i2015)

- Can the introduction of signs in a supermarket increase caregiver child language interactions?
- Signs up and signs down in middle and low income area supermarkets
- Results show a 33% increase in caregiver - child language when the signs were up in low income neighborhoods.





Example 4 Parkopolis

- The Human Sized Board Game designed to foster early mathematical skills and scientific reasoning. Pilot conducted in Switzerland in the summer of 2017



NEWPROFIT

Thanks to Fei Xu, Silvia Bunge and all of our mathematic colleagues!



- Pilot results showed increased interaction between caregivers and children and more mathematical talk.

Example 5: Playbrary

- Can we even change a library to enhance playful learning and conversation? You bet.
- Initial results show increased interaction among adults and kids that is filled with number and spatial language





This project is designed to use our science to create playful learning cities!

- With pilots now in Philadelphia, Seattle, Chicago, Tulsa and Johannesburg, South Africa
- We are testing a new kind of dissemination that can be used in public spaces and in "trapped spaces" like waiting rooms, supermarkets, laundromats, etc. Places where people wait and where we might increase the contingent conversations in ways that reduce the achievement gap
- All through playful learning that speaks to how families use the 80% of their child's waking time when she is not in school or care.



These projects allow us to potentially

- reduce the 30 million word gap, while we leap beyond Pasteur's quadrant and cross the silos to include journalism and policy.



In sum, Basic science is key to our mission

- So too is moving across the silos to share the products of our findings with those who can responsibly use the information we provide.
- In this talk we offered language learning and playful learning as examples of where we know enough to enact those changes in our dissemination and in public spaces.

In short, we can do basic and applied research that actually reaches and impacts people!

- By living in Pasteur's Quadrant – understanding that basic and applied research CAN live peacefully together
- By busting the silos that render our work narrow or misinterpreted.
- And by challenging ourselves to work together to bring Developmental Science into the Real World





Isn't it time for all of us...

- To live in Pasteur's Quadrant and Beyond
- To break down the haloed silos that separate scientists from journalists, policy makers, practitioners and entertainers?
- And to loudly share what we know about how to help all children thrive

Thanks to....

- The families and children who participated in our research
- The many organizations that have supported our research over the years
- And Debra and Stan Lefkowitz for supporting our work for the last 10 years; and the Unidel Foundation



NEWPROFIT



Thanks my fabulous collaborator Roberta M. Golinkoff and our fabulous labs!

Roberta Michnick Golinkoff



- *The Temple Infant and Child Lab*



- *The Child's Play, Learning, and Development Lab at the University of Delaware*

