



Online data collection for developmental research



Kim Scott | Thesis defense | September 28, 2017

Committee: Laura Schulz | Rebecca Saxe | Liz Spelke | Josh Tenebaum





Online data collection for developmental research

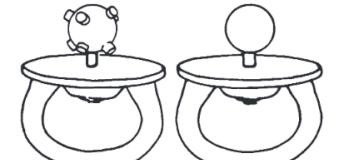
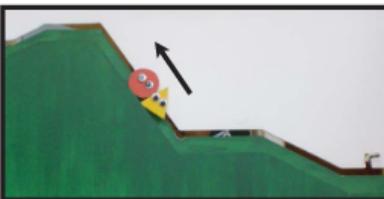


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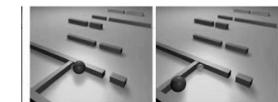
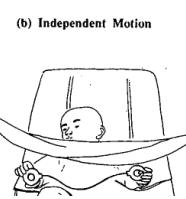
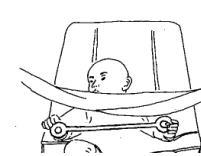
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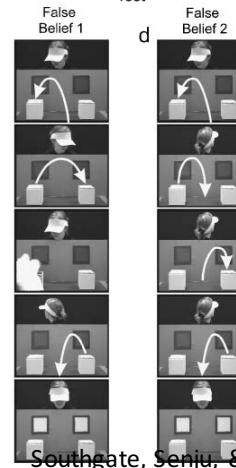
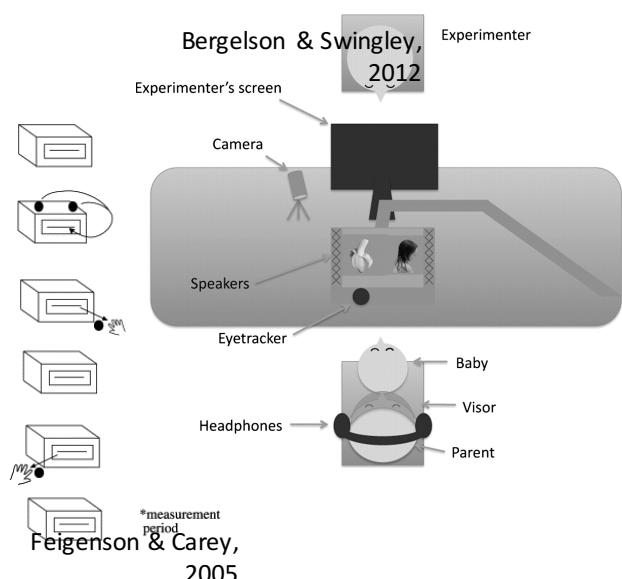
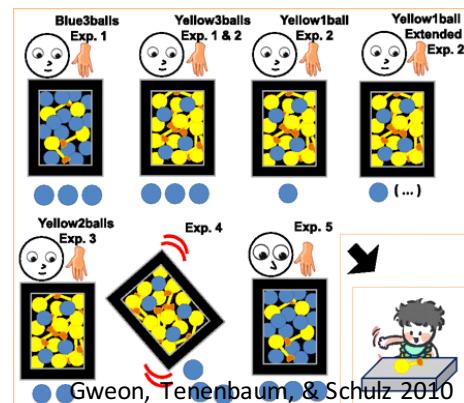
Practical challenges for developmental research: posing questions so babies can answer



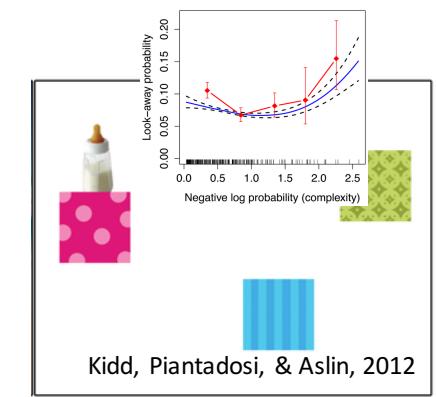
(a) Rigid Motion
Strelak & Spelke, 1988



Southgate & Csibra, 2009



Southgate, Senju, & Csibra, 2007



Kidd, Piantadosi, & Aslin, 2012

Practical challenges of developmental research: getting kids into the lab

- Takes a lot of time to get kids into the lab
 - Small sample sizes
 - Large effects, few conditions
- Even harder to bring them back!
- Recruiting special populations locally
- Kids behave differently in the lab
- Kids who come in aren't representative
- Socially-transmitted methods

<https://www.mass.gov/how-to/order-a-birth-marriage-or-death-certificate>

Access to records of births to unwed parents is restricted to the:

- Child
- Parents
- Father not listed on the record (this requires documentation supporting paternity)
- Legal guardian (this requires documentation supporting guardianship)
- Legal representative (this requires documentation supporting representation)

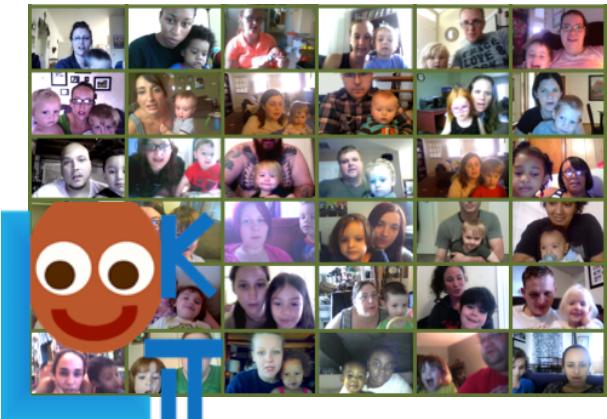
Outline

Why move online?

- Practical challenges in testing kids
- Illustration: looking for split-brain babies
- Advantages of online testing

Adapting to the online environment

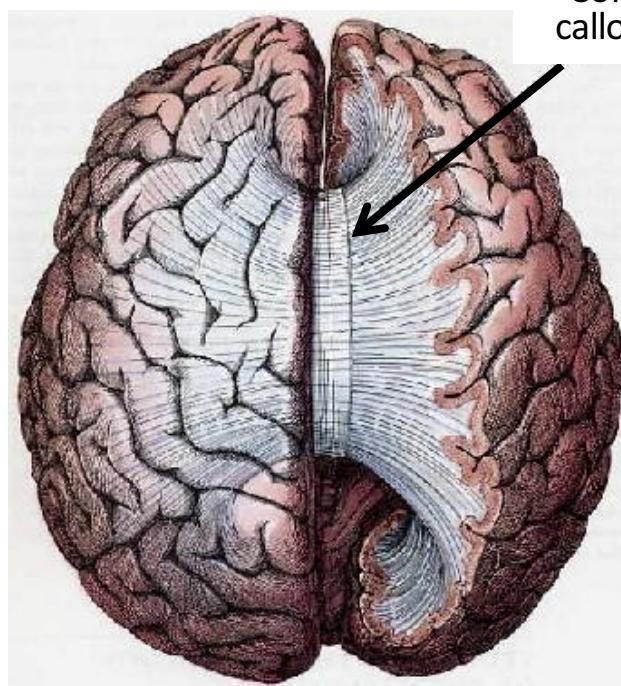
- Test study protocols & results
- Demographics
- Looking measures
- Verbal responses
- Yield



Current Lookit platform & next steps

- How it works
- Example use cases
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Case study: evaluating interhemispheric integration in infancy



Corpus
callosum

LEFT HEMISPHERE

SCRAPER

RIGHT HEMISPHERE

SKY



DRAWING

LEFT HEMISPHERE



RIGHT HEMISPHERE

FIRE

ARM



DRAWING



<http://hubel.med.harvard.edu/book/b34.htm>

Gazzaniga, M.S. The Split Brain Revisited. *Scientific American*, 2002.

Do we start as “little split-brains”?

functional deficits...

Up to age 7:

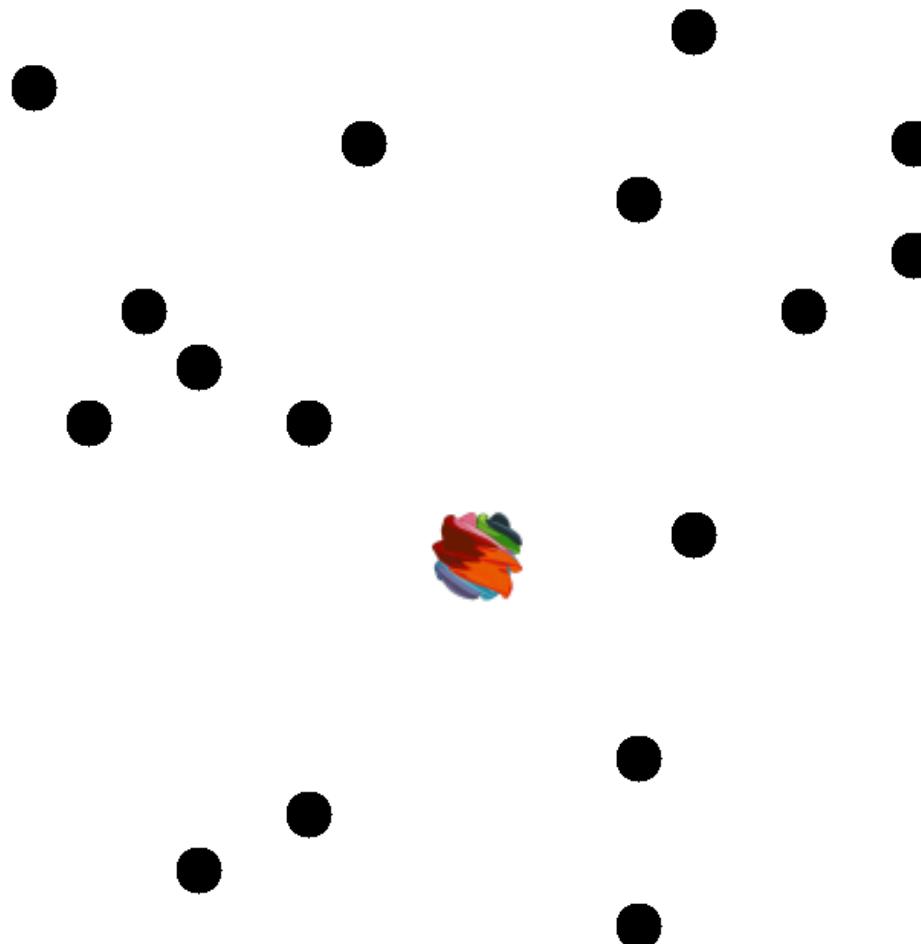
- Fail to transfer a manual task learning in one hemisphere to the other (Chicoine, Proteau, & Lassonde, 1992)

Up to 24 months:

- Fail to learn rules requiring comparison of shapes across the midline (Liegeois and de Schonen 1996; Liegeois et al. 2000)

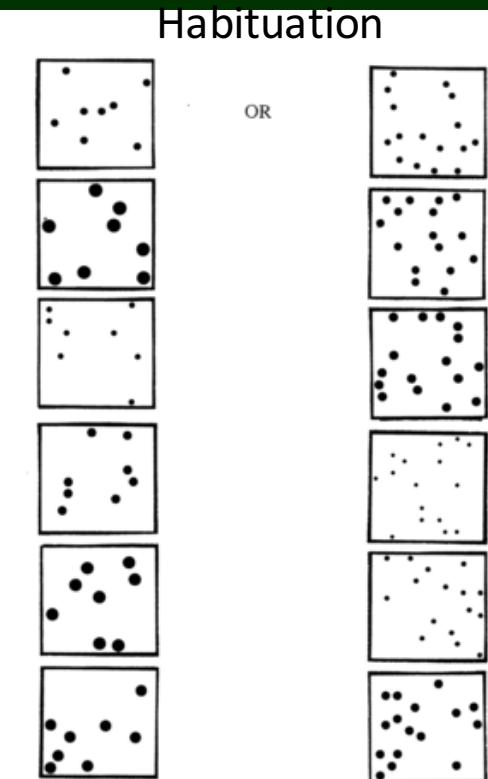
but what do
they
experience?

Do infants combine number across the midline?



Why use approximate number?

- Well-characterized, ratio-dependent
- Parallel detection, local adaptation (Burr & Ross 2008)
 - Intermediate representation with spatial receptive fields
- Babies can distinguish large approximate numbers

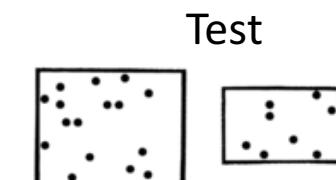


Birth: 1:3 (Izard et al., 2009)

6 months: 1:2 (Xu and Spelke, 2000)

10 months: 2:3 (Xu & Arriaga, 2007)

Adult: 7:8 (Huntley-Fenner 2001,
Mazzocco et al, 2011)







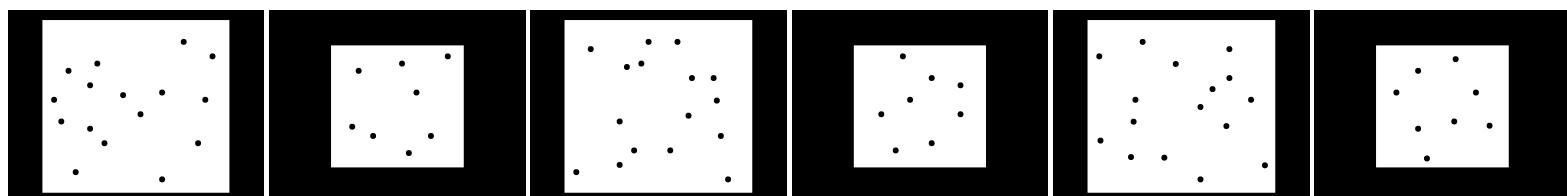
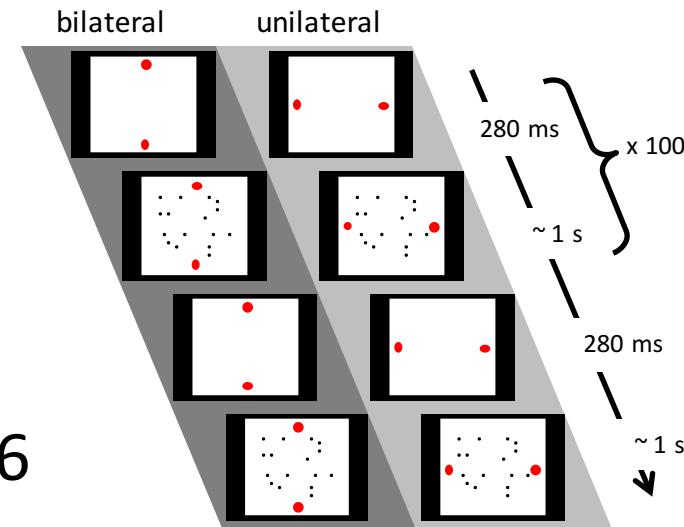
Do infants combine number across the midline?

1. Familiarization with 16 dots

“Split-brain” prediction:

- Unilateral: see 16 dots
- Bilateral: see 8 dots

- Test: Looking time to 8 and 16 dots. Measure until first continuous 1 second lookaway.

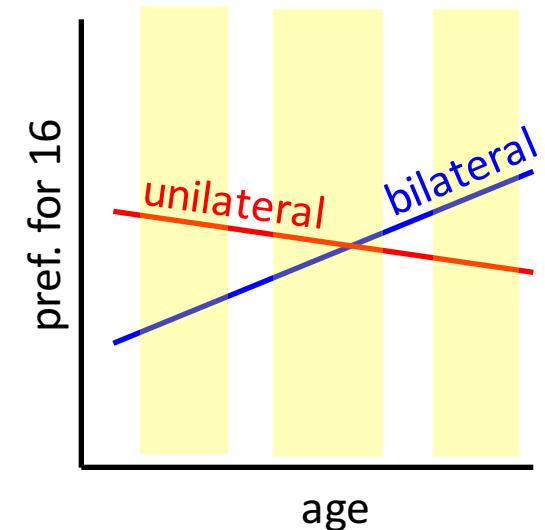


Looking time effect is hard to predict

Quality of the representation affects preference :

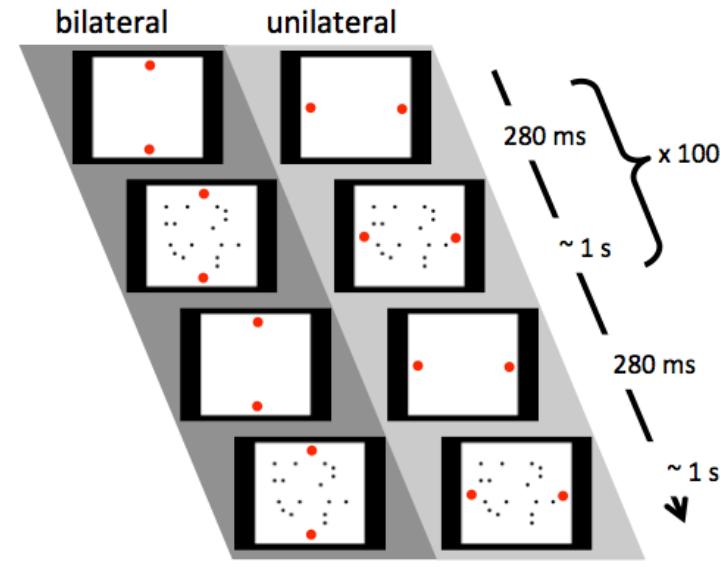
Familiarity preference	Novelty preference
Complex stimuli	Simpler stimuli
Fewer presentations	More presentations
Younger infants	Older infants

(Rose, Gottfried, Melloy-Carminar, & Bridger, 1982; Hunter, Ames, & Koopman, 1983; Richards, 1997; Roder, Bushnell, & Sasseville, 2000; Houston-Price & Nakai, 2004; Kidd, Piantadosi, & Aslin, 2012)



We check for **any** effect of condition or
condition * age on looking preferences.

Results: Babies say $16 + 0 \neq 8 + 8$



$$F(2, 731) = 3.82, p = 0.022$$

741 trials from 147 children, ages 10 – 19 months
additional 92 children excluded/fussed out

Exclude individual trials:

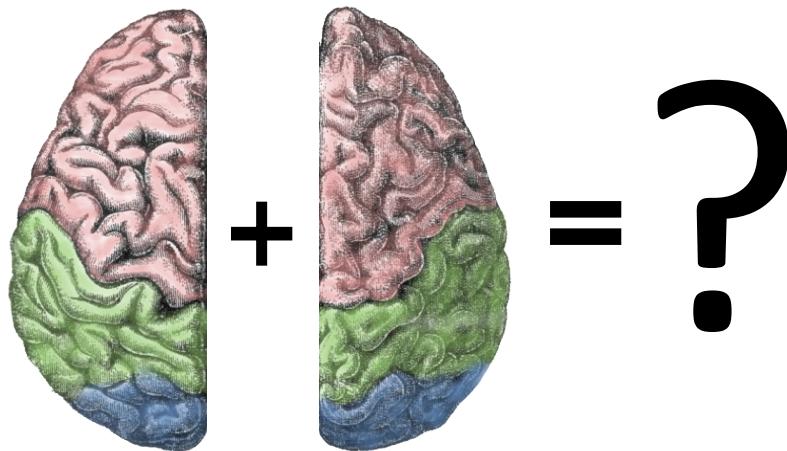
- No valid lookaway
- Looking time < 1 s
- Child is fussy during lookaway
- Parent talks to child during measurement

Hierarchical linear model on individual trial looking times:

LogLookingTime ~ Age * Bilateral * Stimulus16 + (TrialOrder - 1 | Child) + (1 | Child)

predictor	B	SE_B	t(731)	p
(Intercept)	0.64	0.03	24.16	0.000
Age (months)	0.02	0.01	1.16	0.248
Stimulus16	0.03	0.03	0.98	0.327
Bilateral	-0.01	0.04	-0.27	0.791
Age : Stimulus16	0.00	0.01	0.05	0.960
Age : Bilateral	0.00	0.02	-0.02	0.981
Stimulus16 : Bilateral	0.12	0.04	2.76	0.006
<u>Age : Stimulus16 : Bilateral</u>	<u>0.00</u>	<u>0.02</u>	<u>-0.07</u>	<u>0.944</u>

Next questions (in an ideal world)



- Is this really a novelty preference?
 - Compare 16 + 0 vs. 8 + 0
 - Do infants also show a preference for novel numerosities in the opposite direction (4 and 16 after seeing 8, 8 and 32 after seeing 16?)
 - Does more familiarization lead to stronger preference?
- By what age (and how fast) does integration occur?
 - What's represented in the process?
- Is the timing of integration linked across domains?
 - Comparing shapes, colors across hemifields
 - Use of language, other lateralized abilities

Collecting *these* data took 3 full years.

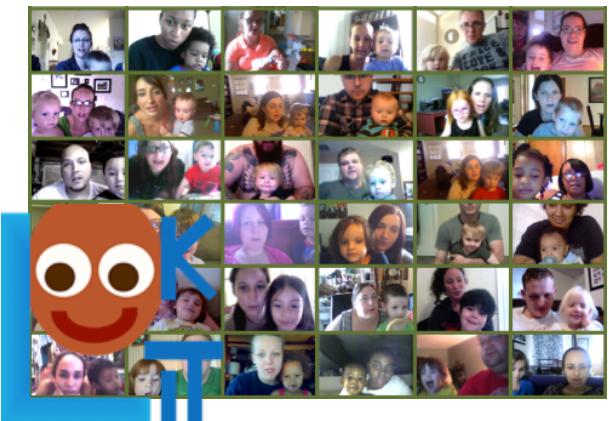
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Current Lookit platform & next steps

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Why put studies online?

Reducing practical constraints on the questions we can ask...

- Larger sample sizes
- Longitudinal designs
- Special populations
- Behavior at home
- More representative samples

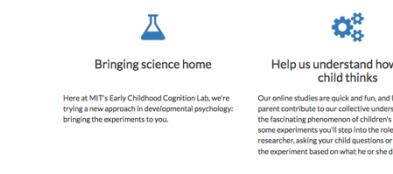
Designing for:

- Accountability and replicability
- Science outreach (“citizen science”)
- Bringing together computational, clinical, cognitive, educational approaches



How it works: <https://lookit.mit.edu>

- Parents register, complete child profiles, find and do studies in the web browser
 - Webcam video recording
 - No scheduling
 - No software download
- Researchers define & control studies from an 'Experimenter' platform
- Prototype site: ad-hoc study code, no experimenter interface
- Recruitment: early test studies used Mechanical Turk, currently volunteers



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7         "video-preview",
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30            ...
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32    ]
33}
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Experiments / Your baby's physician / Edit

Experiment editor

Firebox

Experimenter

Experiments

Project Settings

Create users

Logout

Discard changes Save Try experiment

"I have read and understand the above information. I am this child's legal guardian and we both agree to participate in this study."

Outline

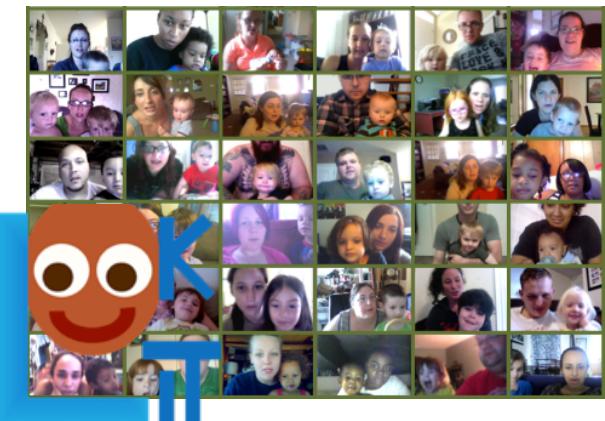
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Test studies on Lookit prototype

Intuitive probability

10 minutes



Age range: 11-18 months.

Infants have rich expectations about how the world works. Can they estimate how probable a completely new event is? In this study your child will see some 'lottery drawings' of shapes, for instance a yellow ball coming out of a mostly-blue container. We're interested in which outcomes he or she finds most surprising.

Learning new verbs

10 minutes



Age range: 2-year-olds (24-36 months).

In this experiment, your child will watch several clips of conversations that introduce a new verb, followed by side-by-side movies of experimenters pantomiming two different verbs. We are interested in how children use information from the conversations to figure out which action matches the new verb.

Learning from others

10 minutes



What do you think it's called?

Age range: 3-, 4-, and 5-year-olds.

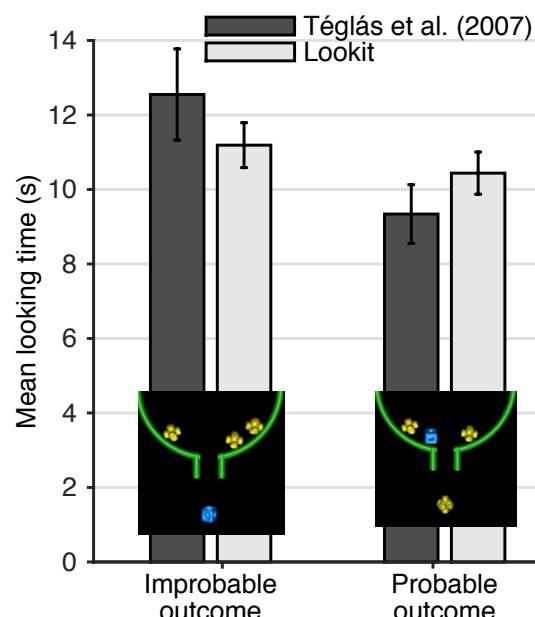
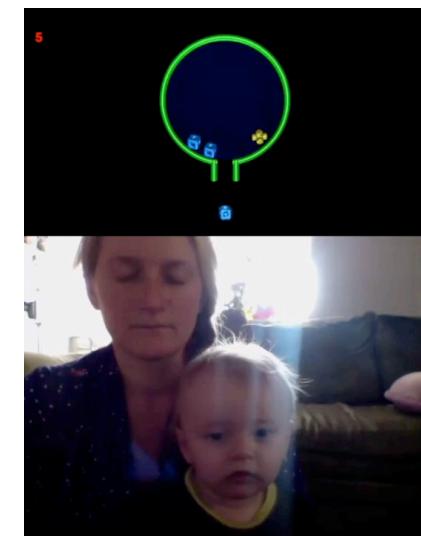
How do children filter through many sources of information to learn robustly from other people? In this study two women will name familiar objects with varying accuracy. We're interested in how your child chooses which one to trust when the same women name new objects as well.

Scott, K., & Schulz, L. (2017). Lookit (Part 1): A new online platform for developmental research. *Open Mind*.

Scott, K., Chu, J., & Schulz, L. (2017). Lookit (Part 2): Assessing the viability of online developmental research, results from three case studies. *Open Mind*.

Study 1: One-shot probability

- Replicating Téglás et al. (2007): 12-month-olds look longer when the minority object exits a lottery container
- Four warmup (2:2) and four test (3:1) trials
- Parents close their eyes for the outcomes
- Measure **looking time** until first continuous 1 s lookaway on each trial.
- **49 children included, 11-18 months.**

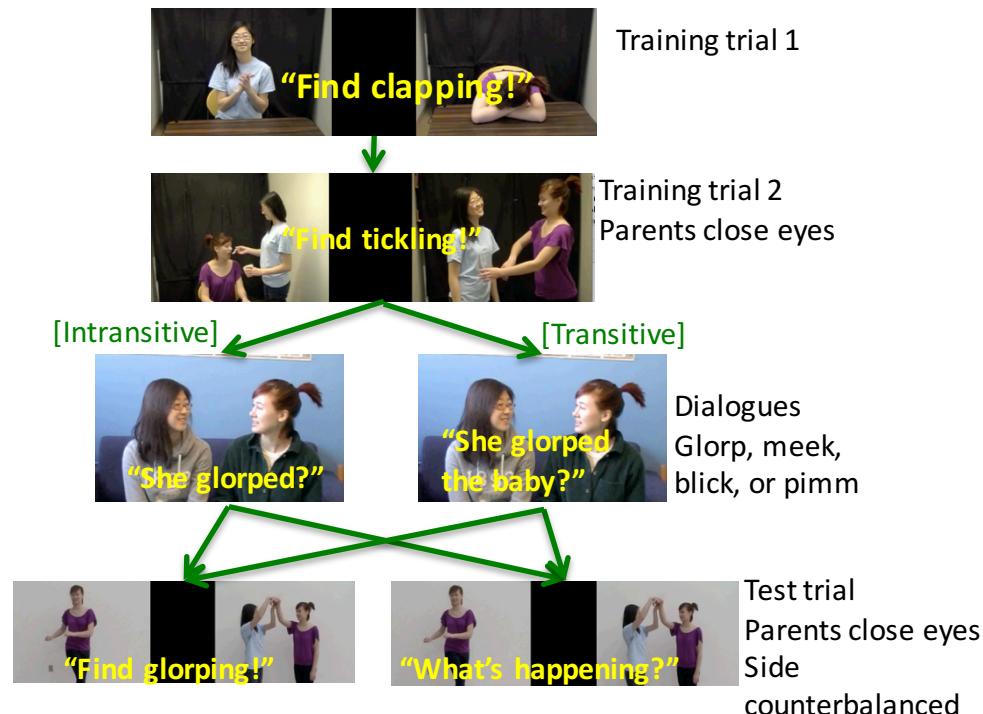


	B	SE B	p	95% CI
Intercept	13.08	0.94		[11.23, 14.94]
Improbable outcome	0.62	0.66	0.35	[-0.68, 1.93]
Trial order (1 - 4)	-0.86	0.29	0.003	[-1.44, -0.29]

Difference in looking time, Téglás et al.: **3.21 s [0.36, 6.1]**
(replicated internally)

Study 2: Syntactic bootstrapping

- Replication of Yuan & Fisher (2009): 2-year-olds use combinatorial information about a new verb to interpret its meaning
- Those who heard a transitive verb introduced looked longer than those who heard an intransitive verb at two-participant videos when asked to “find blicking!”
- No effect of transitivity when asked “what’s happening?” instead

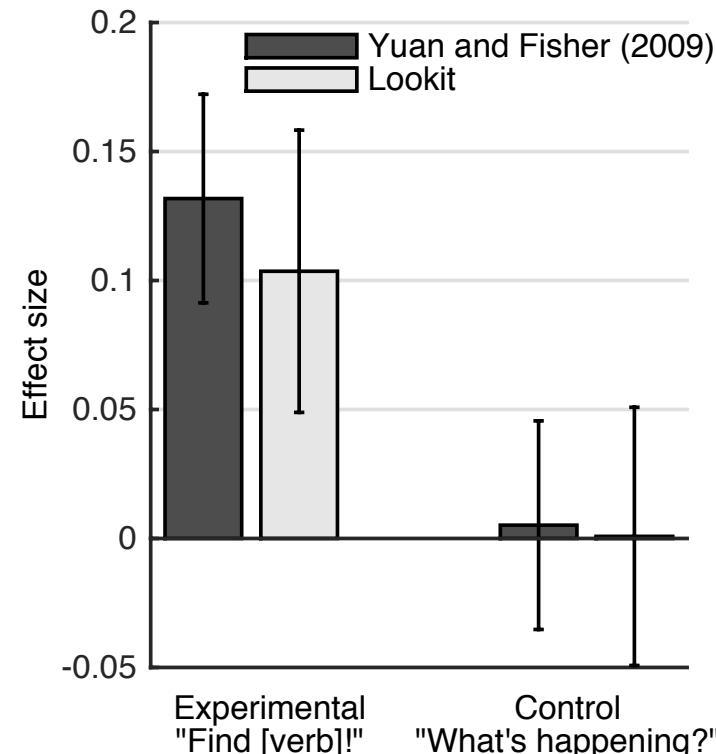


Study 2: Syntactic bootstrapping



Preferential looking, 67 toddlers (24-36 months)

How much does verb type affect action preference?



Fraction looking time to two-participant video
~ experimentalCondition * transitiveVerb + stimulusSet
Weighted by variance estimated from practice trials

Study 3: Trust in testimony

Replicating Pasquini et al. (2007)'s "trust in testimony" work: Preschoolers use past reliability of informants to identify who was more accurate and endorse her labels for novel objects.

- **Verbal responses**
- **148 preschoolers (3-4 years old) included**
- Informant accuracy conditions:
 - 100% vs. 0%
 - 100% vs. 25%
 - 75% vs. 0%
 - 75% vs. 25%

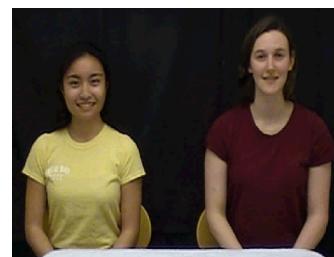
1. Familiar objects



x 4

Counterbalance who's more accurate and when incorrect answers happen

2. Explicit judgment

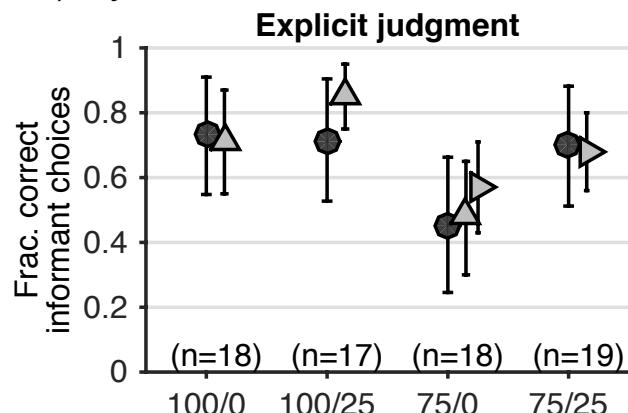


3. Novel objects



Study 3: Trust in testimony

a) 3-year-olds

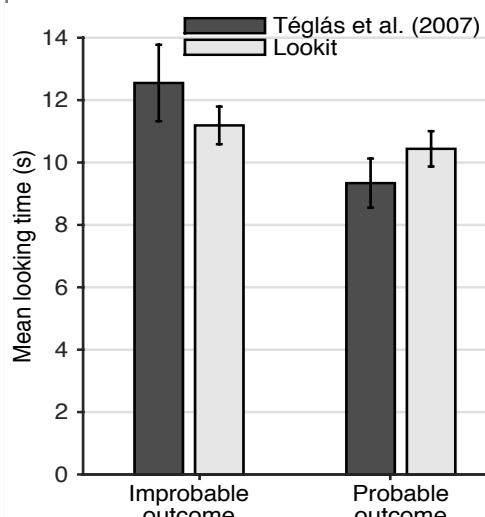


● Lookit
△ Pasquini et al. (2007), Exp 1
▽ Pasquini et al. (2007), Exp 2

Test study results

Oneshot probability: 12-month olds look longer at less probable events, even without prior experience

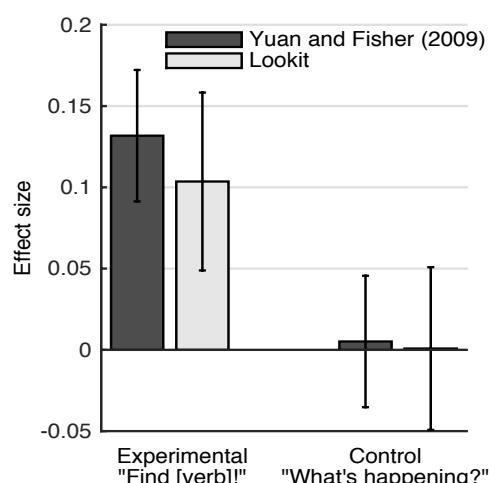
Looking time, 49 infants



Téglás, E., Girotto, V., Gonzalez, M., & Bonatti, L. L. (2007). Intuitions of probabilities shape expectations about the future at 12 months and beyond. *Proceedings of the National Academy of Sciences*, 104(48), 19156-19159.

Syntactic bootstrapping: 2-year-olds use combinatorial information about a new verb to interpret its meaning (semantic bootstrapping)

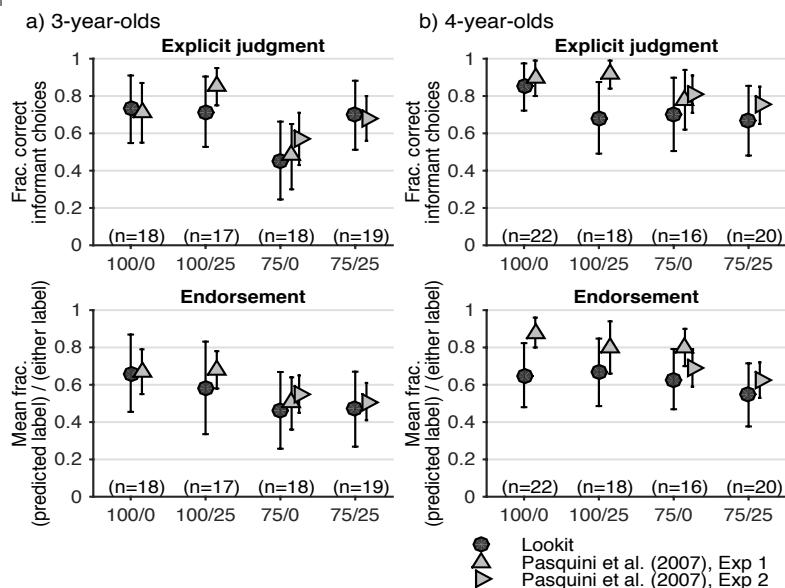
Preferential looking, 67 toddlers



Yuan, S., & Fisher, C. (2009). "Really? She blicked the baby?" Two-year-olds learn combinatorial facts about verbs by listening. *Psychological Science*, 20(5), 619-626.

Trust in testimony: Preschoolers use past reliability of informants to choose whose labels of novel objects to identify who was more accurate and endorse her labels

Verbal responses, 148 preschoolers



Pasquini, E. S., Corriveau, K. H., Koenig, M., & Harris, P. L. (2007). Preschoolers monitor the relative accuracy of informants. *Developmental psychology*, 43(5), 1216.

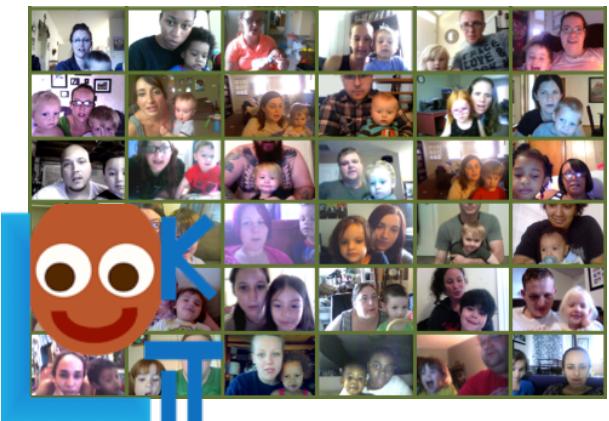
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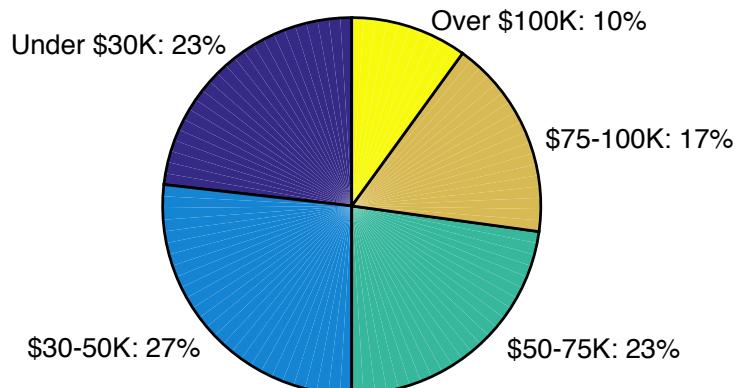


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Online participants are more diverse

Family income

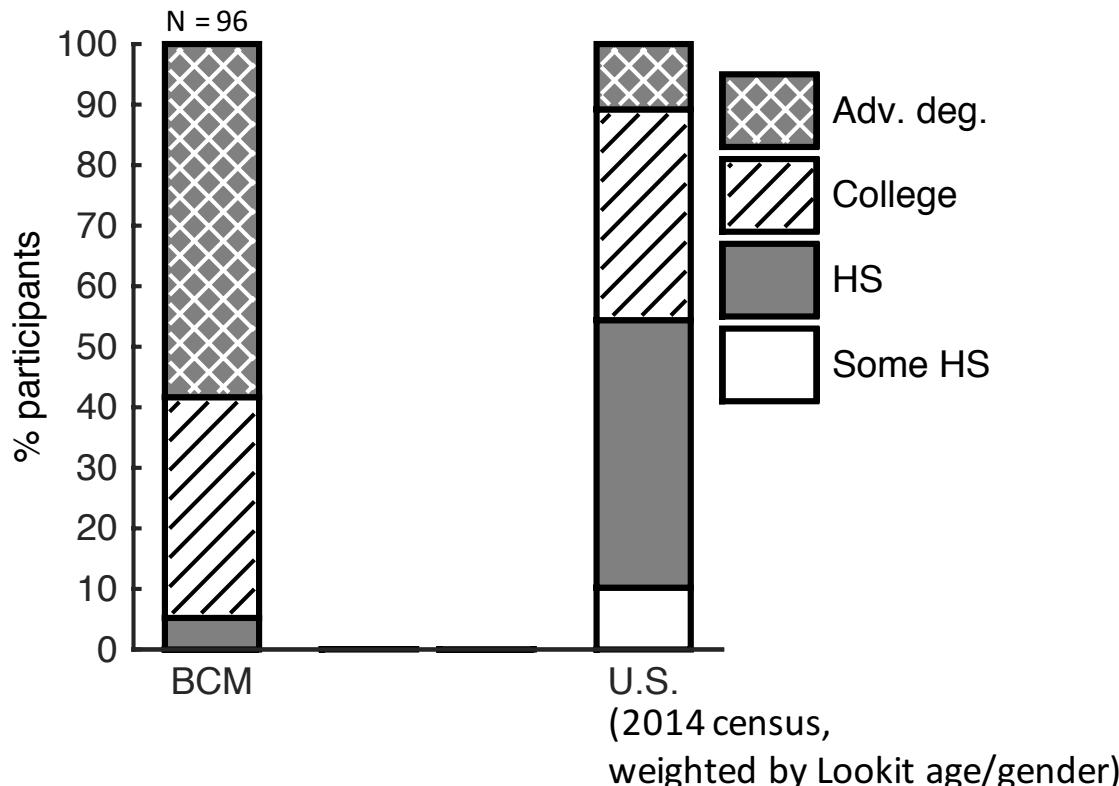


Race of child & Hispanic origin

	Lookit	US population
Hispanic	9.6	17.4
White	79.6	77.4
Black	7.1	13.2
Asian	1.6	5.4
American Indian, Alaska Native, Native Hawaiian, or Pacific Islander	0.4	1.4
2 or more races	11.3	2.5

- Based on 572 surveys (75% response rate) from families who gave valid consent to participate in at least one test study
- Almost all recruited from MTurk
- Languages:
 - 8% at least bilingual
 - 21 Languages represented: Arabic, ASL, Azerbaijani, Bengali, Chinese, Czech, French, German, Hindi, Hungarian, Japanese, Korean, Portuguese, Romanian, Russian, Spanish, Tagalog, Telugu, Turkish, Urdu, Vietnamese
- Still mostly moms (84%)

...and less over-educated



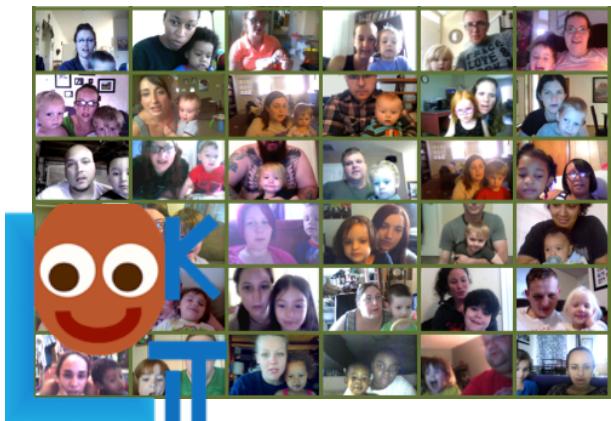
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Coding looking time works!



Looking time (looking vs. not)

blind coders agree 95% of the time (N = 63 children, SD = 6%),
mean absolute difference in LT
is 0.8 s (SD = 1 s)

Coding preferential looking works!



Looking time (looking vs. not)
blind coders agree 95% of the time (N = 63 children, SD = 6%),
mean absolute difference in LT is 0.8 s (SD = 1 s)



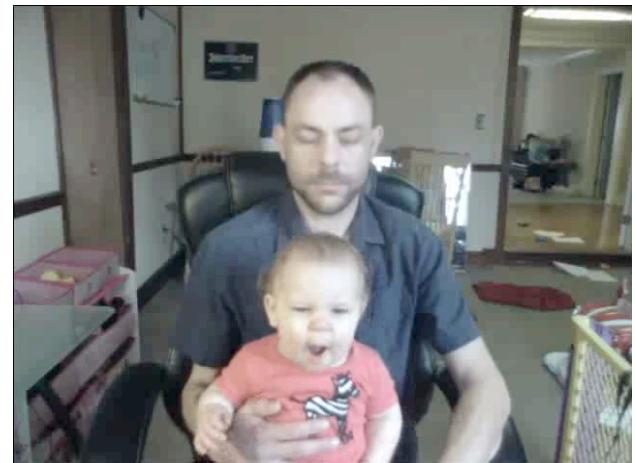
Preferential looking (right vs. left)

Blind coding done close to real-time; mean disparity between coder's judgments of looking time to left/right is 4% of trial length (SD = 2%, N = 140 children)



But what about data quality?

One of our postgraduate students kindly agreed to provide reliability coding for another postgraduate student, who had found null results in a visual habituation study. These two students had both been trained on lab procedures, including criteria for eliminating untestable infants. Despite this, their working definitions of excessive “fussiness” were apparently different, because as the reliability coder watched the videotapes she was surprised to see that a number of the infants completed their looking task while simultaneously squirming in their seats, making whining noises and in some cases overtly weeping.



For all looking studies,
two coders recorded for
each clip:
fussiness
distraction
parental interference,

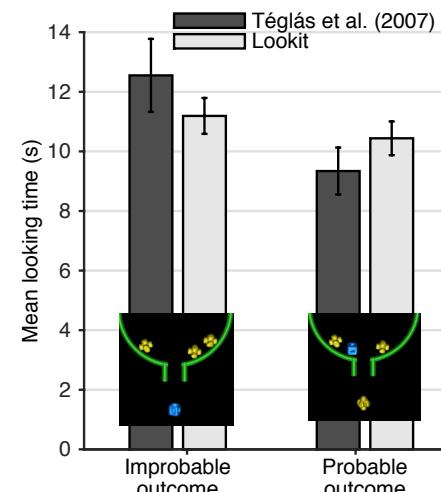
Slaughter, V., & Suddendorf, T. (2007). Participant loss due to “fussiness” in infant visual paradigms: A review of the last 20 years. *Infant Behavior and Development*, 30(3), 505-514.

Coders agree on “fuzzy” events

	Intuitive probability (113 infants)			Learning new verbs (141 toddlers)		
	Agreement	Cohen's κ	Frequency	Agreement	Cohen's κ	Frequency
Fussy (crying or trying to get out of parent's lap)	85%	0.55	13%	99%	0.42	1%
Actively distracted (lookaway caused by external event)	85%	0.40	10%	97%	0.37	2%
Parent's eyes open	98%	0.67	4%	97%	0.70	5%
Parent's eyes not visible	97%	0.35	4%	99%	0.91	7%
Parent peeks	90%	0.36	9%	90%	0.36	11%
Parent's eyes open briefly at very start of clip	77%	0.49	38%	93%	0.68	13%
Parent talks to child	98%	0.16	2%	95%	0.70	9%

Child attentiveness at home

Common concern: home is “noisier” than the lab...



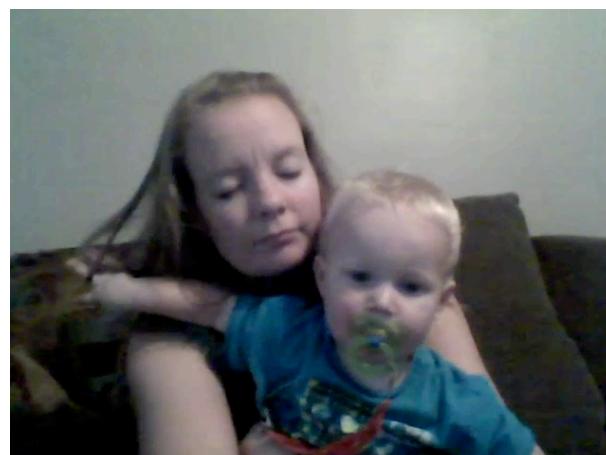
Indeed, relatively frequent distractions for LT measurements (10%)

BUT...

- Looking times similar to those found in lab (~10 s)
- Excellent attention (>80% looking) to dialogue videos during preferential looking study

Parents cooperate online

- Most parents report that they did keep their eyes closed (63%, 67%) or that they tried (28%, 25%).
 - "I always kept my eyes closed except for once when my child was moving the computer with his feet."
 - "yes, and she reprogrammed my laptop smashing keys."
 - "Looked when he said uh oh, just to make sure he wasn't talking about his siblings"
 - "Well, I did until my 6 year old came in unexpectedly. Sorry"
- But never peeking is hard (just like in the lab): 22% of parents peeked during at least one test trial



Adapting looking measures

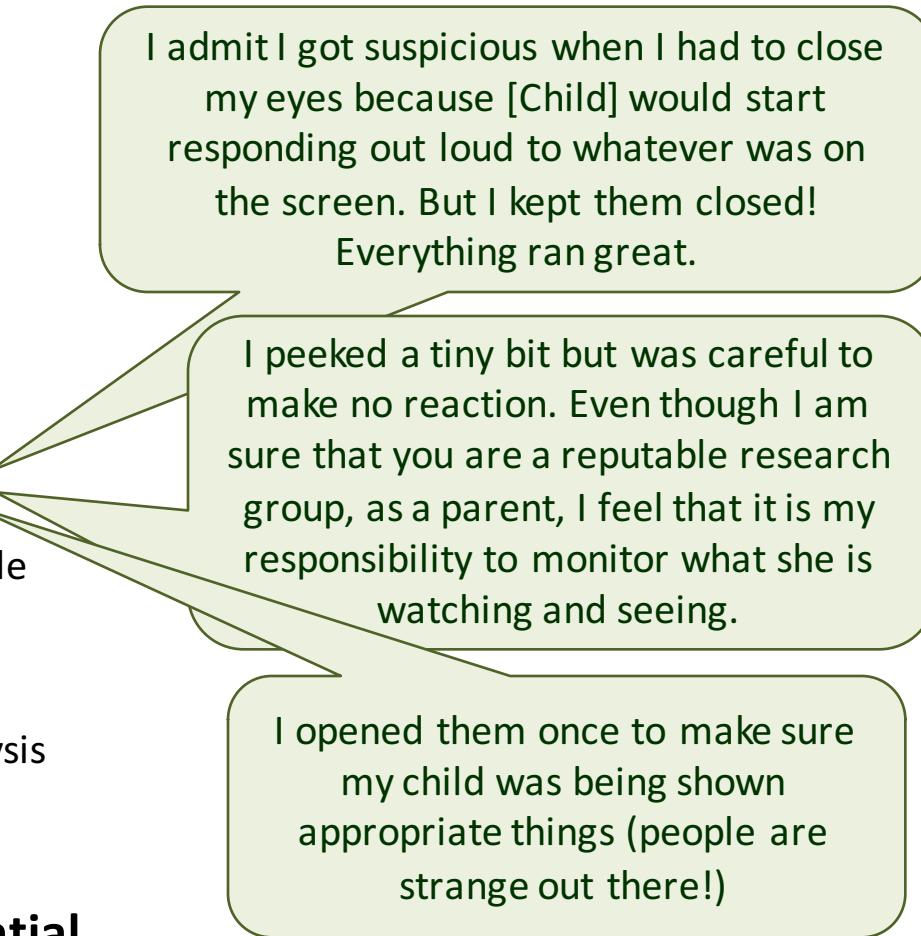
Advice – parent blinding:

- Have parents hold children looking over their shoulder, give practice trials if possible
- Keep parents in the loop: play audio to confirm everything's working
- Let parents see all the stimuli ahead of time

Advice – engagement:

- Use parents rather than recorded audio if possible
- Use methods robust to distractions
 - preferential looking over looking time
 - hierarchical linear models or Bayesian analysis to deal with missing trial

Can reliably code looking time & preferential looking from webcam!



I admit I got suspicious when I had to close my eyes because [Child] would start responding out loud to whatever was on the screen. But I kept them closed! Everything ran great.

I peeked a tiny bit but was careful to make no reaction. Even though I am sure that you are a reputable research group, as a parent, I feel that it is my responsibility to monitor what she is watching and seeing.

I opened them once to make sure my child was being shown appropriate things (people are strange out there!)

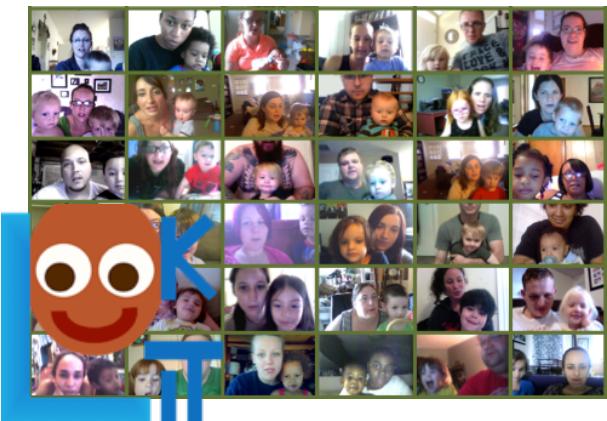
Outline

Why move online?

- Practical challenges in testing kids
- Illustration: looking for split-brain babies
- Advantages of online testing

Adapting to the online environment

- Test study protocols & results
- Demographics
- Looking measures
- Verbal responses
- Yield

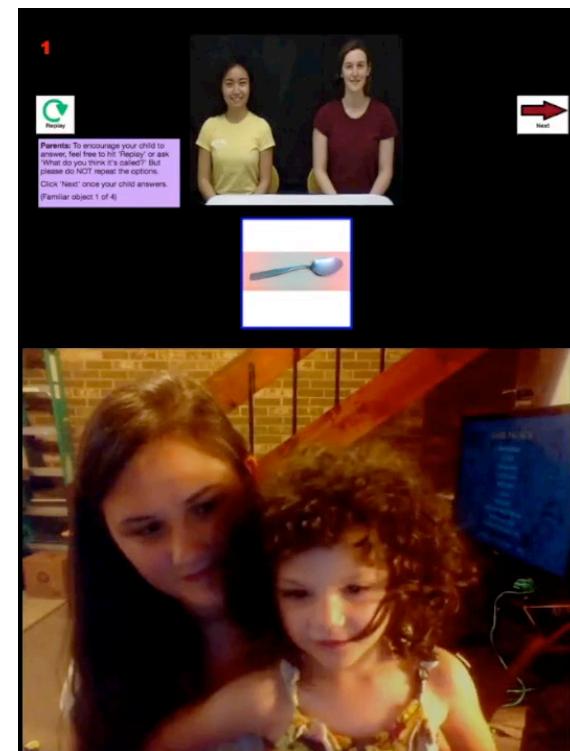


Current Lookit platform & next steps

- How it works
- Example use cases
- A vision for Lookit

Collecting verbal responses

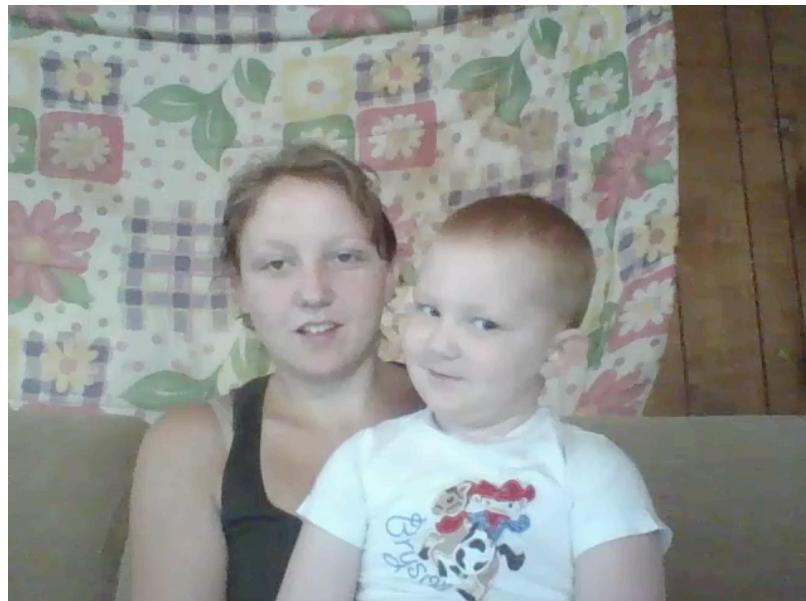
- Parent and child speech transcribed
- Parent interference and interaction types recorded
- Only use responses before any parent interference (8% of trials). Examples: child [parent]
 - What do you think, mom? [I want your answer, not what mommy thinks.] **Red**.
 - I don't know how to say those words. [Try it, which one are you trying to say? What do you think it is?] I don't know how to say those words. [Just try it, you're doing good. Try to pronounce it.] I can't, I can't though. [Okay. Do you want to listen to it again?] Yeah. [REPLAY.] A **toma**? [Then say it again...] A toma!



Verbal responses

Recorded questions asked to children, with parent instructions for prompting (234 preschoolers with usable video)

“More natural behavior” at home



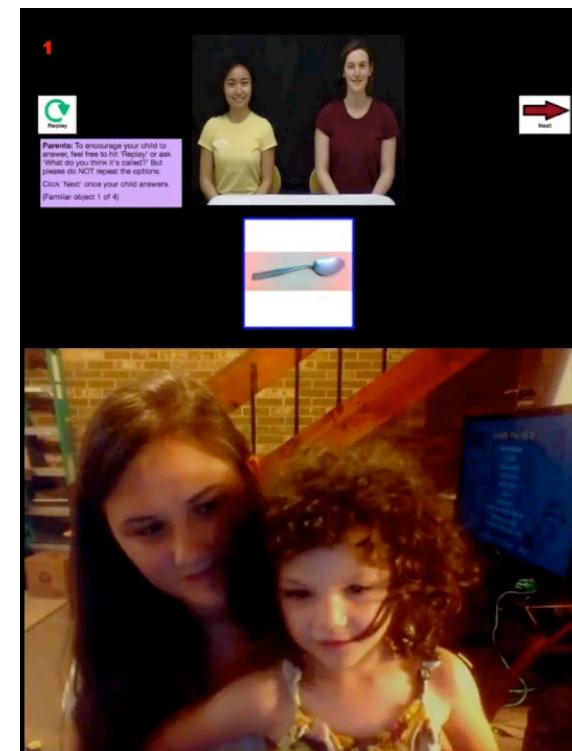
We rely on parents' help!

Adapting verbal response measures

Advice

- Encourage responses
 - Involve the parent where possible
 - Give computer-based contingent responses
- Show parents exactly what to do/what to avoid
 - Include video examples
 - Give practice trials before data is critical
- Design studies to be robust to non-responses
 - Many short, independent questions
 - Analysis to use whatever you get

Can collect verbal responses online!



Verbal responses

Recorded questions asked to children, with parent instructions for prompting (234 preschoolers with usable video)

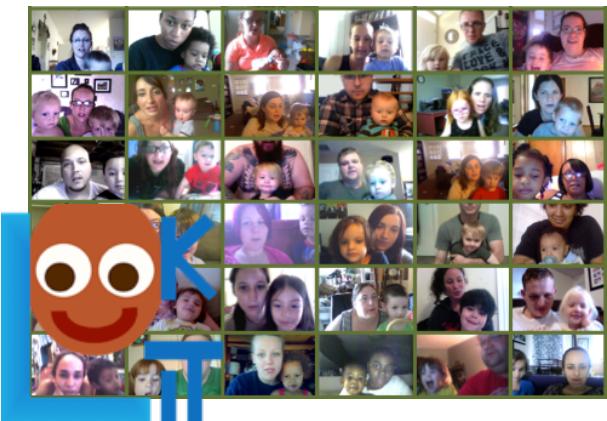
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Yield is lower online

Percentages	Looking time	Pref. looking	Verbal resp.	Total
Invalid consent	19	16	15	16
Out of age range	7	4	7	6
Unusable video	32	38	20	29
Video is okay...	42	43	59	49
<i>Actually included</i>	18	20	37	26
Total	100	100	100	100

50% no video
 15% incomplete
20% low framerate or too dark/blurry
1% eyes generally not visible on screen

- **Mostly** lower due to online-specific issues early in (or before) data collection

Exclusion rates	Looking time	Pref. looking	Verbal resp.
Lookit	56% (63/112)	52% (73/140)	37% (86/234)
Original lab study	50% (20/40)	12% (13/92)	6% (6/98)

- Time cost is **still** lower to collect data online

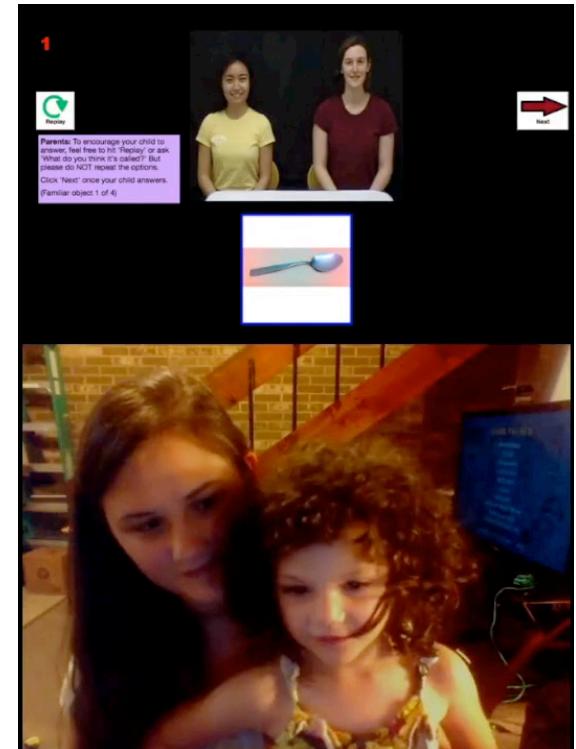
Data we can collect



Looking time (looking vs. not)
blind coders agree 95% of the time (N = 63 children, SD = 6%),
mean absolute difference in LT is 0.8 s (SD = 1 s)



Preferential looking (right vs. left)
Blind coding done close to real-time; mean disparity between coder's judgments of looking time to left/right is 4% of trial length (SD = 2%, N = 140 children)



Verbal responses

Recorded questions asked to children, with parent instructions for prompting (234 preschoolers with usable video)

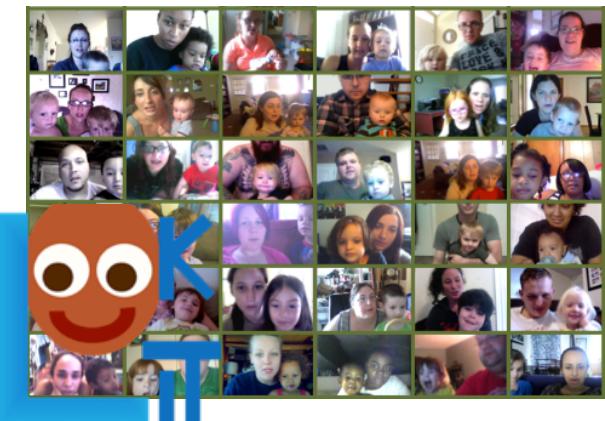
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Current Lookit platform & next steps



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Towards a multi-lab platform

Lookit

The Lookit website features a grid of four photos showing families with children. Below the grid, a banner reads "Lookit: the online child lab, A project of the MIT Early Childhood Cognition Lab". Buttons for "Participate in a Study" and "Learn More" are visible. The main content area includes sections for "Bringing science home", "Help us understand how your child thinks", and "Participate whenever and wherever". It also contains news articles and a sidebar with a "Log in or create an account" button.



Experimenter

The Experimenter platform interface shows a "Manage Studies" section with a search bar and filters for "Active", "Submitted", "Approved", "Created", "Deactivated", "My Studies", "Begin Date", and "End Date". A green "+ Create Study" button is at the top right. Below, three study entries are listed:

Name	Date	Status
Baby Euclid: custom code testing	Sep 13, 2017	N/A
Copy of Baby Euclid	Sep 13, 2017	N/A
Labels & concepts	N/A	N/A

Each study entry includes details like "Study Creator: Kim Scott", "Status: Active", "Last Edited: Sep 15, 2017", and response counts ("Compl Responses: 0", "Inc Responses: 11" for the first study).

Participate in studies

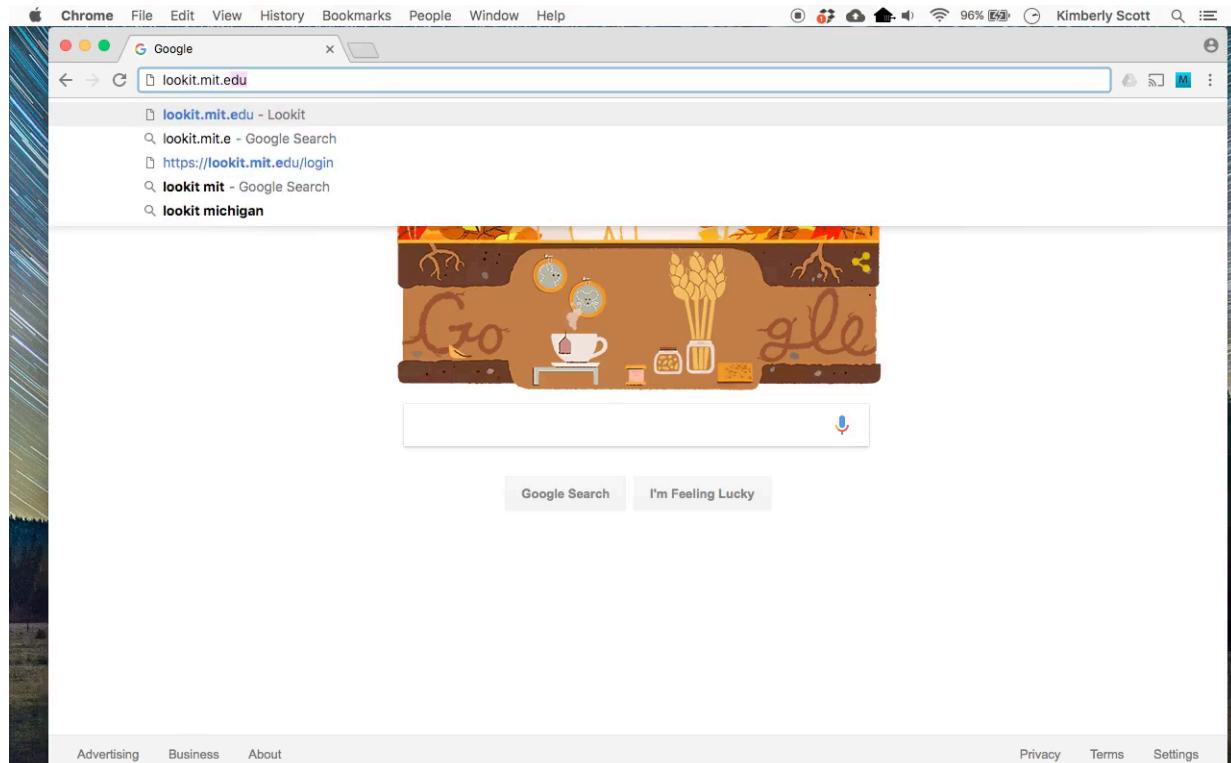
Design, manage, & collect data from studies

Code available at: <https://github.com/CenterForOpenScience/ember-lookit-frameplayer>
[lookit-api](#)
[experimenter](#)
[exp-addons](#)

Participant experience

Account

- Any family can create an account
- Register any number of children
- General demographic survey
- Email preferences



Study participation

- Select from list of studies
- Webcam setup, verbal consent
- Choose privacy level at end
- Previous sessions & any feedback shown

Researcher experience

Permissions

- Researchers given access to Experimenter by admin
- Manage / view data from own studies only

Managing a study

- Preview on Experimenter
- Submit study for approval by an admin
Pause/stop/restart at any time
- Studies can be active but “non-discoverable”



Getting data

- Download JSON/CSV data via Experimenter
- Download data about own participants only
- Download individual or bundled videos
- Programmatic access via API

Communication

- Email participants via Experimenter
- Actual email addresses hidden

Study protocols specified in JSON

JSON (JavaScript Object Notation) object example:

```
{  
  "name": "Jane",  
  "age": 43,  
  "favoritefoods": [  
    "eggplant",  
    "apple",  
    "lima beans"  
,  
  "allergies": {  
    "peanut": "mild",  
    "shellfish": "severe"  
  }  
}
```

Specifying a study protocol

- Studies specified using JSON (JavaScript Object Notation), a simple text format
- Studies broken into “frames”
- JSON object needs a “frames” key and a “sequence” key

```
"frames": {  
    "my-consent-frame": {  
        "kind": "exp-video-consent",  
        "prompt": "I agree to participate",  
        "blocks": [  
            {  
                "title": "About the study",  
                "text": "Not a real study."  
            }  
        ]  
    },  
    "my-exit-survey": {  
        "kind": "exp-lookit-exit-survey",  
        "debriefing": {  
            "title": "Thank you!",  
            "text": "You participated."  
        }  
    },  
    "sequence": [  
        "my-consent-frame",  
        "my-exit-survey"  
    ]  
}
```

Common frames available

Basic webcam setup

No recording during this section

1. Make sure your camera is working so that you can see yourself to the left! (For troubleshooting tips, scroll down.)

2. To check that your privacy settings are working, click **reload**. You should see your webcam view again in a moment, without having to click "Allow". If you were prompted again, this time make sure to also click the "Remember" box, and try reloading again.

3. Make sure your microphone is working: right-click on the camera image, choose "Settings," and click the microphone tab. If you say "Hi!" or clap your hands, you should see the green volume bar go up.

Next

Troubleshooting tips

Adjusting microphone settings

If the microphone icon in your video screen shows red bars like this , you may not be recording sound. To adjust your microphone settings, right-click on the webcam view and choose "Settings":

HDFVR v2.1.1
Settings...
Global Settings...
Check for Updates...
About Adobe Flash Player 28

Click on the microphone tab to choose which microphone to use (you may have and adjust the volume. If you speak or clap near the microphone, you should see). Adobe Flash Player Settings
Microphone

① Read through this consent document:

Consent to participate in behavioral research:
Inference and induction study

About the study
Observing your child's behavior during this experimental session will help us to understand how infants and children use evidence to learn and make predictions about the world.

Participation
Your and your child's participation in this session are completely voluntary. If you and your child choose to participate, you may stop the session at any point with no penalty. Please pause or stop the session if your child becomes very fussy or does not want to participate. If this is a study with multiple sessions, there are no penalties for not completing all sessions.

Webcam recording
During the session, you and your child will be recorded via your computer's webcam and microphone while watching a video or completing an activity. Video recordings and other data you enter are sent securely to our lab. At the end of the session, or when you end it early, you will be prompted to choose a privacy level for your webcam recordings.

Use of data
Recording and survey responses will be stored on a password-protected server and accessed only by the Lookit researchers working on this study and any other groups you allow when selecting a privacy level. A researcher may transcribe responses or record information such as where you or your child is looking. Data will not be used to identify you or your child. The results of the research may be presented at scientific meetings or published in scientific journals, but no video clips will be shared unless you allow this when selecting a privacy level.

Raw data may also be published when it can not identify children; for instance, we may publish children's looking times to the left versus right of the screen, or parent comments with children's names removed. We may also study your child's responses in connection with his or her previous responses to this or other studies, siblings' responses, or demographic survey responses. We never publish children's birthdates or names, and we never publish your demographic data in conjunction with your child's video.

Contact information
If you or your child have any questions or concerns about this research, you may contact Professor Laura Schulz: lschulz@mit.edu or (617) 324-4859.

② Click to **start consent recording...**

③ Read the statement below out loud:

"I have read and understand the consent document. I am this child's parent or legal guardian and we both agree to participate in this study."

④ Click to **submit!**

Webcam setup for preferential looking

No recording during this section

We'll be analyzing where your child chooses to look during the videos—but only if we can tell where that is! Please check each of the following to ensure we're able to use your video:

1. Make sure the webcam you're using is roughly centered relative to this monitor. This makes it much easier for us to tell whether your child is looking to the left or right!

2. Turn off any other monitors connected to your computer, besides the one with the centered webcam. (If there's just one monitor, you're all set!)

It's practical, minimize exciting things that are visible behind or to the side of the screen—for once, by facing a wall instead of the kitchen. (If this isn't practical for you, don't worry about it!)

Be sure you can clearly see your own eyes on the webcam view to the right. You may need to turn on a light or reduce backlighting (e.g. closing a window curtain behind you).

Common frames available

Important: your child does not need to be with you until the videos begin. First, let's go over what will happen:

In this study, your child will see 24 short video clips of physical events. Before each segment, a woman will introduce an object ("Look, this is a ball!"). Then, on one side of the screen, something "normal" will happen to that object; for example, the ball will roll off a table and fall to the ground. On the other side, something surprising will happen: the same ball will roll off the table and fall up! Each video clip takes under 30 seconds. We're interested in where your child chooses to look. A tendency to look either at the expected or the unexpected videos, if it's consistent across different types of events, demonstrates that your child may be making predictions about what will happen!

There are also some "control" video clips where the left and right sides are very similar, or where one side moves and the other doesn't. These are to measure your child's basic "looking personality": for instance, does he or she prefer to look at the same thing for a while, or switch back and forth?

Altogether, the video section is about 12 minutes long. After the videos, you'll give any feedback and select a privacy level for your webcam recording.

Mood Questionnaire

How are you two doing? We really want to know: we're interested in how your child's mood affects surprising physical events he/she notices. You can help us find out what babies are really learning as what they already knew, but weren't calm and focused enough to show us!

How is your CHILD feeling right now?

Tired	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Rested
Sick	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Healthy
Fussy	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Happy
Calm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Active

How are YOU feeling right now?

Tired	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Energetic	
Overwhelmed	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	On top of things
Upset	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Happy

About how long ago did your child last wake up from sleep or a nap?

01:00

Does your child have a usual nap schedule?

★ Please confirm your child's birthdate:

We ask again just to check for typos during registration or accidental selection of a different child at the start of the study.

★ Would you like to share your video and other data from this session with authorized users of the secure data library Databrary?

No
 Yes

Only authorized researchers will have access to information in the library. Researchers who are granted access must agree to maintain confidentiality and not use information for commercial purposes. Data sharing will lead to faster progress in research on human development and behavior. If you have any questions about the data-sharing library, please visit [Databrary](#) or email ethics@databrary.org.

★ Use of video clips and images:

Private: Video may only be viewed by authorized scientists (researchers working on the Lookit project).
 Scientific and educational: Video may be shared for scientific or educational purposes. For example, we might show a video clip in a talk at a scientific conference or an undergraduate class about cognitive development, or include an image or video in a scientific paper. In some circumstances, video or images may be available online, for instance as supplemental material in a scientific paper.
 Publicity: Please select this option if you'd be excited about seeing your child featured on the Lookit website or in a news article about this study! Your video may be shared for publicity as well as scientific and educational purposes; it will never be used for commercial purposes. Video clips shared may be available online to the general public.

Withdrawal of video data

Every video helps us, even if something went wrong! However, if you need your video deleted (your spouse was discussing state secrets in the background, etc.), check here to completely withdraw your video data from this session from the study. Only your consent video will be retained and it may only be viewed by Lookit researchers; other video will be deleted without viewing.

Your feedback:

- “Randomizer” frames allow counterbalancing
 - Shuffle or select from frames
 - Arbitrary & nested designs
- Video recording behavior determined per frame
- Time of frame start + custom data saved to database throughout study

Or use your own custom code

- Specify a commit of your own fork of exp-addons
- ALL code for your study is bundled up and deployed, separate from any other study code

Study Editor

Build Study - Add JSON

```
{"frames": {"alt-trials": {"kind": "choice", "sampler": "geometry", "frameType": "exp-lookit-geome"}}
```

Add the frames of your study as well as the sequence of those frames.

Try Experiment Discard changes Save

Change Study Type

Study Type

Ember Frame Player (default)

Specify the build process as well as the parameters needed by the experiment builder.

addons_repo_url
https://github.com/kimberscott/exp-addons/

last_known_addons_sha
545427914f62b68bf880d8a8effeae0b38589dd3

last_known_player_sha
6c6baa6fe33784ec067b59e8cd43794ca2383522

Discard changes Save

Documentation

Experimenter/study creation: lookit.readthedocs.io

The screenshot shows the navigation bar with "Experimenter" and "latest". Below it is a search bar and a sidebar with links to various experimental components and development sections.

- Using the staging server to try your experiments
- Building an Experiment
- Experiment data
- Glossary of Experimental Components
- Preparing your stimuli
- Development: Installation
- Development: Custom Frames
- Development: Mixins of premade functionality
- Development: Randomization

This page includes a "Docs" link, a GitHub edit button, and a main heading: "Welcome to Experimenter's documentation for use on Lookit!". It also features a note about the documentation being a work in progress and a brief introduction to the platform.

NOTE: This documentation is a work in progress

Experimenter is a platform for designing and administering experiments. It uses Ember.js for experiment components, and is developed by the [Center for Open Science](#).

Contents:

- Using the staging server to try your experiments
 - A sandbox environment
 - Getting access

Lookit API: lookit-api.readthedocs.io

The sidebar includes links for Navigation, Definitions, API Documentation, Experimenter, Django Project Local, Installation, Ember App Local Installation, Setup for local frame development, Development: Custom, Frames, Development: Mixins of premade functionality, and Development: Randomization. It also has a Quick search feature.

Welcome to lookit-api's documentation!

NOTE: This documentation is a work in progress

The lookit-api codebase contains the Experimenter and Lookit applications. Experimenter is a platform for designing and administering research studies, meant for researchers. The Lookit platform is participant-facing, where users can signup and take part in studies. It is built using Django, PostgreSQL, and Ember.js (see Ember portion of codebase, [ember-lookit-frameplayer](#)), and is developed by the [Center for Open Science](#).

Contents:

- Definitions
 - Children
 - Demographic Data
 - Experimenter
 - Feedback
 - Groups
 - Organization
 - Organization Site

Individual frames:
centerforopenscience.github.io/exp-addons/
(automatically generated from comments)

This page shows the class structure for ExpLookitStoryPage, including its inheritance from ExpFrameBaseUnsafe, its methods (e.g., ExpExitSurvey, ExpExitSurveyPilot, ExpFrameBase, ExpFrameBaseUnsafe, ExpLookitDialoguePage, ExpLookitExitSurvey, ExpLookitGeometryAlternation, ExpLookitInstructions, ExpLookitMoodQuestionnaire, ExpLookitPreferentialLooking, ExpLookitPreviewExplanation, ExpLookitStoryPage, ExpLookitText, ExpMoodQuestionnaire, ExpPhysicsIntro, ExpPhysicsPreVideo, ExpPhysicsPreviewExplanation, ExpPlayer, ExpVideoConfig, ExpVideoConfigQuality, ExpVideoConsent, ExpVideoPhysics, ExpVideoPreview, FullScreen, geometry, MediaReload, randomParameterSet, videoRecorder, VideoRecorderObject, VideoRecordMixin), and its properties (frames, story_intro_1, images).

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- Yield



Current Lookit platform & next steps

- How it works
- Example use cases
- A vision for Lookit

Studies implemented on new platform

Round	Study	With...	Method
0 (our own study)	Dense measurements of intuitive physics judgments	[ECCL]	Preferential looking/VoE

Dense measurements of intuitive physics judgments

Ongoing study: “Your baby, the physicist”

- 50 infants (4- to 12-months) participate online in a preferential looking study
- Each trial: introduce an object, then show a pair of more- and less-surprising events (loosely related to gravity, inertia, and support)
- Control measures about looking patterns interspersed
- Repeated measures: 24 trials per session, 15 sessions over 1-2 months.
- Also collect mood survey

Gravity comparisons

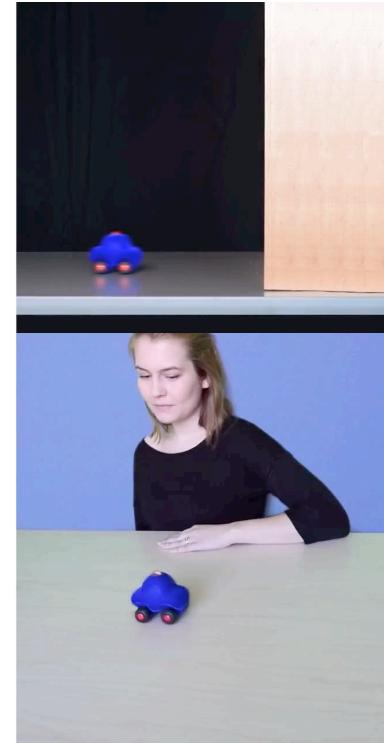


Dense measurements of intuitive physics judgments

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- Also collect mood survey

Inertia comparisons

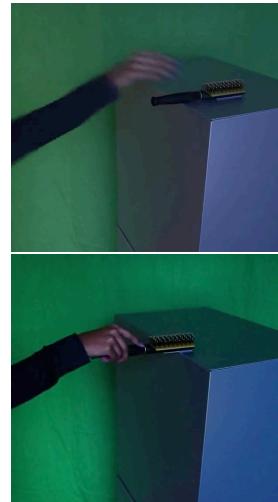


Dense measurements of intuitive physics judgments

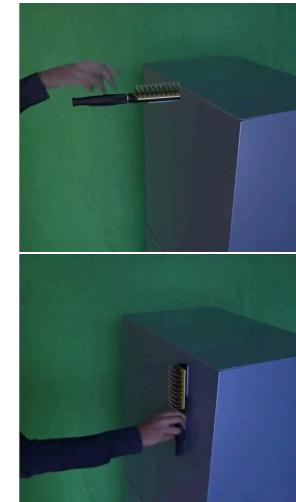
Ongoing study: “Your baby, the physicist”

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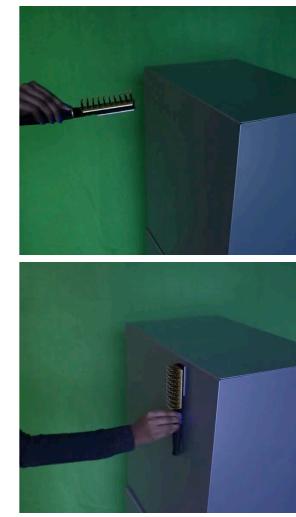
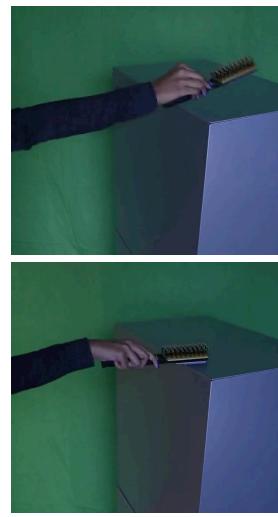
Stay



Support comparisons



Fall



Dense measurements of intuitive physics judgments

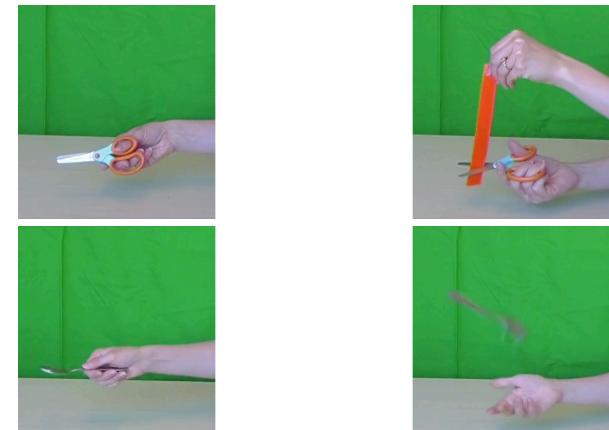
Ongoing study: “Your baby, the physicist”

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- Control measures about looking patterns interspersed
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- Also collect mood survey

Calibration



Salience



Similar



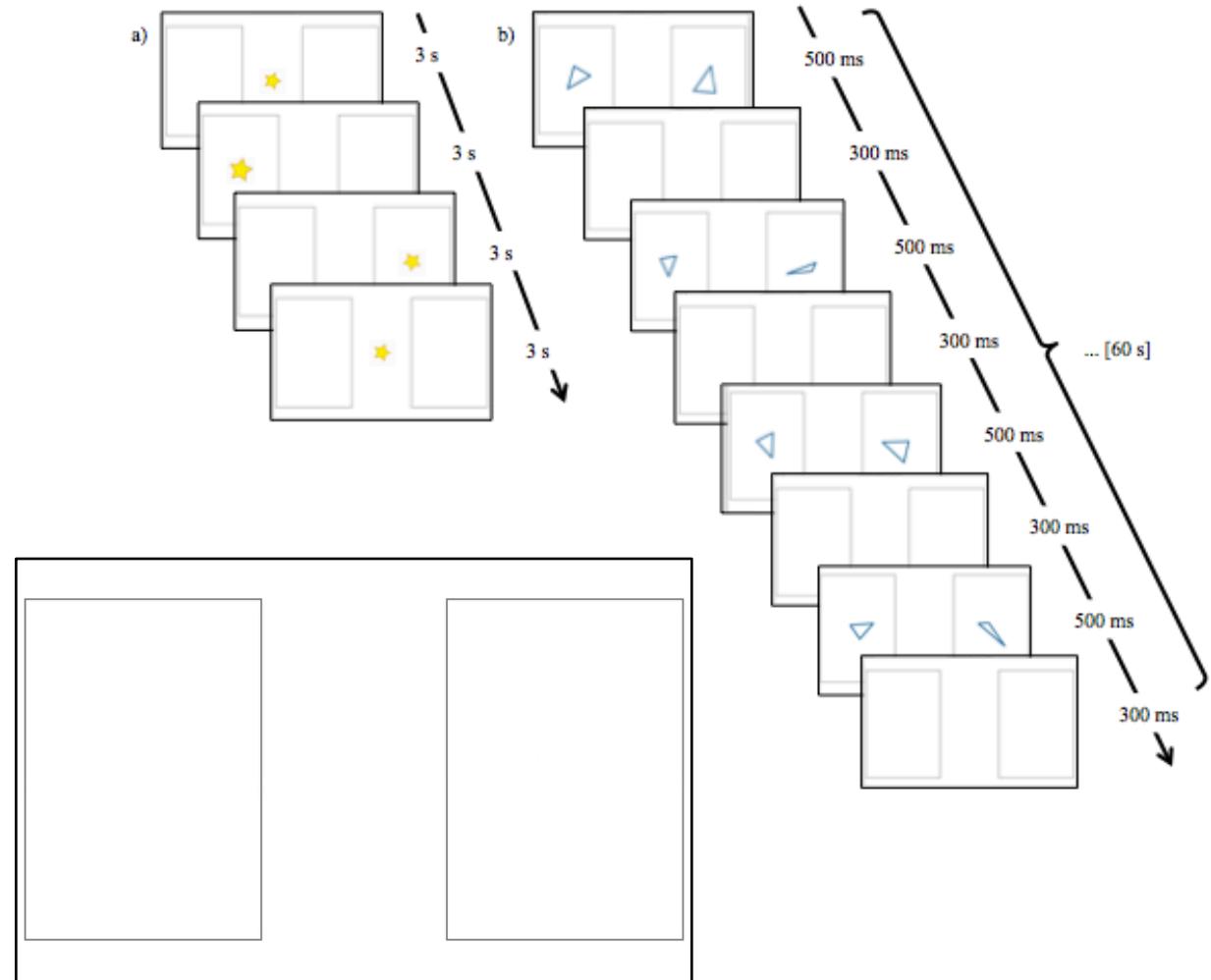
Dense measurements of intuitive physics judgments



- How stable are kids' looking patterns across sessions?
 - Contributions of age, child, session to variance on controls & test
 - How much can controls – stickiness, sensitivity – explain variation? How do these relate to measures of mood?
- Overall structure of tasks
 - Gravity, inertia, support: do responses cluster by “concept”?

Shape perception (with Molly Dillon, Liz Spelke)

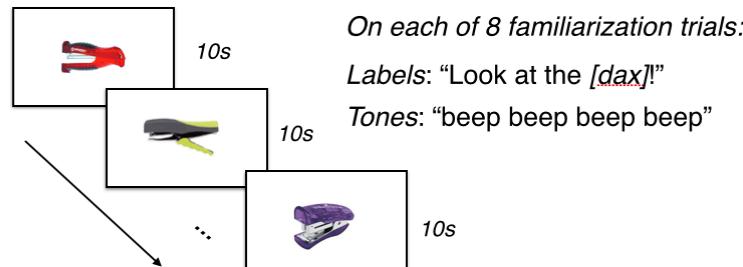
- Are infants sensitive to shape changes within triangles?
- Two triangle “streams”: alternating in size only, or in shape and size
- 4 trials, each starting with calibration
- Custom frame for trial – generalizable example of “state changes” and on-the-fly graphics



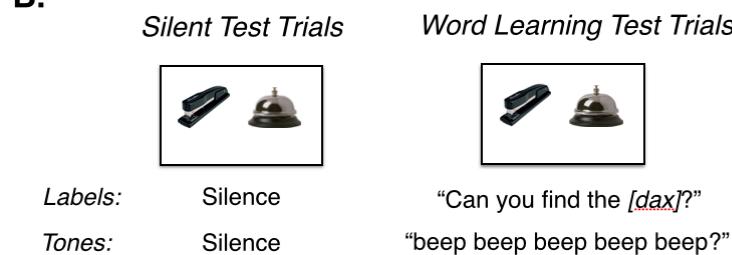
Facilitation of visual category formation by labels (with Bria Long, Mike Frank)

- Do linguistic labels help infants represent visual categories?
- Familiarization, silent test, and word learning trials supported by a new looking time frame
- Motivated development of a general-purpose randomizer

A.

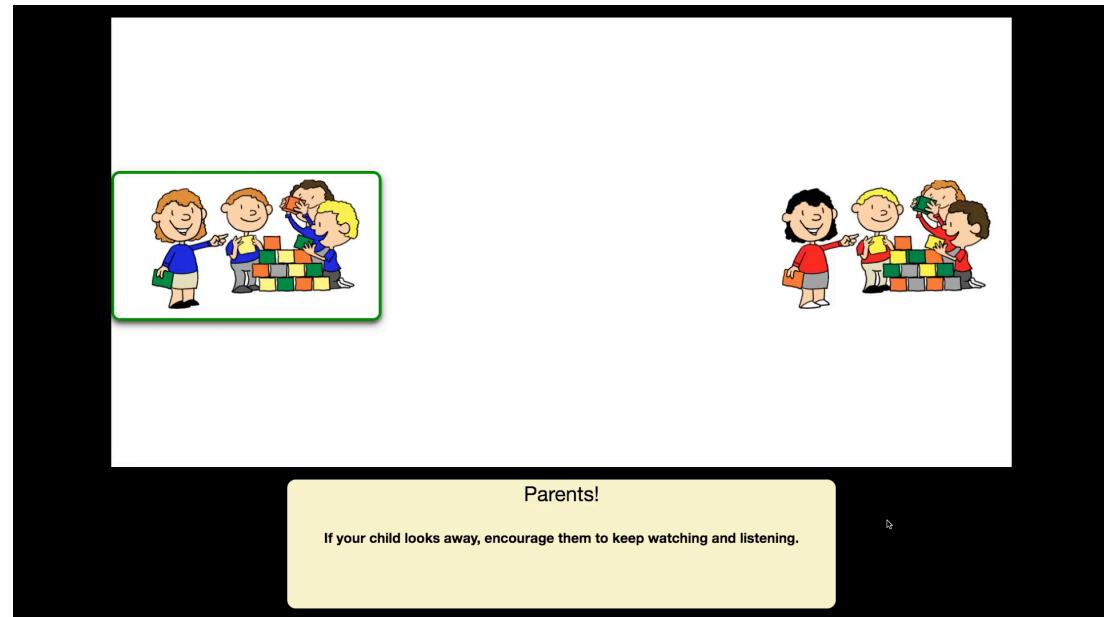


B.



Ingroup/outgroup moral obligations (with Lisa Chalik, Yarrow Dunham)

- How do preschoolers view moral obligations within vs. across social groups?
- Custom “storybook” frame supports introduction segments, two-alternative forced-choice questions

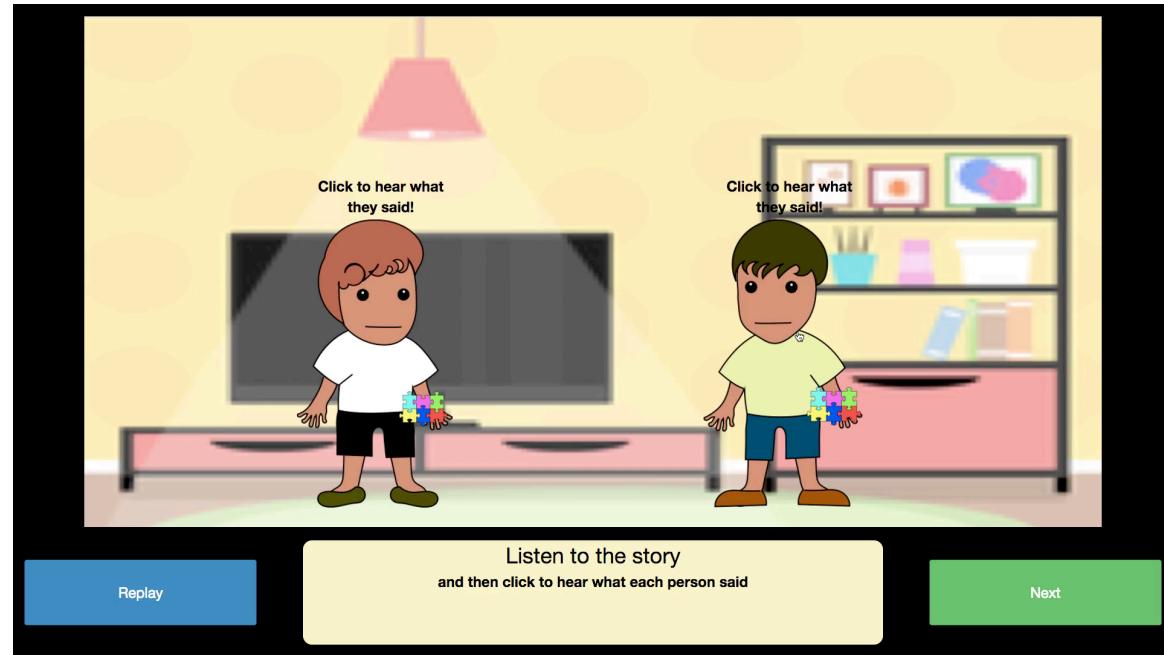


Parents!

If your child looks away, encourage them to keep watching and listening.

Evaluating politeness of utterances (with Erica Yoon, Mike Frank)

- What signals do preschoolers use to judge politeness?
- Custom “dialogue” frame supports showing characters + what they say, two-alternative forced-choice questions



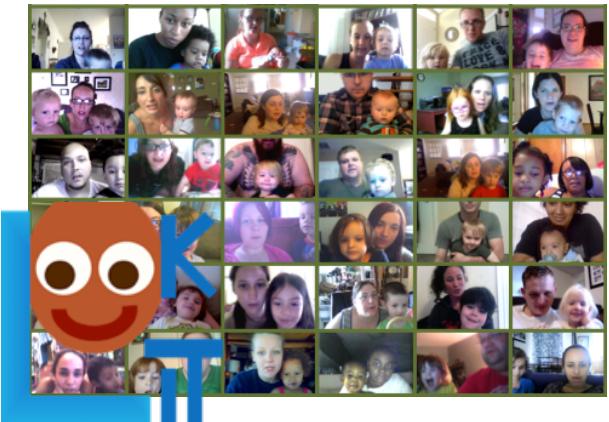
Outline

Why move online?

- Practical challenges in testing kids
- Illustration: looking for split-brain babies
- Advantages of online testing

Adapting to the online environment

- Test study protocols & results
- Demographics
- Looking measures
- Verbal responses
- Yield



Current Lookit platform & next steps

- How it works
- Example use cases

→ A vision for Lookit

Lookit: a platform for everyone

A vision for Lookit:

- Large collaborative “online lab” run by group at MIT
- Single participant interface; shared participant pool, servers, recruitment efforts
- Training, IRB coordination, study implementation, design support
- Researchers independent, but centralized approval of studies
- Support/incentives for best practices



Lookit: a platform for everyone

Mission: Lower barriers to conducting and participating in rigorous, reproducible developmental research that advances our understanding of development or our children's quality of life.

We are committed to...

- Open source development
- Encouraging data and protocol sharing
- Encouraging best practices in experimental design
- Advancing our understanding of methods
- Recruiting a representative participant pool
- Respecting participants' time and parents as partners in discovery
- Enabling non-traditional developmental researchers and supporting work that benefits children



What's left to figure out

Recruitment

 babycenter COMMUNITY

BIRTH CLUBS GROUPS MOM ANSWERS MY STUFF PHOTOS SHOP

TODAY'S MOST POPULAR POSTS Welcome Little Lady by 4lifeyo in April 2017 Birth Club

Groups by topic Birth Clubs

- Adoption
- Baby
- Big Kid
- Birth Club Buddies
- Family Life
- Feeding & Nutrition
- Fertility Issues &

Birth clubs

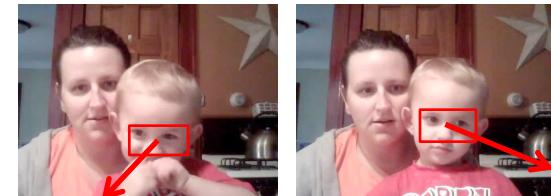
Birth clubs by year

- January 2017 Birth Club 25,054 members · 42,238 posts
- February 2017 Birth Club 25,394 members · 31,024 posts
- March 2017 Birth Club 30,279 members · 33,629 posts

Additional functionality

	est. dev. weeks
Lookit website:	
Highlight new feedback on Lookit	1
Sort/display available studies by child's eligibility	1
Experimenter:	
Expanded set of useful, generalizable frames	6
Ability to export a static version of an experiment	4
GUI for consent coding (or centralize)	4
Speed up preview when only JSON changes	2
Support for payment to participants	4
"Study slot" cap and management by admin	3
Store JSON schema text directly	1
More powerful counterbalancing possibilities	3
Tool to upload feedback	2
Expanded email functionality	4
General access to API	1
Improve CSV data provided to researchers	1
Download arbitrary list of videos	2
Allow families to see their videos	3
Automatic concatenation, annotation of videos	6
Video recording:	
Switch from Flash to HTML5 video	8
Investigate missing audio issue	2
Salient way to check whether mic is working	1
Supporting online processing of video frames	4
TOTAL	63

Automated gaze coding



- Relax coding bottleneck
- Online contingent displays

many thanks to

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Cynthia Fisher, Kathleen Corriveau, and Ernő Téglás who graciously shared original stimuli and/or data

Laura Schulz
Rebecca Saxe
Liz Spelke
Josh Tenenbaum



David Szakaly: <http://dvpd.tumblr.com>

Kris Brewer; Melissa Kline, and 9.S93 students who made stimuli: Emily Lydic, Larissa Pachuta, Tina Zheng, Alice Lu; Max Siegel



Research assistants: Susie (Sol Jol) Lee, Cindy Zho, Alice Lu, Jessica Wass, Chloe Joray, Vivienne Wang, Shirin Shivaei, (Nia) Dasul Jin, Jean Chow, Jasmine Gums, Scout Brisson, Daniela Carrasco, Jean Yu, DingRan (Annie) Dai, Joseph Alvarez, Junyi Chu, Rianna Shah, Katy Hanling, Hope Fuller-Becker, Audrey Ricks, Jessica Zhu, and Alice Wang.

Lookit beta testers:
Molly Dillon, Liz Spelke, Mike Frank, Erica Yoon, Bria Long, Yarrow Dunham, and Lisa Chalik



CENTER FOR
Brains
Minds +
Machines



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Center for Brains, Minds and Machines (CBMM), funded by NSF STC award CCF-1231216
American Association of University Women



Age 1

Me: No pens in the eyes, Remy.

Remy: Put it in the nose? Put it in the mouth? Put it in the Mama nose? Put it in the Mama mouth?

Age 2

I don't wanna stay in this world... my belly hurts. [...] I wanna go back to the BCS, because in the BCS I'm feeling fine.

Remy: Are you alive?

Me: Yes.

Remy: AM I?

Me: Yes.

Remy: But I don't know what to do. I have NO IDEA.

Age 3

Everybody has something they're afraid of. I'm afraid of dolphins. [...] What makes my belly hurt is, something might go wrong with a dolphin.

Age 4

Remy: What do you love about yourself?

Me: Uh, I love all the things I can do.

Remy: And all the things you try to do, but you can't do? And all the things you want to do, but you can't do?

Remy: If they go together, they don't fight. If they go apart, they fight. So if the two countries want to go towards each other...

Me: Countries actually don't move.

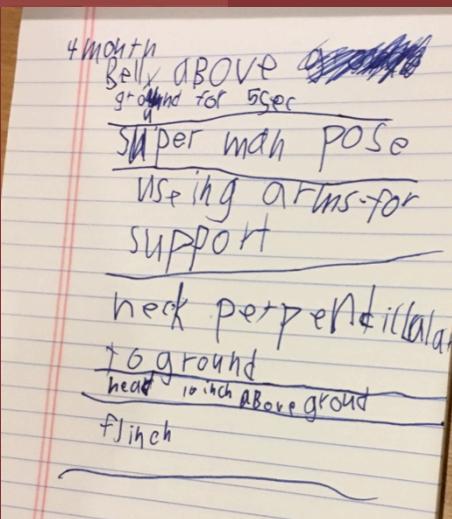
Remy: PLATE TECTONICS. Do you know about plate tectonics?

Age 5

Rough days are just a thing you have to go through. When you have a rough day I'll just be extra kind to you.

Age 6

You're my favorite mama... even though there are others that are better... which you know.



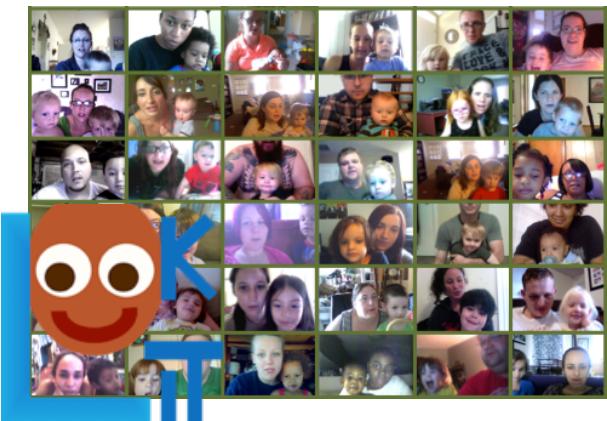
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