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Foreword

A special shout out
to all those families
who dressed for the
occasion!
Thank you!



Dear Parents!

Since we have opened our research center in April 2022, many wonderful things have happened—this newsletter is not only a means to share findings with you—the families who make our studies possible, but also an opportunity for us to reflect and take stock on our own work.

However, first and foremost, the aim of this newsletter is to show our gratitude to all the parents who take time out of their busy schedules and participate in our studies with their children. Thank you for your valuable contribution to enriching our knowledge about how early cognitive abilities develop!

The number of test sessions that we carried out since we started here in Vienna—almost 3500!—speaks of the enthusiasm of the moms and dads who visit us. We are glad to find so much curiosity about the developing human mind in this community—and we see it not only with parents, but also with schools, educators, the media, and finally research funds.

In this newsletter you will read about our KiKo parental café that grew out of a parent initiative of the Vienna Family Network and is becoming a regular event. Another recurring event that was initiated by a teacher was the lab visit we organized for 11th graders. I especially want to highlight our participation in the Wiener Töchertag where we let young girls peek behind the research scenes. If you are interested in taking a peek too, I would recommend watching the short report featured in [NANO](#) on 3sat (starting at minute 20:00).

Finally, we are very proud to have been awarded two prestigious grants, which will allow us to work on long-term collaborative projects evolving around ecological neuroscience and evidence-based belief updating in children. These studies are starting right now, and we are excited to embark on this journey together with you!

In this sense, we hope to see you soon in our labs (again)! In the meantime, enjoy reading our newest findings in our research summaries.

Ágnes Melinda Kovács

Head of the Cognitive Development Center at CEU

Team

1

NEWS

Team Changes

We welcome Giovanni, Leslie, and Luisa, our new PhDs, as well as Bettina, our new research assistant.



TEAM

We are the CEU Babylab!



Scientific team

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**Research
Summaries**

2

MANAGING UNCERTAINTY

Understanding How We Revise Our Guesses



Researcher:
Munther Ahmed

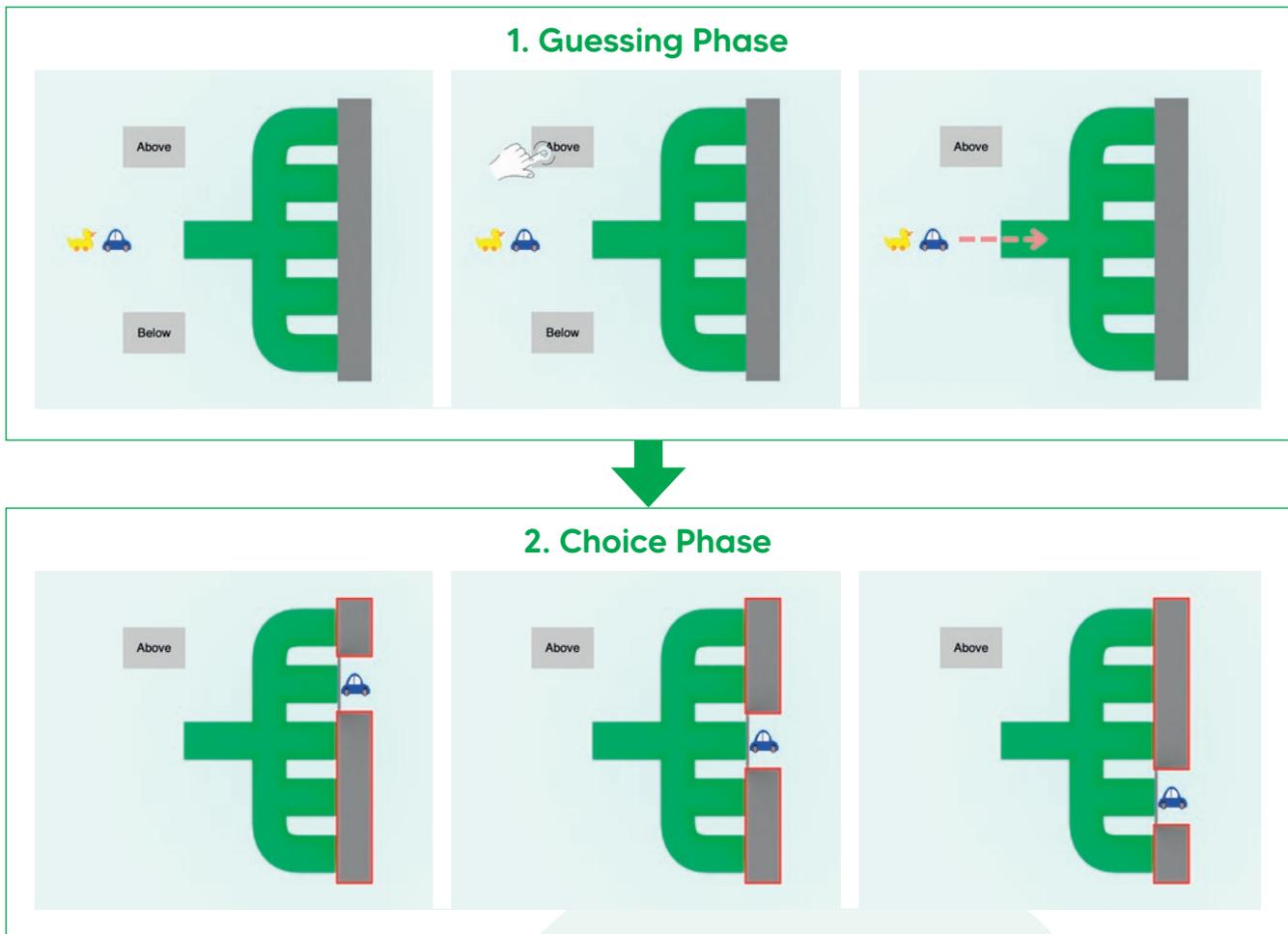


Fig. 1: The game setup.

We make guesses every day when facing uncertain situations. We wake up in the morning, see a clear sky and assume that it will not rain that day. Upon checking the weather forecast, we discover that there is a 70% probability of rain, yet we might still ignore this information, continue with our assumption, and leave the house unprepared for potential rain.

Reality Or Just A Guess?

Despite how common guessing is in our daily lives, the specific role of guessing in decision-making remains poorly understood. Recent research has proposed that young children tend to treat their guess-

es as reality until about age four, which may create a “cognitive blind spot” in their decision-making, as they exclude other options. In other words, if they expect a ball to fall out of one of two holes, then they would only cover the hole where they guessed that the ball would appear. But are these phenomena confined to early childhood, or does it continue to affect decision-making also in adulthood?

In this study, we sought to explore two key questions: how flexibly can people adjust their initial guesses when new evidence emerges? And are young children truly considering multiple possibilities when they guess, or do they hold only a single option in mind?

To answer these questions, we developed a computer game that could be played by both adults and children. The participants watched two objects (a car and a duck) hide inside a tube system with five covered exits. Before the objects hid, participants guessed whether the duck would end up in a location that is relatively “above” or “below” the car. After both objects entered the tubes, the car’s location was revealed, creating different probability scenarios that made the guess either highly likely, highly unlikely, or remained neutral (Figure 1). For example, if the car appeared in the second position from the top, there was only a 25% chance that the duck was above it versus a 75% chance that it was below. Participants then had to search for the duck.

Adults And Children Behave Similarly

Adults and five-year-old children produced very similar results. Once they made a guess, they tended to stick with it even when the evidence suggested they were wrong. They changed their minds just over half the time when the evidence indicated that their guess was highly unlikely and rarely switched when their guess appeared to be correct. When they were not asked to make an initial guess, their choices were much more efficient.

In short, these results highlight a basic limit in human reasoning. Once we make an initial guess, it strongly shapes our thinking. Even when we see clear evidence against it, we struggle to let go and choose the better option.

CURIOSITY

Social Learning And The Brain



Researcher:
Yi-Lin Li

From a very young age, children are active and curious learners. This idea dates back to the work of Jean Piaget, who proposed that children learn best through active engagement with the world around them. More recently, researchers have described learning through the predictive processing framework, which suggests that learners build internal models of their environment. When something happens that doesn't match their expectations, they experience surprise and feel motivated to explore and update their understanding of the world.

Can Contradictions Help Us Learn?

Building on this framework, our study explores how social information—that is, information coming from other people—can trigger surprise and guide

infants' exploration. We are particularly interested in how infants respond when two people provide conflicting or non-conflicting information about an object. We conducted two studies with infants aged 12 to 18 months.

Functions

The first study focused on function and examined how infants respond when two people give the same or different information about what an object does. The participants watched short videos about two people showing them an unfamiliar toy. The first person greeted the baby, briefly looked at the object, and then demonstrated how to use it (for example, folded the object). In the next scene, infants saw another person greeting them, taking a look at the same object, and then providing infor-

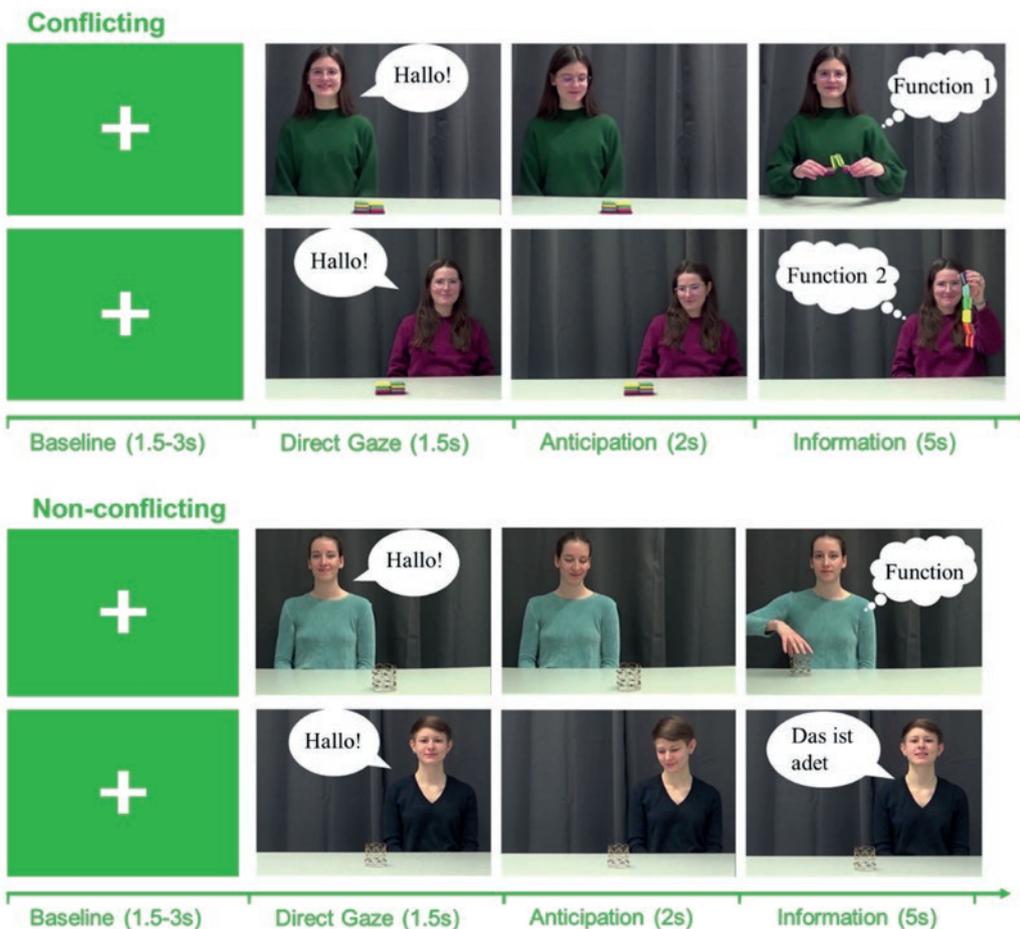


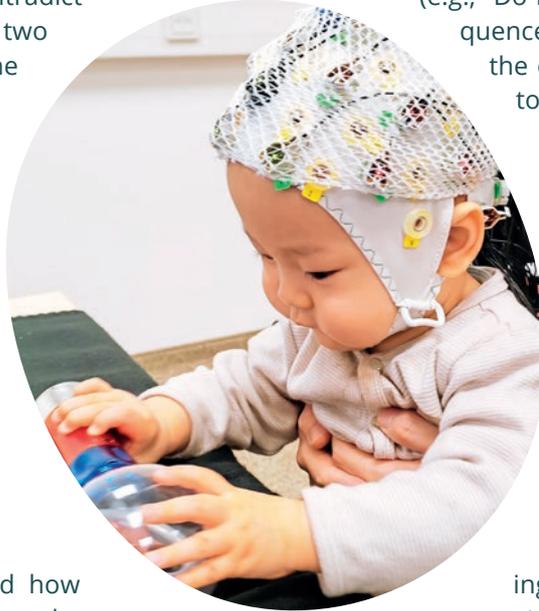
Fig. 1: Two people give conflicting information about an object.

Fig. 2: Two people give non-conflicting information about an object.

mation about the toy. In some cases, the second person demonstrated a different function than the one infants saw in the first scene (e.g. rolling the object instead of folding it), so the participants received contradicting information from the two people. In other cases, the second person named the object instead of presenting a function, so even though both people showed the babies different things, they did not contradict each other. After watching the videos, infants got a chance to explore the toys in real life.

Valence

The second study tested how infants react when two people express the same or different emotions (positive or negative) toward an object. Similarly to the first study, participants were shown brief videos about two people showing them a toy, but this time, both people demonstrated how they feel about the object. In some cases, they expressed



conflicting emotions: one of them had a positive reaction and said something encouraging about the toy (e.g., "Play with it, it is fun!"), while the other has shown negative emotions and warned the baby (e.g., "Do not touch it, it is bad!"). In other sequences, both people reacted similarly to the object. Infants then had the chance to try the toys they had seen.

Measuring Brain Activity

While infants watched the videos, we recorded their brain activity using non-invasive EEG (electroencephalography). This method allows us to measure electrical signals from the brain. Our focus is on theta activity, a type of brain rhythm linked to attention and learning. Preliminary results revealed that infants showed stronger theta activity when seeing conflicting information, reflecting greater processing effort or surprise.

We are also interested in the link between brain responses and curiosity-driven behavior. We're still in the process of analyzing how infants' brain activity (theta activation) predicts how they explore.

PROBLEM SOLVING

Can Toddlers Differentiate Between Exploration Strategies?



Researcher:
Eszter Körtvélyesi

One hallmark of goal-directed behavior is efficient problem solving—executing a planned sequence of steps to achieve a goal. Research shows that infants readily draw inferences about others' efficiency: they expect a character who has previously acted efficiently to continue doing so in new situations. Classic paradigms investigating this question typically rely on well-defined problem spaces: there's usually an optimal solution that even naive observers can easily find, such as a clear shortcut to take or an obstacle to avoid.



Fig. 1: Characters from the study.

Problem-Solving In The Real World

In everyday life, however, problem spaces are often underdetermined: there's many options to try and not enough information to choose from them. In such cases, our problem-solving efficiency improves by broadly exploring the available possibilities. For example, when we witness someone pressing different buttons on an unfamiliar device like a new remote control, we can infer something about their general problem-solving abilities from

the way they approach this particular problem. Someone who systematically tests every button seems more likely to succeed in future challenges than someone who persistently presses the same one over and over again.

One Problem – Multiple Approaches

In our study, we asked whether 18-month-old infants have similar intuitions about exploration being a helpful tool in efficient problem-solving. Our participants watch short animations featuring two clearly distinguishable characters with the same goal: to get a ball. In the first half of the video, infants can observe how these characters interact with various unfamiliar machines. The main difference between the characters lies in the way they explore their environment: one systematically turns every knob on every device it interacts with, while the other keeps turning the same knob on each machine, making the same amount of effort but only trying one option. It's important to note that none of these actions elicit an effect: infants can only learn about the characters' exploration strategies from these scenes, but not their success rates. Subsequently, both characters manage to solve a different problem—opening a special box with multiple knobs to retrieve a ball.

Toddlers' Intuitions

We test whether infants are surprised by the success of the character who had previously only explored a limited range of possibilities. Such an effect would suggest that they can track behavioral patterns that reflect the exploration of possibilities, and assume that someone with an exhaustive exploration strategy is more likely to find a solution to a new problem than a person with a repetitive approach. We measure how long infants look at each character's successful problem solving: longer looks indicate that the event was unexpected. Data collection for this study is still ongoing, but we hope to get some exciting insights soon.

ACTIVE LEARNING

How Do Babies Choose Their Teachers?



Researcher:
Maria Mavridaki

Babies are naturally curious! When something is new or uncertain, they actively look for clues. One way they do this is by checking in with the people around them, a behavior called social referencing. And interestingly, babies don't seek guidance from just anyone. Even in the first year of life, they are picky about who they turn to, preferring adults who seem knowledgeable and reliable, already preferring “good teachers”.

Two approaches to competence

In our study, we are testing how this selectivity looks like around infants' first birthday. First, we ask whether babies seek more information from a person who has seen what they are curious about (specifically, where an interesting toy was hidden) compared to someone who could not see. Then, we ask whether this preference for a “better informed” person carries over into other domains, such as learning new words for objects. Do babies only trust adults in the specific domain, where they have shown that they can provide information (hiding locations)? Or do they assume that an informative person can also be a helpful guide in other domains (like what objects are called)?

Think about adults in everyday life: if you trust your mechanic to fix your car, do you also trust them to give medical advice? Probably not! That's the expertise account—knowledge is specific to a certain domain. But sometimes, especially when we don't have much information, we might assume that someone who seems smart or reliable in one area will be helpful in others too. That's the generalizability account. In our study, we're asking: do babies rather take the “expertise” approach, or the “generalizability” one?

“Where Is The Toy?”

The study starts with a hiding game: the baby sits on the caregiver's lap and watches an adult hide an interesting toy in one of two cups in each round, sometimes visibly, sometimes invisibly for the child. Two other people are also playing: one of them, the Informant, can always see where the object is hidden and tells the child, while the other



Fig. 1: The girl on the right can see where the object is hidden, the girl on the left cannot.



Fig. 2: “Which one is the dax?”

one, the Non-Informant, can never see where the toy is hidden (because her view is always blocked), and only ever says that she doesn't know where it could be. During the test, an object is hidden without the child seeing where, and then every adult remains passive for 15 seconds. We measure whether and how much babies look at the Informant and Non-Informant before the location of the toy is revealed. This tells us whom they rather expect information from.

“Which One Is The Dax?”

In the next phase, the game changes, which signals to the baby that the domain of interest is shifting too. Two familiar objects are shown to the child

(e.g. a plush dog and a plush cat) and the child is invited to choose the one with a given name (“Which one is the dog?”). Finally, in the second test, babies are shown two completely new objects and asked to pick one using a made-up name (“Which one is the Moch?”). Similarly to the invisible hiding scenario, babies have no way of finding the answer on their own, but they can turn to the adults for help. Again, we measure how often they look at the Informant versus the Non-Informant.

What Babies’ Gaze Tells Us So Far

Preliminary results show that 12- to 14-month-old babies, as a group, tend to prefer the Informant during the first test phase. When babies themselves are unsure where the toy is hidden, they understand that the person who watched the hiding knows more and is the right person to ask for help. In the second test phase, when the task

shifted from finding a hidden object to figuring out which object a word refers to, babies who had already shown a preference for the knowledgeable person during the first test continued to look more often toward that same person. This pattern supports the generalizability account: instead of treating knowledge as something that belongs to a single, specific domain, babies seem to assume that someone who has been informative in one situation will also be informative in a completely different one. Infants appear to generalize a person’s competence across domains, even when the new domain (knowing words) has nothing to do with the earlier one (knowing hiding locations). This strategy may help babies around their first birthday to learn more efficiently: by identifying someone who seems knowledgeable, they can rely on that person again, allowing them to quickly take advantage of the social world to learn!

THE ROLE OF RELEVANCE

How Referential Ambiguity And Relevance Impact Children's Learning



Researcher:
Maria Mavridaki

Childhood is an incredibly rich period for learning. From a very young age, children actively decide when, how, and from whom to learn, navigating a world full of unknowns. They are especially curious when events don't go according to their expectations, when the outcomes are uncertain, or when situations offer meaningful opportunities to explore. Social cues also play a crucial role. Children prefer to seek information from adults who seem knowledgeable or reliable, using these traits as signals to guide their own choices.

Uncertainty Or Relevance

By examining both what children choose to explore and what they remember, we aim to better understand the factors that drive their learning in everyday life. For this reason, in our study, we focus on two key factors: the uncertainty and social relevance of the information (or its usefulness in communication about the object's identity), to see how they shape four-year-olds' curiosity and learning.

During their visit, children played a fun, interactive tablet game with an adult. First, children learned how the game worked with familiar objects. Then, we looked at how children seek information in situations with differing ambiguity and prospective relevance. Sometimes children saw two unfamiliar objects and had to figure out which one matched a new word (high ambiguity), and sometimes one object was familiar, and one was new

(low ambiguity). In other rounds of the game, objects were presented as future toys in the child's environment (high relevance), whereas in others, they were said to be for kids in a faraway country (low relevance). During the game, while they tried to identify the correct objects, we measured the participants' implicit information seeking (simple looks at the adult asking for guidance) and explicit information seeking (asking questions). In a later test phase, children faced situations combining ambiguity and relevance in different ways. Finally, we tested their retention of newly learned labels, to see which ones they remembered.

Children Seek Out Information Strategically

Preliminary results suggest that both ambiguity of the situation and the prospective relevance of information influence children's information seeking and learning. In particular, children seem to seek information the least when both ambiguity and relevance is low. Moreover, children's memory of labels seems to be worse when ambiguity is high and relevance is low. Meaning they asked less questions when there was no uncertainty and the information will not be useful for identifying the objects. Further, they remembered the labels worse when they could not know whether the information is correct and it wasn't going to be useful for communication.

These results suggest that children are strategic about when they seek information. They do so when they really need information and when this information is more likely to be important. Learning also appears to be selective. When the information

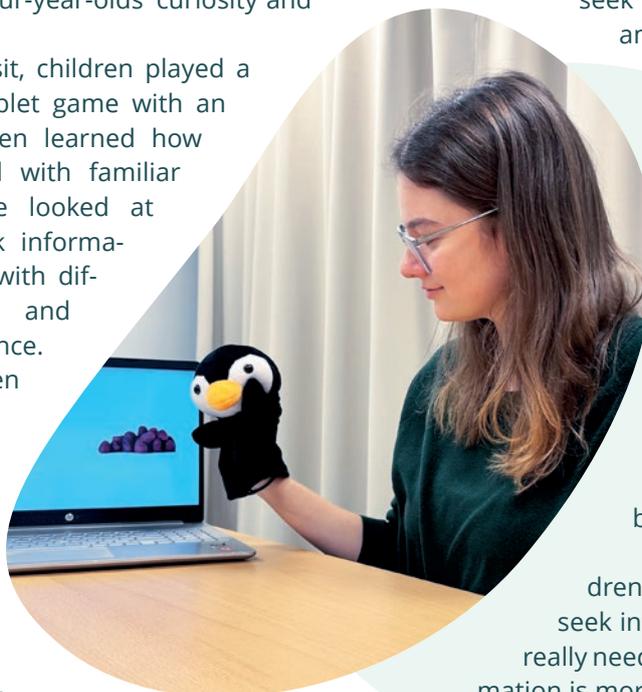


Fig. 1: Explaining the game with Momo the puppet.

seems uncertain and less important, learning is less robust.

The Role Of Multilingualism

We also assessed the child’s vocabulary via a standardized test, curiosity via a parental questionnaire and the language environment they grew up in via

a short interview with the caregiver. Children who grow up surrounded by multiple languages seem to show a different pattern of information seeking and learning, but more detailed analyses will be needed to examine these effects. We are looking forward to the final results of this study!

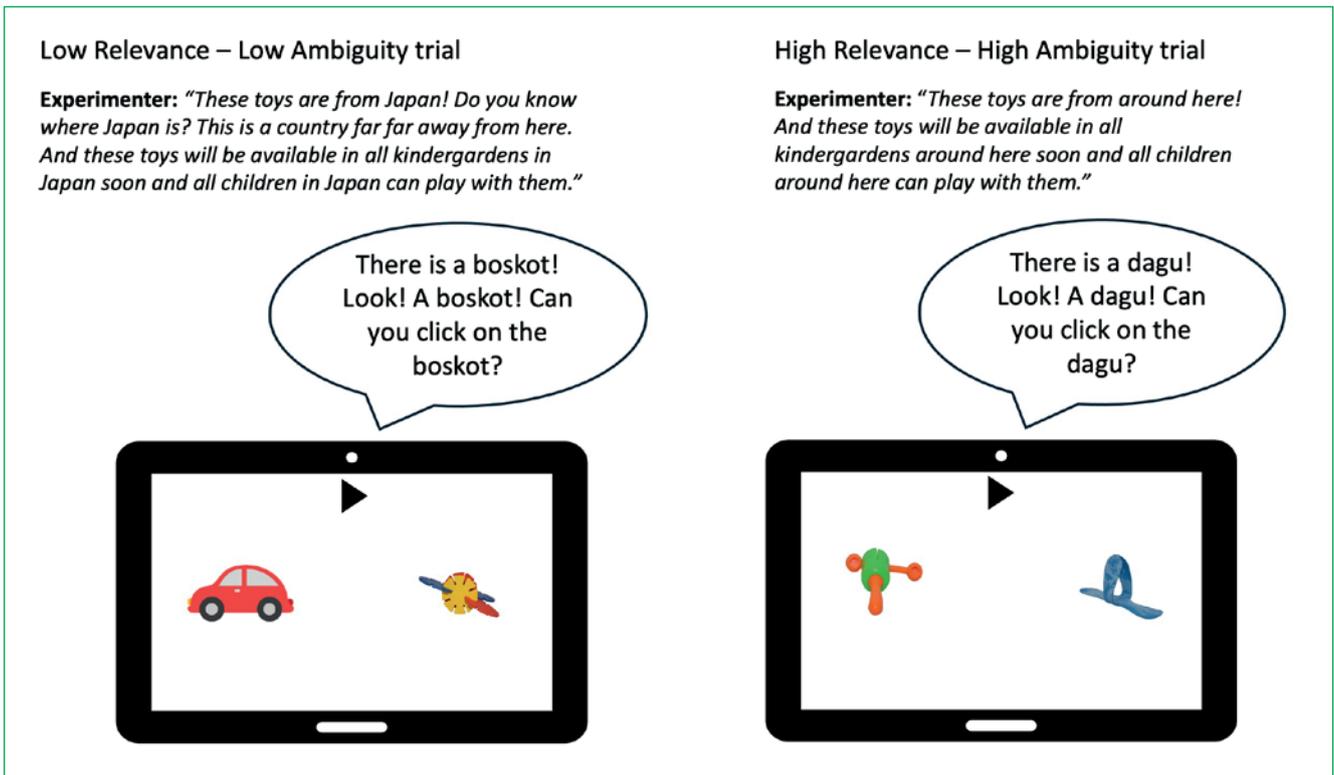


Fig. 2: Trial example

CULTURAL TRANSMISSION

“Don’t Cross The Road At A Red Light!”



Researcher:
Tibor Tauzin

In everyday life, we often behave in ways that are expected by others and align with social and cultural norms. For instance, we stop at a pedestrian crossing when the signal is red, or we take off our hat when entering a church. In our experiment, we investigated whether infants understand that communication can serve as a tool to teach such social norms.

Teaching How To Behave

The participating infants were shown a series of videos featuring two unfamiliar animated characters, in two distinct roles: a Learner and a Teacher. In the warm-up phase, infants observed the Learner approach a target object by following a straight trajectory, which required no extra effort.

In the subsequent video, however, the object was located inside a building. Although the Learner again began to approach the object using the same, effortless and easy straight trajectory, before reaching the object, the other character (the Teacher) produced a sound to call the Learner back and initiated a communicative interaction. The communication consisted of unfamiliar sounds (melodies) exchanged in a turn-taking manner. Following this interaction, the Learner began to approach the object using a zig-zag path instead of a straight line. This change in behavior suggested to infants that the Teacher had conveyed a social norm, teaching the Learner how to behave appropriately within the building.

In the final phase, infants saw the Learner alone, moving toward the object inside the building—either by following a straight trajectory (indicating non-normative behavior) or a zig-zag path (acting in accordance with the cultural norm). In these trials, we measured the participants’ attention directed towards the videos based on their looking time as well as the dilation of their pupils. In such stud-

ies, looking time is used to indicate surprise, while pupil dilation is associated with a higher cognitive demand.

Babies Understand The Communication Of Social Norms

We found that infants were surprised when the Learner used the straight path, suggesting that they understood the communicative interaction as conveying a social norm. Moreover, they expected the Learner to have acquired the norm and to behave accordingly.

In the following condition, we tested whether infants held the same expectation in the absence

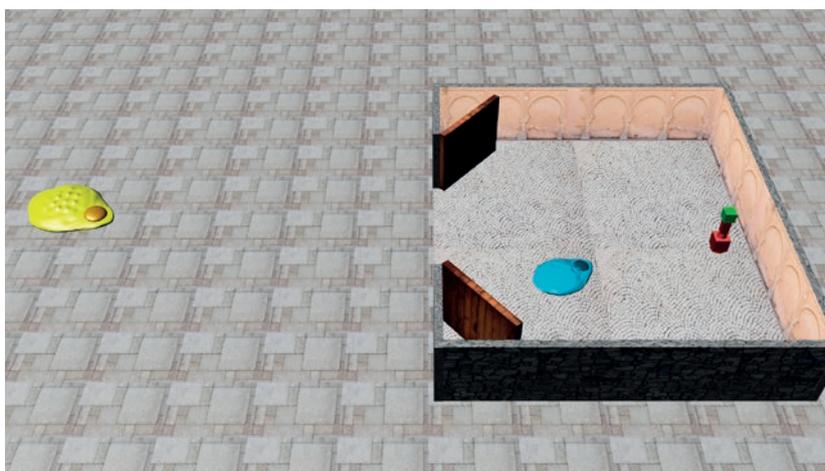


Fig. 1: The Learner approaches his goal with the Teacher watching him

of communicative information transfer. We found that they did not, indicating that infants specifically expected communication—rather than non-communicative actions—to transmit culturally relevant knowledge to the Learner. Here, with the exception to the signals produced by the characters, all aspects of the videos were consistent with the above-mentioned version.

SYMBOLS

Do Infants Have The Same Expectations As Adults When It Comes To Symbols?



Researcher: Mariem Diané

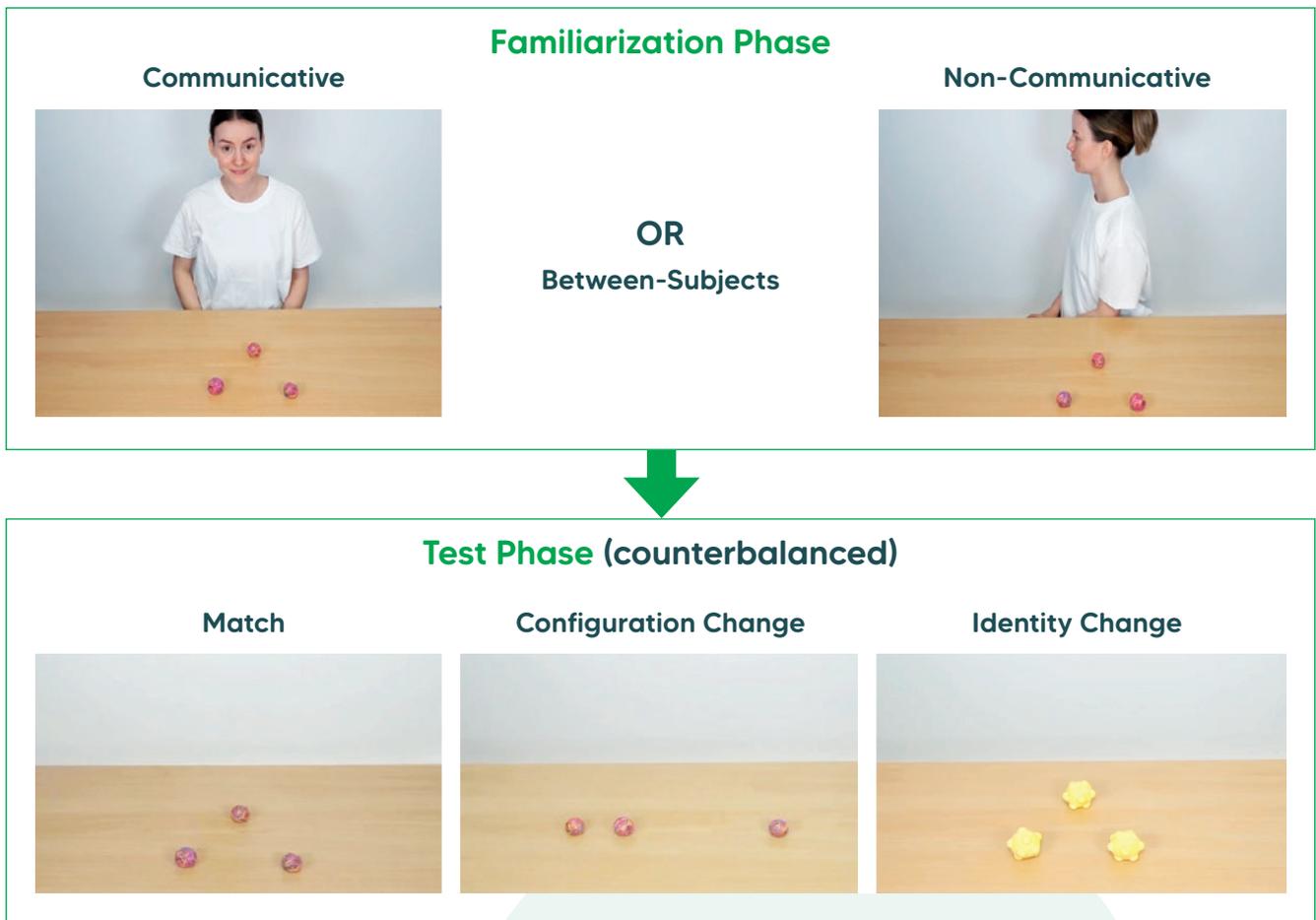


Fig. 1: Study 1—Videos of an actress placing objects on a table with or without communicative cues followed by no change, a change of shape or a change of object identity.

Background & Research Question

Our goal with these two experiments was to see whether infants, like adults, believe that the position of objects in space matter when those objects are acting as potential symbols, i.e., when someone is communicating while manipulating them. As adults, we would understand that a map of Vienna that is placed to the left or the right of a table, or that has a lighter or a darker color palette, is still representing Vienna. But when the elements on the map change position, the map is representing

something novel. We wondered if infants as young as 10 months, who don't know about maps yet, might already have the same expectations about objects manipulated in a communicative context.

Our Methods

In study 1, infants saw videos of an actress placing objects on a table. For half the infants, the actress was displaying communicative cues while placing down the objects (eye contact and body orientation toward the infant). The other half of the infants

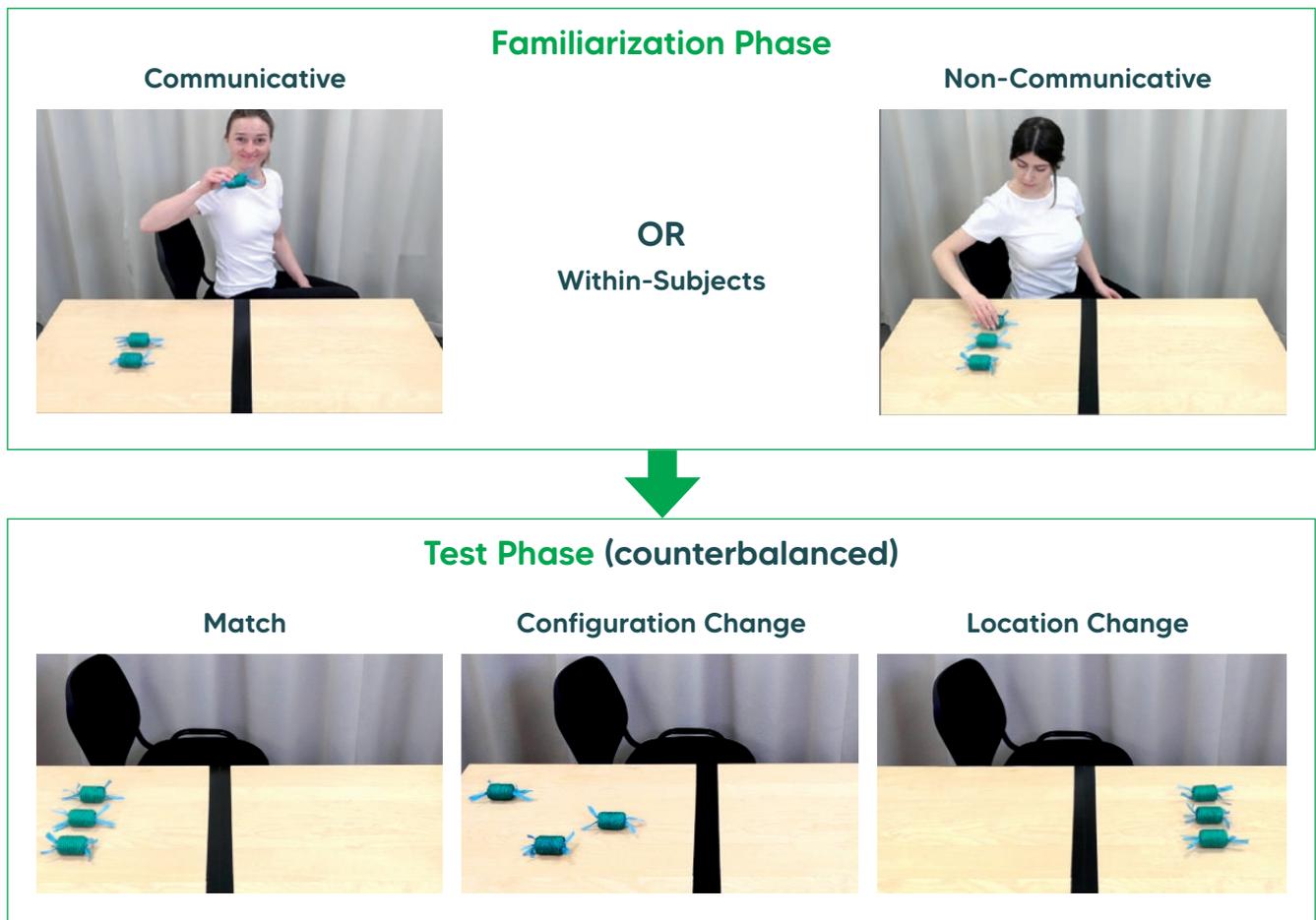


Fig. 2: Study 2—Videos of two different actresses placing objects on a table with or without communicative cues followed by no change, a change of shape or a change of location.

were in the non-communicative condition, where the same actress was putting down the objects in the same manner but with no communicative signals. The actress never spoke in either condition. After putting down three objects, which were together forming a given shape (for instance a line or a triangle), a curtain would come down and hide them for three seconds.

To see whether babies were indeed paying attention to the shapes that the objects were forming, we tested whether they detected change in these shapes. To do so, we used a looking time paradigm: the idea is that babies look longer at something that is new or surprising. When the curtain came back up, the objects were either a complete match (no change at all), or they were still forming the same shape but they looked different (for instance, they were still forming a line, but while they were green stars before they are now yellow squares), or the objects themselves were the same but the shape that they were forming was different (they are still green stars, but now they are forming a triangle). We measured how long infants looked

at these three outcomes, expecting longer looks for the change of shape in the communicative condition but no differences otherwise.

In study 2, the logic was similar, but all infants now saw both the communicative and non-communicative condition, with two different actresses. Furthermore, instead of a change in the identity of the objects, we introduced location changes, where the objects looked the same and were forming the same shape but were placed on the opposite side of the table on which they were placed originally.

The Results

Data is still being collected for both experiments. So far, it seems infants detect identity changes (e.g., green stars changing to yellow squares) in both communicative conditions, while they detect shape changes (e.g., line changing to a triangle) specifically in communicative contexts. They also seem more sensitive to location changes in the non-communicative scenarios.

LEARNING FUNCTIONS

How Babies Understand Functional Relations Between Objects



Researcher:
Maja Blesic

Babies are very curious about what objects are for and learn it remarkably quickly from others' demonstrations. However, some objects are only functional in combination with another specific object: there is an effect that depends on their joint use. For example, we cannot explain the purpose of a key without the concept of a lock.

We are interested in whether babies would learn about the relation of such objects differently from relations between objects that can be used independently. To test this, we designed an eye-tracking study, in which 15-month-old infants watched videos of objects and a hand interacting with them. The objects were completely new for our participants (Figure 1) to control for any prior experience they might have had if we had used real objects.



Fig. 1: Snapshots from the function demonstrations

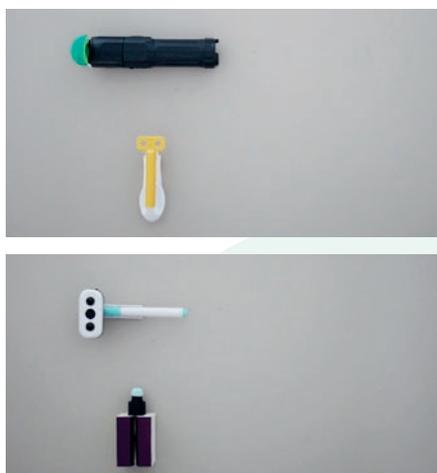


Fig. 2: Images at test

pair, the effect depended on the objects' joint use, while in the non-functional pair it depended on one object alone. During the familiarization phase, babies watched these videos one at a time.

Change Detection

After the familiarization, we had to test whether infants indeed tracked the relation between the functionally related objects. In adults, one sign of tracking functional relations between objects is that seeing them in their typical interacting position makes them easier to recognize. Based on this, we reasoned that if babies learned the functional relation, disrupting the interacting position should get infants' attention more than disrupting the configuration of two functionally unrelated objects. Thus, at test, we disrupted the spatial configuration of both pairs (Figure 2) and presented these still images to the infants. We then measured how long they looked at each pair for five seconds. If infants distinguish between functionally related and unrelat-

Together Or Separate?

During each trial, babies were shown two types of videos with two object pairs in each. In one pair—the functional pair—an effect (for example, a flashing light) occurred only when the two objects touched, the hand couldn't make the objects work separately. In the other, non-functional pair, the effect occurred when the hand touched one object alone, and nothing happened when the objects touched. Although the kinds of hand movements were the same in both conditions, in the functional

ed object pairs and learn about them differently, we would predict that they would look longer at the disrupted configuration of the functionally related pair. Our data collection is still ongoing—stay tuned for the final results!

VISUAL RECOGNITION

How Infants Use Actions To Understand Their Environment



Researcher:
Maja Blesic



Fig. 1: Structure of the trials. Each trial began with (a) a video of an action without context that could be either congruent or incongruent with the scene that followed, (b) the first image of a scene presented briefly, (c) a short unrelated image shown to interrupt any further perceptual processing of the previous scene, and (d) a second image from the same scene category but depicting a different example. Infants' looking times to the final image were measured as an indicator of surprise, and pupil size was recorded at both points (b) and (d).

One of the remarkable abilities humans possess is to simplify the big amount of visual sensory information from their surroundings into coherent concepts—such as recognizing that a space is a “kitchen” or a “bathroom.” But how do infants begin to form these concepts, and what helps them understand the meaning of the spaces around them? Our research suggests that goals and actions may play a role in helping infants grasp what an environment is about.

In a previous study, we investigated whether babies use action cues to recognize scenes. 18-month-old infants were shown videos of a person performing actions, such as eating, followed by two images depicting different scenes side by side—one related to the action (e.g., a kitchen) and one less related (e.g., a bathroom). We have shown that infants preferred to look at the scene congruent with the action they had just observed, suggesting that an action helps infants recognize the environment where this behavior typically occurs.

Concepts Versus Details

Building on these results, we conducted a follow-up study to investigate whether action information can help infants represent the scene at a categorical level such as “a kitchen” as opposed to “this particular kitchen”. We built on the idea that once people form an abstract concept, they become less sensitive to switches between examples of the same kind. For example, if one recognizes a picture as a kitchen, another image of a new kitchen will seem largely similar to them. In contrast, if one lacks the concept, a new kitchen will appear more different from the first one.

Using this logic, we again showed 18-month-old babies a short video of an action that could happen in a particular type of scene (for example, eating), then an image depicting a scene which was subsequently replaced with another picture of the same kind of scene. Sometimes the scenes shown matched the action the infants had seen beforehand (for example, the babies saw two kitchens

after watching someone eat) and sometimes they did not (seeing two bathroom pictures following eating). We wanted to find out whether the relationship between the action and the scenes would influence how babies detect the change between the two images. We measured both how long babies looked at the last scene and how their pupil size changed.

Actions Change The Way We See Scenes

In our final sample of 24 infants, we found no difference in how long babies looked at the scenes

when preceded by the related or unrelated action. However, infants' pupils were larger when the action matched the scene, suggesting increased cognitive effort. This pattern indicates that goal-directed actions congruent with a scene influence how infants process that scene. The increased pupil size for congruent action-scene pairs may reflect an effort to represent the scene abstractly. Further studies will help us understand more clearly how goal-related information helps babies form abstract knowledge of the world around them.

NAIVE BIOLOGY

The Sorting Shells Game



Researcher:
Giovanni Lumicisi

Background & Research question

Seashells can be puzzling for children. On one hand, they clearly look like natural objects, showing variation in colour, size, and shape. On the other, their striking patterns and symmetry can make them appear almost designed, even man-made. They also do not fit neatly into the familiar categories of plants or animals. How, then, do children make sense of seashells? What features do they notice most? Previous studies show that younger children often group human-made objects by shape, while older children tend to sort them by function. But much less is known about how children categorize natural objects—and especially about unusual natural items linked to animals, such as seashells.

Our Methods

In collaboration with Vienna’s Natural History Museum (NHM), we conducted an observational study as part of the museum’s exhibit program. Our aim was to explore how children at different ages categorize natural objects like shells. Presented with a large collection of seashells, children were asked to sort them by placing them into circles marked on a tablecloth. The set contained hundreds of shells varying in size, colour, pattern, and shape. After the children sorted them, we recorded the number of shells in each of the 25 circles and counted how many within each group matched in size, shape, or surface pattern. Many shells matched across more than one feature.

The Results

Across ages, children relied most heavily on shape when grouping the shells. This echoes developmental findings showing that children, and even infants, treat shape as a reliable cue for deciding what belongs in the same category (such as when

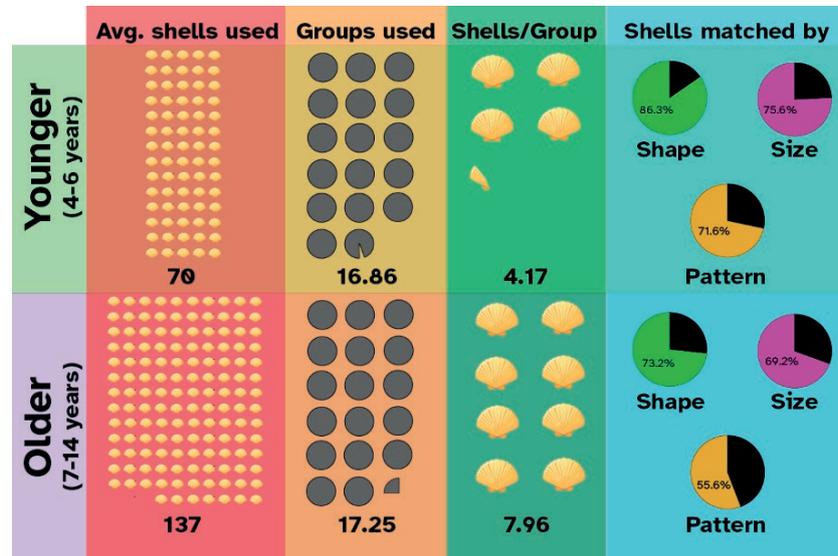


Fig. 1: Results of the sorting shells game, comparing younger to older children.

learning new words). Younger children tended to create many small groups of shells that looked nearly identical. Older children, in contrast, formed larger groups (about twice the size) that were still organized around one main feature (most often shape) but included more variation in other details, like surface patterns. These results suggest that younger children prefer narrower, stricter categories for natural objects, requiring several features to match before grouping them. Older children, by contrast, are more flexible: they can form broader categories by focusing on one or two key features while tolerating greater variation in others.

CATEGORIZATION

Was It Alive?



Researcher:
Giovanni Lumicisi

Background & Research Question

The inanimate–animate distinction appears early in infancy, but when, and how, do children come to understand the meaning of being alive? Not in a metaphysical sense, but in the practical sense of what it means for an entity to be alive: requiring sustenance and displaying behaviours that serve nourishment. When clear behavioural cues like movement are missing, children may rely on other features—such as shape, texture, or structure—to decide whether something is or has been alive. This ability seems to emerge intuitively with development, helping children grasp the domain of biology while also shaping how they distinguish natural objects from artificial ones. In partnership with Vienna’s Natural History Museum (NHM), we conducted an observational study as part of the museum’s exhibit activities. Our goal was to investigate whether children hold intuitions about the origins of unfamiliar objects, whether natural or intentionally made, based on their surface properties, and how children’s intuitions about the living vs. non-living and natural vs. artificial distinction change with age.

Our Study

The activity presented children with a set of nine pre-selected items, which they were asked to sort by following a series of branching questions (e.g., “Is/was it living?”) displayed on a large, printed roadmap. Guided by a museum staff member, children placed each item on circular markers positioned along the roadmap tablecloth, which visually represented the natural world. There were three main questions of interest, presented across two branching points. The first branching asked: (1) “Is (or was) it alive?”. The second branching asked either: (2) “Did it belong to a plant, animal, or human?” or (3) “Is it of natural origin, or was it intentionally made?”



Fig. 1: The roadmap tablecloth visually representing the natural world.

The Results

In our observational study, we found that children between 5 and 10 years old were generally good at deciding whether most objects were alive or not. Still, there were a couple of tricky cases: about one in five children misclassified a natural sea sponge or a fossilized tooth. When asked about their origins, however, those same children recognized both objects as natural, and all of them thought they were either plants or animals. For the tooth, the children who answered correctly said it came from an animal, while those who got it wrong were split between calling it natural or man-made. These mistakes are understandable: a sharp, symmetrical tooth could be mistaken for a tool, since many artifacts are symmetrical, and a sponge can be puzzling even for adults. Overall, the findings suggest that by this age, children already have an intuitive sense of how to place new objects into the broad “living” category, even if they don’t yet fully grasp what makes something alive. It also hints that they may be relying on certain visual features to guide them. Our next planned experiments will explore what those features might be.

THE ROLE OF AFFORDANCES

Infants and Plants – Handle With Care



Researcher:
Giovanni Lumicisi



Fig. 1: An experimenter presents various objects to the baby one after the other

Plants cannot run. Instead of fleeing their predators, the herbivores, plants evolved as specialist chemists. Their weapon of choice? Toxins. Each plant species produces hundreds of chemical defences to discourage being eaten. Herbivores didn't give up, though. For millions of years, they have been locked in an evolutionary arms race with plants, developing organs and enzymes to break down those toxins. And what about us humans? Unlike many herbivores, our physiology lacks dedicated detoxification systems. And yet, we have long relied on plants as tools, medicine and even food. Our main line of defence has been cultural transmission: learning which plants are poisonous, which are safer to eat, and which become safer with preparation (like cooking or removing seeds). This life-saving knowledge has traditionally been passed down through generations. Interestingly, research in developmental psychology shows that infants approach plants with caution, especial-

ly at an age when accidentally ingesting toxic plants would be most dangerous. Babies often hesitate to touch plants and look to adults for guidance before engaging with them. In our work, we explore a complementary hypothesis: maybe infants' delayed engagement with plants isn't just about recognizing plants as a special object category, but also about the relative affordances of plants compared to other natural objects. Thin leaves and stems require a precision grip (two-finger pinch) and fine motor control, whereas objects like rocks can be picked up more easily with a power grip (whole-hand grasp). Could infants' hesitation be driven by the motor skills that handling plants demand?

To Touch Or Not To Touch – That Is The Question

To explore this question, we conducted a behavioural study based on designs used in previous studies. Infants sat with their parents at a ta-

ble across from an experimenter, who presented the infant with a series of objects one by one. We measured two things: how long it took for the infant to touch the object, and whether (and for how long) the infant looked to their parent or the experimenter before making that first touch. Crucially, we adjusted the objects so that their physical features—their “affordances”—were as comparable as possible to plants. The set included: two real plants (basil and parsley), two fake plants (plastic), two novel artifacts (paper and foam objects shaped like plants, but not coloured like them), two familiar household objects (a lamp and a plastic container) and two natural objects (a large rock and a large seashell), matched in size to the plants. At the end, we also presented five smaller objects: a wooden branch, a small seashell, a small rock, a single basil stem, and a pen.

Maybe Just Too Hard To Handle?

Our results showed that infants hesitated longer before touching real and fake plants compared to familiar household objects but not compared to the other categories. Similarly, infants looked more often, and for longer, toward their parent or the experimenter when faced with real plants versus familiar objects. This pattern suggests that once we accounted for the physical features of objects, their affordances, the hesitation effect found in earlier studies became smaller, though it still persisted. In other words, affordances may play a key role. Further evidence comes from the small objects category: infants touched these much faster than the larger ones. Taken together, our results suggest that the shape and size of objects—likely due to the motor skills needed to handle them—may drive infants’ delayed manual exploration more than whether the object is a plant or not.

ANIMACY

It Moves. What's Inside?



Researcher:
Giovanni Lumicisi

Animals have internal structures that support life functions and enable their movement. Children know that—but do infants know that? A central idea in developmental psychology is that infants readily distinguish inanimate objects from animate agents. One main cue they use is self-propulsion: if an object moves on its own, it's likely to be alive. Previous work suggests that this distinction may come with further assumptions, specifically that there should be something inside living agents that makes them move.

In our study, we replicated a previous experiment, but this time with 12-month-olds. The original experiment had two goals. First, to see whether infants would be surprised if an object with animal-like features and behaviour turned out to be hollow inside. Second, to test a new contrast that earlier studies hadn't tried: self-generated movement versus entrainment (being moved by another actor). Are 12-month-olds more surprised when a self-propelled, fur-covered object is hollow than when an entrained one is hollow?

It Looks Like An Animal. It Moves Like An Animal. But Is It An Animal?

In this looking-time study, infants were shown two boxes covered in fur (one orange, one blue). One box moved on its own and even changed direction without help, making it appear self-propelled. The other was moved around by a person, so its motion clearly came from the outside. Both looked animal-like on the surface, but only the self-propelled one had two strong cues to being alive: it had fur and it moved on its own. If infants really expect objects with multiple animal-like cues to have something inside that drives their movement, then they should react more strongly—by looking longer—when the self-propelled object is revealed to be hollow compared to when the carried-along object is revealed to be hollow.

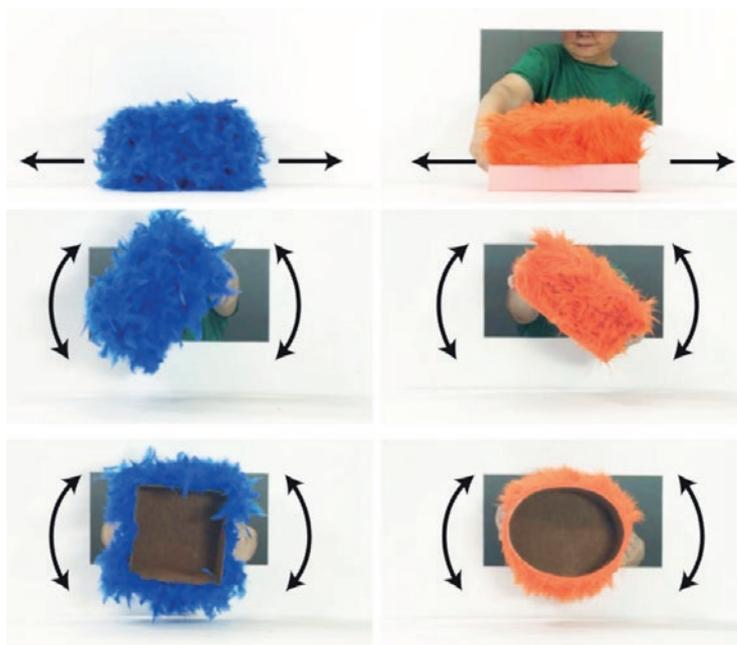


Fig. 1: Infants saw two boxes covered in fur. Here, the blue one moved on its own and changed direction without help, making it appear self-propelled. The orange one was moved around by a person, so its motion clearly came from the outside.

What's Inside Matters!

We found that babies around one year old paid more attention when a furry box moved on its own but turned out to be empty, compared to when the same box was moved by a person. This shows that even at this age, babies seem to expect that things which move on their own have something inside that makes it possible. In other words, they may already have the vitalist intuition that living things need an “inner cause” to move. Our next step is to find out whether babies are curious about what's actually inside these objects, or whether they just expect that things which move on their own should stay closed and not be open.

CAUSAL INFERENCES

Cause Meets Effect— And What Babies Already Know About Animacy



Researcher:
Beyza Gokcen
Ciftci

Our everyday lives are full of events that follow one after another, and we often detect them as causal. One common type of causal event that occurs in our environment is what we call a “launching” event. Here, one object moves until it touches another object, then the second object begins to move, for example, when a toy car hits a stationary ball, the ball may roll forward. People can interpret this event in two different ways: as a causal collision (the first object made the second object move) or as two independent movements that follow each other. These different interpretations lead to very different conclusions about the objects and our environment. Generally, some causal events can only happen when living agents are involved—for example, eating a meal requires someone who can chew and swallow. But other causal events don’t need living agents at all. For instance, the wind can knock over a vase and make it break. In this study, we explored whether babies’ expectations about cause and effect (“causality”) in

launching events depend on the livingness of the objects involved.

Surprising Agents And Actions

One way to study babies’ expectations is by measuring changes in their pupil size. Pupils tend to dilate when babies see something surprising, unexpected, or cognitively demanding. When babies are shown events partially hidden by an occluder, their pupil size can reveal what they expect to happen behind it. After the occluded event, when babies are shown two different possible outcomes, the babies’ expectations can be inferred from which outcome causes greater pupil dilation.

In our study, we explored if the type of causal agent (living or non-living) influences babies’ expectations in transport events. First, babies repeatedly saw either a human hand (living) or a toy train (non-living) approaching a blue cube. A black occluder hid part of the scene, concealing the interaction. As soon as the hand or train moved behind

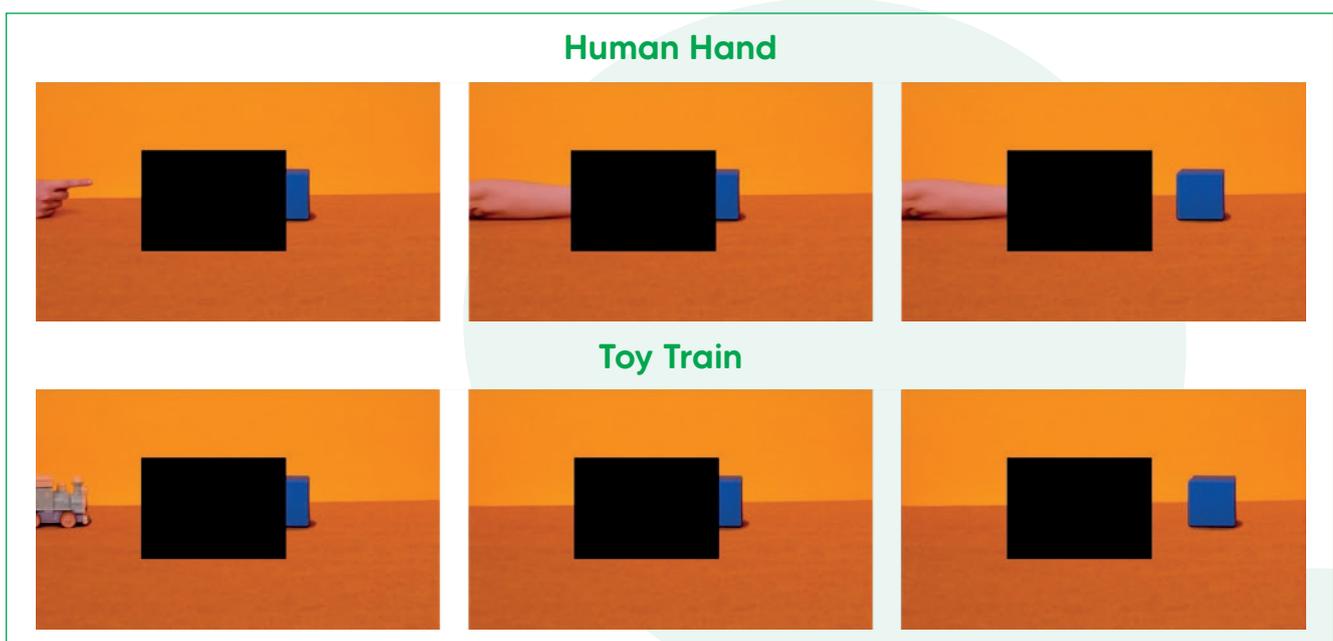


Fig. 1: Two types of causal agents approaching a blue cube with an occluder concealing the interaction.

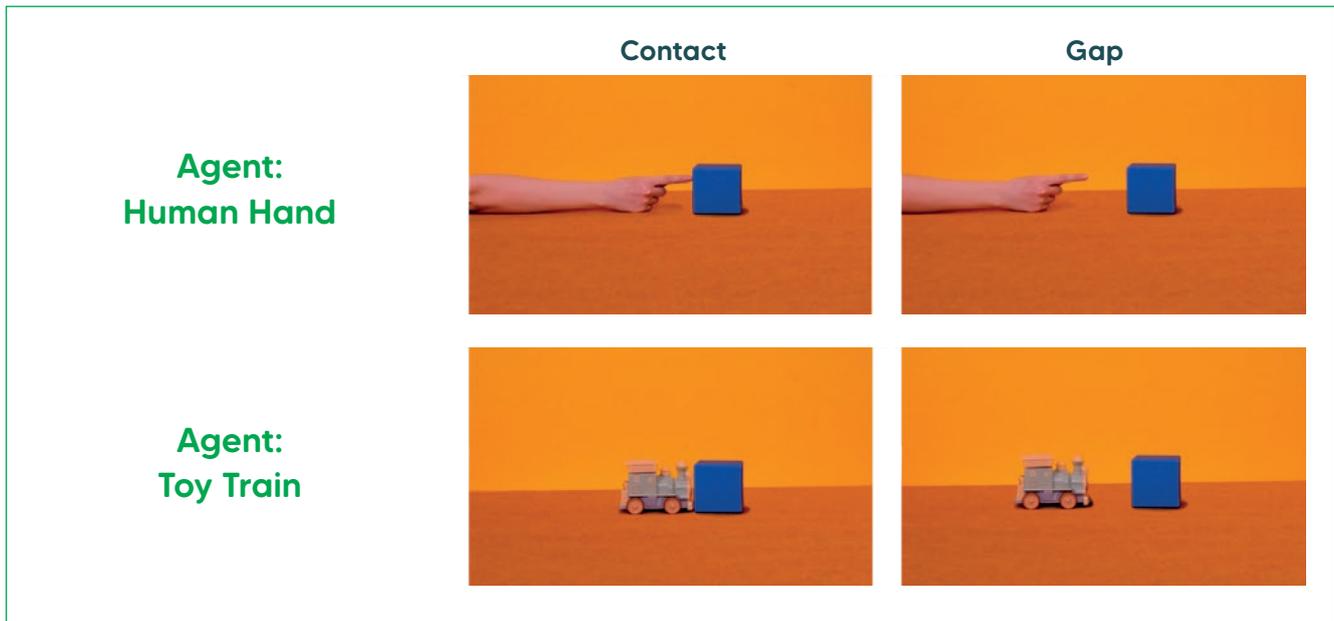


Fig. 2: Test phase with “contact” and “gap” scenes

the occluder, the blue cube began to move to the right. We were interested to see if babies expected the hidden event to involve causal contact (like a launching event) or independent movement, and whether that expectation was different when they saw a living (human hand) or non-living (toy train) agent. To answer our questions, we showed them two unoccluded scenes in the following test phase: in the so-called “contact” scenes, the agent touched the cube before the cube started moving. In the so-called “gap” scenes, the cube started moving without contact from the agent. If babies expected the agent to be the cause of the cube’s movement, they

should be surprised about the “gap” scenes and have greater pupil size.

Unexpected results

Contrary to our expectations, we found that babies were more surprised when there was contact with the blue cube, both for the living (human hand) and non-living (toy train) agent condition. This finding differs from previous results in the literature on launching events. We expect some methodological issues to be the reason for the different findings, and we are currently running a series of new experiments to test our ideas.

CAUSALITY IN MOVEMENT

Causality Detectives: Babies And Dogs On The Trail Of Cause And Effect



Researcher:
Leslie-Ann Eickhoff

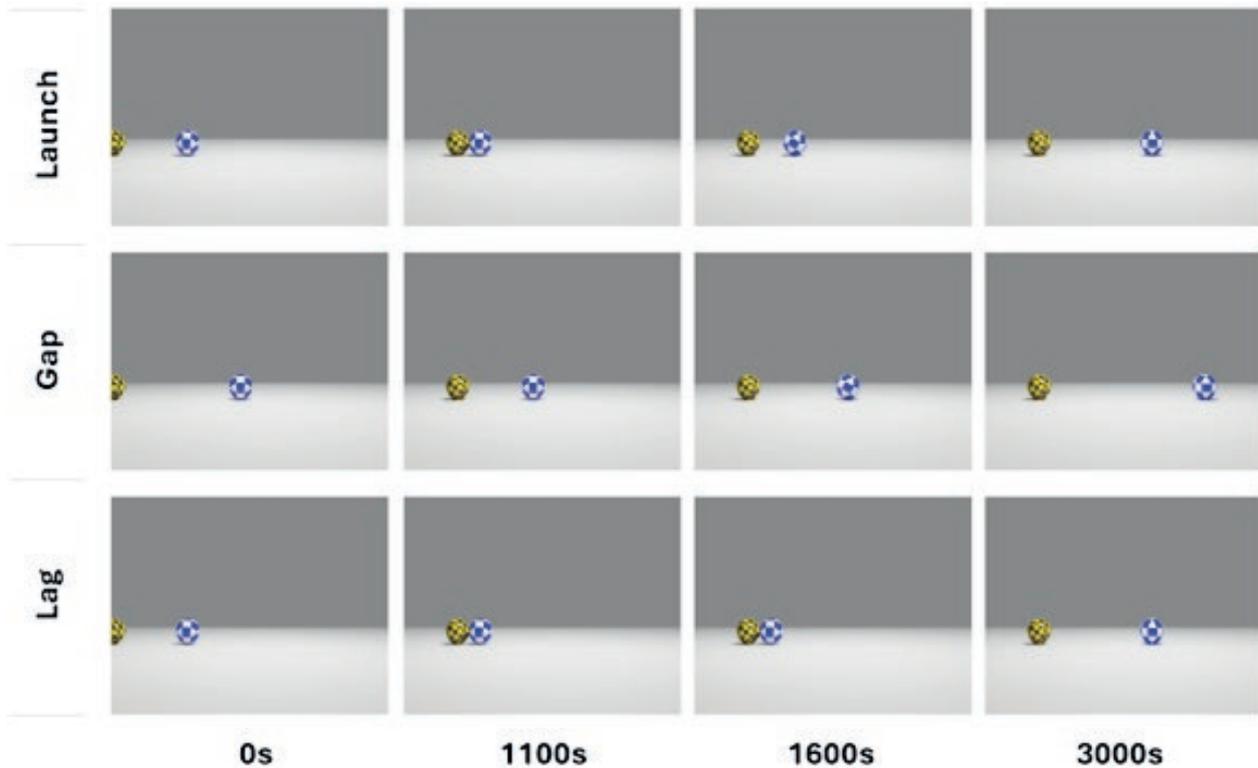


Fig. 1: Animated videos of three variations of a launching event: a causal launching event, a non-causal “lag” event and a non-causal “gap” event.

Detecting causality in movement patterns can be helpful for many animals. It allows them to predict how objects will move. Also, if there is no clear external cause for a movement, this can signal animacy—meaning a possible predator or prey might be present. An example for a simple causal event is the so-called “launching event”, where one object (A) moves towards another object (B). When A reaches B and they make contact, A stops while B starts moving away from A. Research shows that babies can tell the difference between causal and non-causal launching events based on how the objects move in space and time. Babies perceive a “normal” launching event as causal but distinguish it from similar events, for example, if there is a delay between A stopping and B moving, or if there is a visible gap between A and B. Using simi-

lar methods, there is evidence suggesting that dogs also have basic expectations of causality in launching events.

A Story About Balls, Babies, And Dogs: Who Sees What’s Really Happening?

Both dogs and babies are shown animated videos of three variations of a launching event, in which ball A moves towards ball B, then stops, and ball B starts moving: a “normal”/causal launching event, a non-causal “lag” event and a non-causal “gap” event.

To see if our infant participants can distinguish between causal and non-causal events, we are using a so-called habituation/dishabituation-paradigm: Here, 6-7-month-old babies first watch one event repeatedly to reduce the novelty and establish this

event as a baseline (“habituation” phase). After the babies lose interest in the now familiar stimulus, we proceed to the “dishabituation” phase, in which we show them all three test events (launch, lag, gap). Here, we will analyze the pupil size as an indicator of surprise, and we predict that results depend on the habituation group: If babies were habituated to the causal event, their pupils would be larger in the non-causal events than the causal event. If they were habituated to the non-causal event, their pupils should be larger in the causal event but not in the other non-causal event. For dogs, we are using a slightly different approach, but we also hypothesize that dogs’ pupil size should be larger in the non-causal (gap and lag) events than the causal event.

Research In Progress

Data collection is still ongoing; however, we hope our results will tell us which features aid babies and dogs to categorize causal and non-causal events. This will shed light on how the perception of causality might differ between dogs and humans despite having evolved in the same physical world.

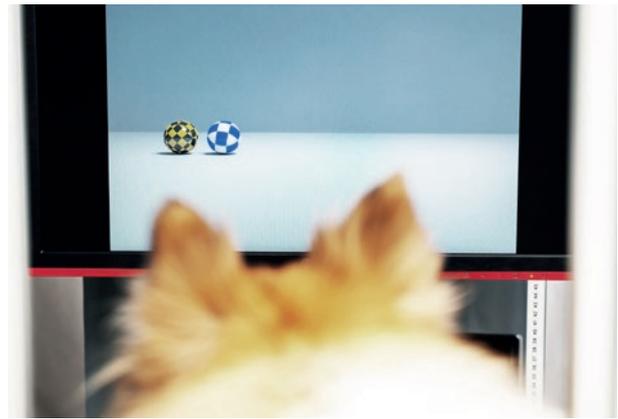


Fig. 2: A dog participating,
Image © Thomas Suchanek, Vetmeduni Vienna

PERSPECTIVE TAKING

Keeping Others' Memories



Researchers:
Ágnes Kovács, Lucrezia
Lonardo

We humans tend to pay a lot of attention to what others around us see, hear, know and think. This is true even when our social partner's perspective is completely irrelevant to the activity we're engaging in: our "social sense" is constantly active. We can even detect the impact of other people's perspective in physiological changes. Our pupils, the black part of our eyes, don't only dilate or constrict in response to illumination changes: psychologists have also found out that pupils react to psychological processes, such as when we keep an object hidden from our view in mind. For example, if we see a ball roll behind a couch, our pupils dilate, reflecting the cognitive effort that goes into keeping the ball in our short-term memory. Interestingly, the same effect can be observed if we see someone else watching a ball disappear behind the couch: our pupils will dilate, even if the ball remains visible for us. Researchers think that this is due to our unconscious tendency to take on others' mental effort to keep the presence of the object behind a cover in mind, even if the object is not hidden from our perspective. It has been suggested that this implicit perspective-taking might develop earlier than explicit reasoning about others' perspectives—maybe even in the first year of life.

Do Babies Track What Others Remember?

The current study explores whether we can also observe pupil size changes in young infants when they are tracking other people's perspective, which differs from their own. We ask if their pupils would also dilate not only after witnessing an occlusion event from the first-person perspective (when an object is hidden from the baby) but also from the third-person perspective (when an object is hidden from someone else, but the baby can still see it). We show our 8-9-month-old participants short vid-

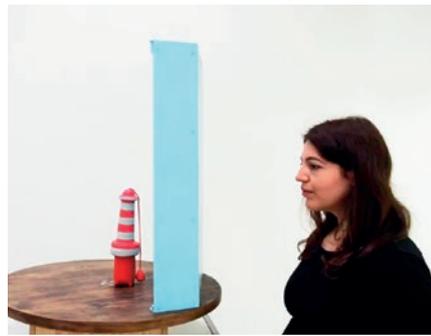


Fig. 1: The object is hidden from the girl

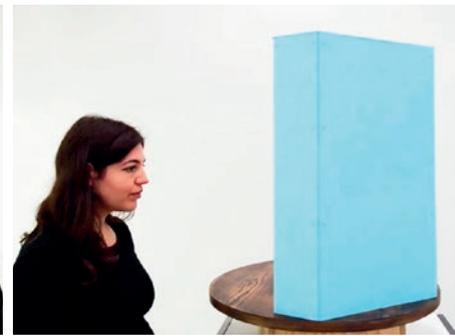


Fig. 2: The object is hidden from the baby

eos of a person looking at a toy. In some scenes, a barrier rotates to occlude the toy from the baby's perspective. In other scenes, it rotates to occlude the toy from the person in the video. We also show the babies control scenes of a hand simply taking away the toy, not requiring either the baby or the person to sustain the memory of the object being behind the cover. While the babies are watching these simple videos, we measure their pupil size with an eye-tracking device to see if any of these events elicit pupil dilation.

The Roots Of Perspective-Taking

We are also investigating whether pupil size can be used as an indicator of tracking a social partner's perspective in dogs as well. Comparative studies like these can tell us about the origins of cognitive skills and processes and how they have been shaped by genetics or our evolutionary past. Dogs are an especially interesting species to compare humans to, since they have co-evolved with humans for tens of thousands of years. Cooperation with people requires sophisticated social skills from dogs, and recent research findings suggest that perspective taking might be part of their repertoire. This study might shed more light on the similarities and differences between dogs' and humans' perspective taking. The data collection with dogs is carried out by a team at the University of Veterinary Medicine, Vienna. The study is still ongoing with both infants and canines, and we hope to share interesting results in next year's newsletter!

COMPARING KNOWLEDGE

When Others Know Better



Researcher:
Anna Kispál

EGOCENTRIC IGNORANCE

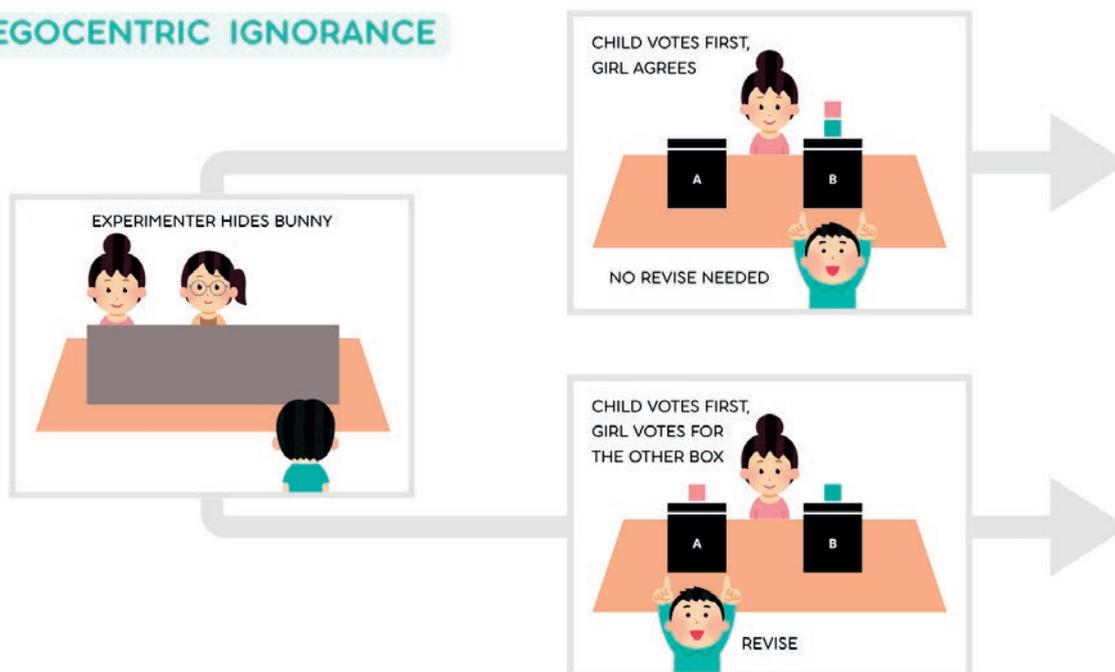


Fig. 1: The girl knows where bunny is hidden, so the child can rely on her vote

We often don't have the same knowledge as the people around us: sometimes, others know more than us, and sometimes they know less. An interesting example of this is what we call 'egocentric ignorance', which occurs when someone knows more than we do. This requires us to realize our own ignorance about an event while acknowledging that someone else is well informed about it. For example, we might not be able to see what is happening on the right side of the stage at a concert because someone tall is blocking our view. This means that we are missing whatever is happening there. However, if our friend sitting next to us can see the right side of the stage, we can ask them what is going on, thus bridging the gap in our knowledge.

What I Know, What Others Know

We would like to find out whether four-year-old children can realize their own egocentric ignorance and trust a more knowledgeable person to help them learn the truth about an event. We chose

four-year-olds for this study because many significant milestones in children's understanding of others' minds happen at this age. For example, children start to correctly respond to what are known as 'explicit false belief tasks'. In these tasks, we tell the children a short story such as Maxi's, who puts his chocolate in the blue cupboard. After Maxi leaves the room, his mum moves the chocolate from the blue cupboard to the red one. We then ask the children where Maxi will look for his chocolate when he returns. If they understand that Maxi missed the crucial event that would have changed his initial belief that the chocolate is in the blue cupboard, they should respond that, even though the chocolate is now in the red cupboard, Maxi will still look for it in the blue one. This understanding of false beliefs, perhaps similarly to understanding egocentric ignorance, requires one to understand and put into words that someone else can see the world differently from us. Children under the age of four generally find it difficult to verbalize what another person might be thinking. However, in sit-

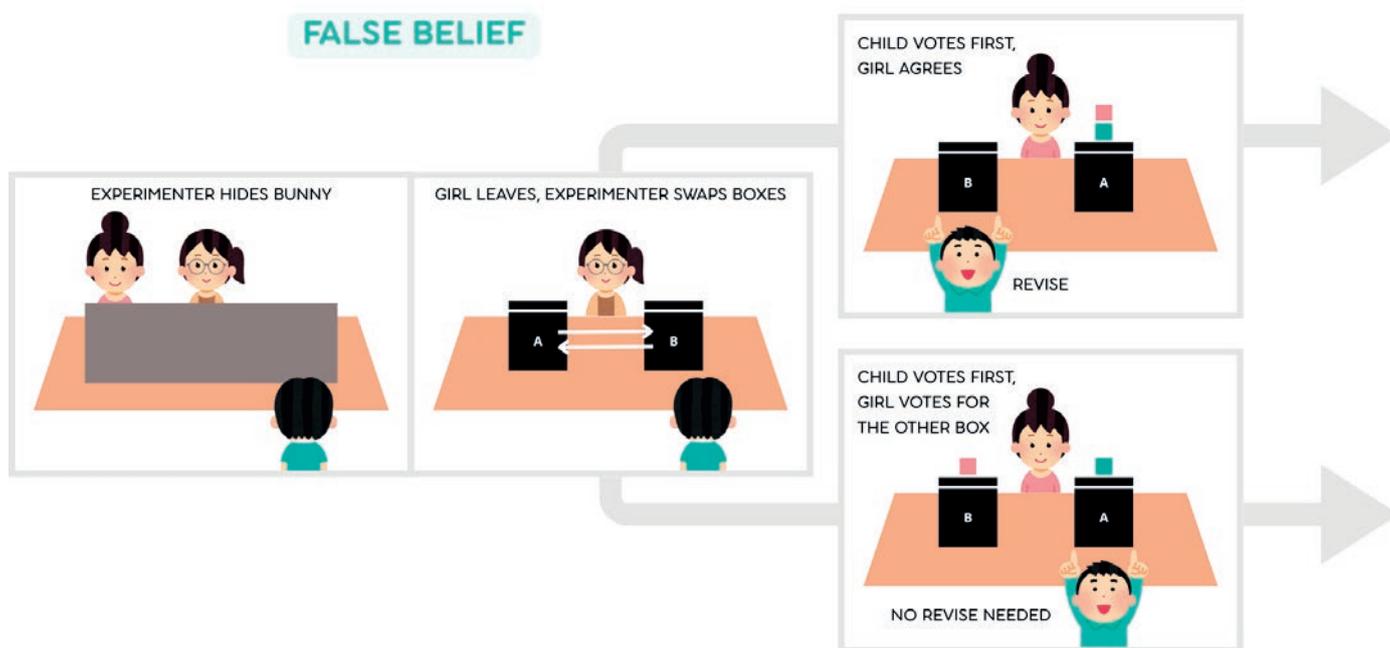


Fig. 2: The girl doesn't know that the boxes were swapped, so her vote is misleading.

uations involving egocentric ignorance, they don't have to consider someone else's outdated or false belief that's different from the reality they know. Instead, these scenarios are characterized by children lacking information about something that the other person knows everything about. Therefore, even though both situations involve the child and their partner seeing the world differently, understanding egocentric ignorance might be easier.

Finding Bunny

In the current study, we created a detective game scenario for the children. The task has five rounds, in which an experimenter (E1) hides a bunny in one of two boxes. Another experimenter (E2) and the child either witness or don't witness the hiding process. Then, both place a token in front of a box to indicate where they think the bunny is. Sometimes it's easy for the child to choose because they see the bunny being hidden, so they know where it is. At other times, they do not see the hiding and can only guess the bunny's location. Another important rule of the game is that whoever votes first about the bunny's location can change their vote after the other player's turn if they wish.

In the egocentric ignorance test trial, the child cannot see where the bunny is hidden, but E2 can. The child is always asked to vote first on where they

would like to look for the bunny. Since they did not see where the bunny was hidden, they make a random guess. The experimenter then either votes for the opposite box or the same box. If the child recognizes their own egocentric ignorance ('I don't actually know where Bunny is, but she saw where she was hidden, so she must know'), they should revise their initial random choice when E2 votes for the opposite box, but maintain it when E2 votes for the same box.

In the false belief test condition, the child is initially unaware of Bunny's location, while E2 can see the hiding. Then, E2 leaves and the boxes are swapped—an event that only the child sees. To find the bunny, the child should not change their choice if E2 votes for the opposite box, but should change it if E2 votes for the same box, recognizing that E2 now has a false belief ('I don't actually know where Bunny is, and while she saw the hiding, she did not see the boxes being swapped, so she is choosing the old, now wrong box'). Data collection is ongoing, but the results so far suggest that understanding egocentric ignorance is not easier than understanding false belief. This could mean that children struggle to take the other person's perspective as soon as two people's knowledge of a situation differs.

FLEXIBLE THINKING

How Do Babies Know What Others Know?



Researcher:
Anna Kispál

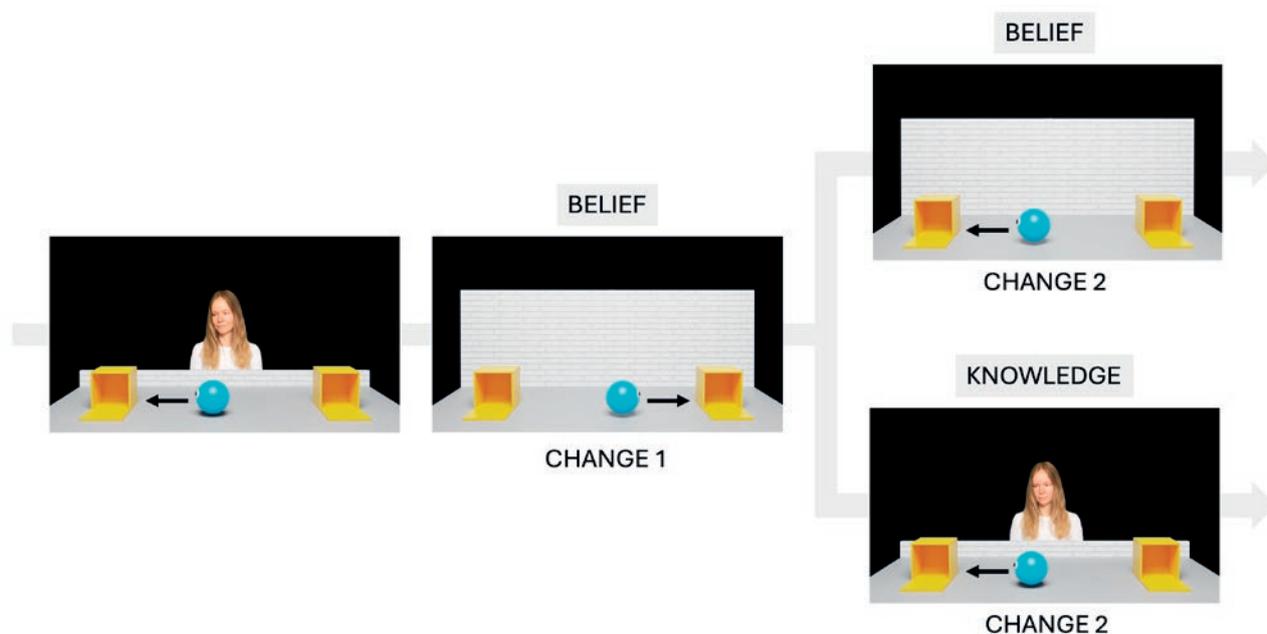


Fig. 1: Both kinds of videos start with the girl first seeing the ball moving to one location. Then an occluder comes up and change 1 is not visible to the girl. In the belief-belief video, the wall stays up during change 2. In the belief-knowledge video, the wall goes down before change 2 and the girl can see the ball moving.

Do babies come to understand that different people can know things differently? To follow how another person sees an event, we must imagine the world from their perspective, while also maintaining how we see the world. This skill, which allows us to realize how another person sees the world and track their mental states, is called Theory of Mind. Theory of Mind is widely used in our everyday lives. For instance, if our partner is looking for their car key in the living room, while we can see that the key is in fact in the kitchen, we can quickly calculate that the partner is not aware of the location of the key, and we can help them find it. Recent studies show that even babies realize when another person has differing knowledge from their own about an event.

Earlier Studies Suggest Babies Can Track Knowledge Of Others

In such experiments, 15- to 19-month-old babies watch simple animated videos about a girl tracking the movement of a ball. This ball can move

back and forth between two boxes and hide inside them. Occasionally, a wall would come up and cover the girl's view. In such cases the girl would not see the movement of the ball anymore, while the babies would still see where it goes. At this point, the knowledge the baby and the girl have about the location of the ball is different.

Belief Or Knowledge?

In our experiment, what the girl knows about the ball changes many times. In one type of video, the girl initially sees the ball moving, but then an occluder blocks her view while the ball changes position twice. In other videos, the girl also sees the ball moving, but the wall blocks her view as the ball changes position once without her seeing it. Afterward, the occluder lowers, and the girl can see the ball's new location. These videos require babies to update their understanding of the ball's location and what the girl might know.

The two videos are similar in how the ball moves. The only difference is whether the girl sees

the movement of the ball at the end or not. This means that in the first type of video, the two changes are both based on what the girl could potentially believe about the location of the ball since she does not have first-hand evidence about where it is. In the second type of video, however, during the first change, the girl has a belief about the ball's loca-

tion, and then she gains knowledge. What we are interested in is whether updating from one belief to the other belief would be easier than updating from a belief to knowledge. This would show us whether different kinds of mental states are organized into two separate systems, one for belief and one for knowledge.

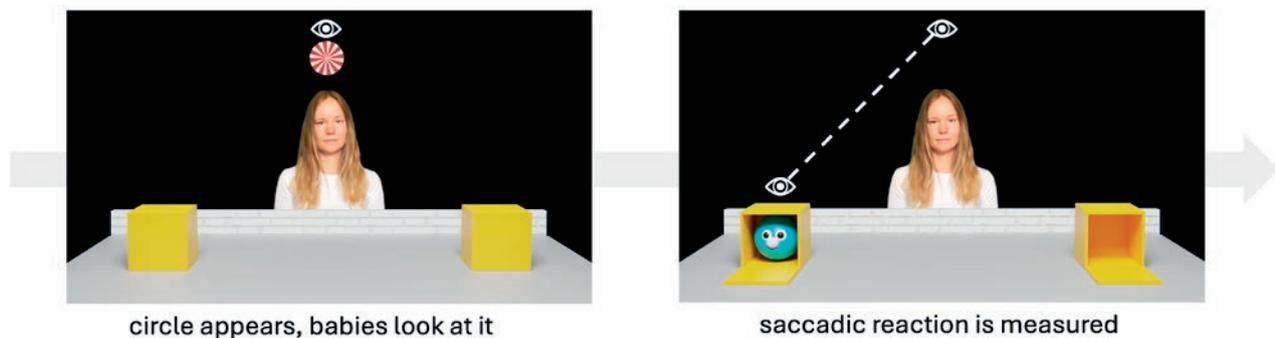


Fig. 2: At the end of each video, a circle with a sound appears, attracting the babies' attention. Then, the circle disappears, and the ball reappears on the screen. Here, we measure how quickly babies look at the ball.

tion, and then she gains knowledge. What we are interested in is whether updating from one belief to the other belief would be easier than updating from a belief to knowledge. This would show us whether different kinds of mental states are organized into two separate systems, one for belief and one for knowledge.

Measuring Eye Movements

Throughout the videos, we follow babies' eye movements with an eye tracker. At the end of each video, the babies see a circle in the middle of the screen, and then the ball reappears in its true location. Here, we measure their saccadic reaction. A saccade is a small eye movement we make when

looking from one place to another. In our experiment, we calculate how quickly babies look at the ball from the previously appeared circle. We expect that if updating between two beliefs is easier, the babies would look at the ball quicker. In case the belief-belief videos would result in faster saccadic reaction times, while belief-knowledge would be

slower, it would indicate that belief and knowledge are processed differently, potentially by two separate systems. The reaction would be slower in the belief-knowledge videos because babies would have to change between the two systems which requires more cognitive effort. Results from 19-month-old babies show that, similarly to our adult participants, they looked at the ball more quickly when watching the video that required switching from guess to guess than when watching the video that required switching from guess to knowledge. This suggests the existence of two separate systems, one for tracking knowledge and one for tracking guesses, which emerge already in infancy.

KNOWING VERSUS BELIEVING

Understanding Different Degrees Of Certainty



Researcher:
Anna Kispál

Information can be communicated in many different ways, and the terms we use influence how others interpret our sentences. By the age of four, children have learned words such as know and think, and they understand their meanings. However, comparing expressions with such words could be difficult for children, as they represent different connections to reality and convey different amounts of certainty. For instance, saying “I know” suggests that my information aligns with reality and that I’m fairly certain of this. On the other hand, “I think” could be used by someone being less certain that they have the correct information.

In our study, we explore how 4- and 5-year-old children compare different sentences containing verbs such as “know” and “see” versus “think” and “believe”. In a game-like task displayed on a tablet, we introduce children to two characters, Bunny and Hedgehog, who went to the forest to collect strawberries. Now they are heading home, but they can only take one of their baskets, and they need the child’s help to decide which basket contains more strawberries. The animals always collect one, two, or three berries, so making the decision based on the quantity information alone should be easy for children at this age. However, the animals use different verbs to inform the child about the number of strawberries they have. We measure how fast children decide which animal collected more berries and whether they are more likely to choose the animal with fewer berries in specific cases.

Less Certainty – More Difficulty

We predicted that if both animals indicate high certainty, for example, Bunny says, “I know that I have three strawberries”, while Hedgehog says, “I see that I have two strawberries”, making a decision should be relatively easy for children. We also predict that comparing the statements should be a bit harder, but still fast, when one animal thinks while the other believes the information. However, we expected that when one animal uses a verb indicating higher certainty than the other (for instance, if Bunny says, “I know I have one strawberry”, while



Fig. 1 One round in the game: After the animals indicate how many berries they have, children have to choose the basket with more berries.

Hedgehog says, “I think I have three strawberries”), and the less certain animal seems to have more berries, children would be slower to make a decision. In such cases, the higher quantity is coupled with less certainty, making the decision-making process more complex if children consider both types of information.

The Results

The results show that there were no differences between the way the two age groups responded to the different types of sentences. Children were indeed the fastest when both animals expressed high certainty (see and know). They were generally slower in situations when one animal was certain and the other was uncertain, regardless of which one mentioned more berries (for example see and believe or think and know). Children were the slowest in cases when both animals were uncertain (believe and think). Results suggest that contrary to our expectations, children overcame the complexity in cases when the higher quantity was coupled with less certainty. Instead, situations where both

animals were uncertain caused children to think more about the correct answer. This suggests that children find it harder to deal with two uncertain informants compared to only one.

We conducted a follow-up study with five-year-olds to investigate what could be the source of this. In the first study, there was a three-second delay between the children hearing the last sentence and having to give an answer. In the new version, we reduced this to one second: linguistic processing takes a short amount of time, so it is possible that the delay might have masked shorter reaction times. The reduced time between hearing the last sentence and having to answer allowed the children to respond more quickly, leaving them with less time to judge the sentences. Interestingly, the effect described above disappeared in this study. There were no differences in children’s reaction times when they had to respond immediately after hearing the second sentence, regardless of the level of certainty. This suggests that the results of the first study may have been influenced by factors other than linguistic processing.

THE INFLUENCE OF OTHERS

Do Babies Understand That Different People Could Have Different Beliefs?



Researcher:
Bartuğ Çelik

Grasping what others think and feel is a key skill that shapes how we navigate our social world. Previous research has shown that others' mental states—such as their goals, knowledge, or beliefs—or even their mere presence can influence young children's behavior. For instance, a child might ask her mother where her toy is rather than her father, because she knows her mother saw where it was placed. But can babies already understand that different people might hold different beliefs?

The Hiding Game

To explore this question with 15- to 18-month-old infants, we designed an interactive study. Two researchers played a hiding game: the Hider always placed a jumping toy under one of two cups, and the Observer tried to find it. In the next phase, infants saw the Hider move the toy to a new location. During true belief trials, the Observer stayed in the room and witnessed this change, so her belief matched reality. In false belief trials, however, the Observer left before the switch and couldn't see the new hiding place. When seeing such situations, we adults understand that the Observer still believes the toy is in the first cup. At the same time, we also know where the hidden object actually is and wouldn't confuse the other person's belief with reality. We asked whether infants would behave in a similar way and search for the toy in the correct location even when someone else thinks it's else-

where. We also wanted to find out if it matters who asks the infants where the toy is: the Hider, who changed the object's location, or the Observer, who falsely believes that the object is still in the first cup.

To test this, both types of trials concluded with the Observer returning to the room, where either the Hider or the Observer asked the child to find the toy while moving the tray with the cups in front of the baby. We measured which cup the babies chose first, how long they took to decide, and whether they showed any hesitation beforehand—such as checking the cup they ultimately did not pick or looking toward the bystander, either the Hider or the Observer, depending on who was asking the question.

Who's Looking Back At Us From The Mirror?

Additionally, we included a classical test of self-understanding—the Mirror Self-Recognition task—which has been well-known and widely used by psychologists for the past 50 years. This consists of the researcher applying a small mark on the participant's nose unnoticed and then observing the child's reaction to their mirror image: if the child touches the mark when they spot it in the mirror, they understand that they are looking at their own face. This task examines how children develop a concept of self, allowing us to explore whether infants' searching behavior becomes less influenced by others' beliefs as their self-understanding devel-



Fig. 1: The Hider puts the toy in a cup.



Fig.2: The Hider changes the toy's location.



Fig. 3: The Observer returns and asks for the toy.

ops. A strong sense of self could reduce the likelihood of errors in their searching behavior, especially when the question is asked by the Observer who holds a false belief about the object's location.

Surprisingly, the results showed that infants would rather search for the toy in the empty cup when the person holding a false belief about the object's location asked the question. In contrast, when the knowledgeable Hider asked for the toy, babies managed to find it on their first try. Additionally, when the Observer asked the question, infants displayed more signs of hesitation—meaning it took them longer to decide, they checked the unchosen cup more frequently and looked toward the bystander more often before making their final choice. However, we did not find any connection between the results of the Mirror Self-Recognition task and the babies' searching behavior.

Egocentrism Versus Altercentrism

These results suggest that babies can understand that different people may hold different beliefs, as their own searching behavior is influenced in distinct ways by the beliefs of the person asking the question. At the same time, the findings indicate that infants' searching behavior is shaped by what

others falsely believe. This could have both positive and negative implications. On the one hand, relying on others' knowledge may help infants learn more effectively about the world. On the other hand, it might make it harder for them to trust their own knowledge—especially when others, like the Observer in the hiding game, hold a false belief. One theory, altercentrism, proposes that in their early years, babies depend heavily on adults and spend much of their time observing them. Before they develop the motor and social skills needed to interact with the world independently, relying on others' knowledge can be adaptive. As they grow, infants gradually become better at learning selectively from their social partners.

While it remains an open question whether there could be a better way to measure babies' development of self-concept and its relation to being influenced by others' beliefs and perspectives in their active behavior, we plan to continue with a new version of the task. In this version, we aim to see how babies respond when a new person—who has no knowledge of the previous hiding events—asks them about the toy's location. This will help us better understand how others' beliefs influence infants' searching behavior.

Publications

3

Publications

HELPFULNESS VERSUS COMPETENCE

Children's Trait Inference And Partner Choice In A Cooperative Game

Efficient cooperation starts with selecting the right partner, someone who is willing and able to work with us toward a shared goal. We can evaluate prospective partners by observing third-party interactions: if a person makes a lot of effort and behaves efficiently in a cooperative scenario, we expect them to be helpful and competent in general. KiKo researchers Laura Schlingloff-Nemecz, Maayan Stavans, Barbu Revencu and Gergely Csibra collaborated with scientists from Japan to find out whether children also tend to choose partners who demonstrated helpfulness and competence working together with others. 5-to-10-year-old kids watched animations of two monsters cracking coconuts to collect berries. The characters differed

in skill (one being slower, the other faster) and/or helpfulness (one making selfish decisions, the other cooperating more). The children could then choose a monster to play the same game with. While even 5-year-olds recognized the relevant differences between the monsters, children only started to rely on these and choose more skilled and helpful partners from 7 years of age.

— [Find the article here](#)

Schlingloff-Nemecz, L., Stavans, M., Revencu, B., Hashiya, K., Kobayashi, H. and Csibra, G. (2025) Children's Trait Inference and Partner Choice in a Cooperative Game. Child Development 96, no. 4: 1458–1473.

A REPLICATION OF THOMAS ET AL. (2022)

Do Infants Use Cues Of Saliva-Sharing To Infer Close Relationships?

Assessing how close two people are, can be challenging for the outside observer: close relationships take many forms (for example, we have different interactions with our siblings and our romantic partners), and they are shaped by norms that vary across cultures. However, a 2022 study from Ashley Thomas and colleagues suggests that saliva-sharing might be a universal cue to identifying close relationships from infancy: 8-month-old babies already expect people who share food with one another to be close. Since this study was conducted online, KiKo researchers Beyza Ciftci, Jonathan Kominsky and Gergely Csibra aimed to replicate it in a more controlled environment, using precise eye-tracking technology. They have shown infants videos of a puppet interacting with two different people. One

person chewed the same piece of orange as the puppet, while the other played ball with the puppet. They measured where the babies looked when the puppet started crying, in other words, whom they expected to comfort the puppet in distress. The infants spent more time looking at the person who shared her food with the puppet, supporting the idea that babies infer a close relationship from such an interaction.

— [Read more here](#)

— [Find the article here](#)

Ciftci, B. G., Kominsky, J. F. and Csibra, G. (2025) Do infants use cues of saliva-sharing to infer close relationships? A replication of Thomas et al. (2022) Royal Society of Open Science 12240229.

Publications

PROSOCIAL VERSUS ANTISOCIAL

A Large-Scale, Multi-Lab, Coordinated Replication Study

The ManyBabies Project is an initiative in developmental science to promote collaborations between labs worldwide, allowing researchers to work together on large-scale studies with big sample sizes and improve replicability in the field. Within this framework, 37 labs (including KiKo) joined forces to replicate Kiley Hamlin and colleagues' famous 2007 study showing that infants can differentiate between prosocial and antisocial behavior in third-party interactions and prefer helpers over hinderers already in their first year of life. To test the reliability of these findings, 5-to-10-month-old babies across the globe were shown videos of a character struggling to climb a hill. In some scenes, a second character pushed him up, helping him to get to the top. In other scenes, a third character pushed him down, stopping him from reaching his goal. The researchers then presented the latter two characters in physical form and asked the infants which one they liked. Babies could choose by touching one of the figures. This large-scale replication study found no evidence that babies would prefer helpers over hinderers: only 50% of infants picked the prosocial character.

— **Find the article here**

Lucca, K., Yuen, F., Wang, Y., Alessandrini, N., Allison, O., Alvarez, M., Axelsson, E.L., Baumer,

J., Baumgartner, H.A., Bertels, J., Bhavsar, M., Byers-Heinlein, K., Capelier-Mourguy, A., Chijiwa, H., Chin, C.S.-S., Christner, N., Cirelli, L.K., Corbit, J., Daum, M.M., Doan, T., Dresel, M., Exner, A., Fei, W., Forbes, S.H., Franchin, L., Frank, M.C., Geraci, A., Giraud, M., Gornik, M.E., Wiesmann, C.G., Grossmann, T., Hadley, I.M., Havron, N., Henderson, A.M.E., Matzner, E.H., Immel, B.A., Jankiewicz, G., Jędryczka, W., Kanakogi, Y., Kominsky, J.F., Lew-Williams, C., Liberman, Z., Liu, L., Liu, Y., Loeffler, M.T., Martin, A., Mayor, J., Meng, X., Misiak, M., Moreau, D., Nencheva, M.L., Oña, L.S., Otálora, Y., Paulus, M., Pepe, B., Pickron, C.B., Powell, L.J., Proft, M., Quinn, A.A., Rakoczy, H., Reschke, P.J., Roth-Hanania, R., Rothmaler, K., Schlegelmilch, K., Schlinghoff-Nemecz, L., Schmuckler, M.A., Schuwerk, T., Seehagen, S., Şen, H.H., Shainy, M.R., Silvestri, V., Soderstrom, M., Sommerville, J., Song, H.-j., Sorokowski, P., Stutz, S.E., Su, Y., Taborda-Osorio, H., Tan, A.W.M., Tatone, D., Taylor-Partridge, T., Tsang, C.K.A., Urbanek, A., Uzefovsky, F., Visser, I., Wertz, A.E., Williams, M., Wolsey, K., Wong, T.T.-Y., Woodward, A.M., Wu, Y., Zeng, Z., Zimmer, L. and Hamlin, J.K. (2025), *Infants' Social Evaluation of Helpers and Hinderers: A Large-Scale, Multi-Lab, Coordinated Replication Study*. *Developmental Science*, 28: e13581.

Publications

CHILDREN'S CONCEPT OF HELPING

Young Children's Understanding Of Helping As Increasing Another Agent's Utility

Humans are prosocial beings: cooperation and helping are essential parts of our social lives. However, how children come to recognize helping behaviors despite the many superficially different forms they take is still not well known. Laura Schlingloff-Nemecz and colleagues' recent study investigated how young children's concept of helping emerges: they asked whether 3-year-olds would understand helping as making it easier for someone else to achieve their goals. Children watched animations about a fictional creature, a kobo collecting apples. Suddenly, two rocks appeared, one blocking the kobo's path and one out of the way. Two other characters then moved the rocks. Even though their actions were superficially very similar, one of them made it possible for the kobo to get to an apple faster while the other either moved a rock to a neutral position or made it more difficult for the

kobo to reach an apple. Children correctly identified the character who helped. The researchers also wanted to find out if 3-year-olds would choose to help others in a way that minimizes others' efforts to reach their goals. In a similar task, they could decide which rock to remove from the kobo's way: the one blocking the shortest path to the apple or one blocking a longer route. When both actions enabled the kobo to reach its goal, children did not differentiate between different degrees of helpfulness and chose both options equally.

— **Find the article here**

Schlingloff-Nemecz, L., Pomiechowska, B., Tatoné, D., Revencu, B., Mészégető, D., Csibra, G. (2025) Young Children's Understanding of Helping as Increasing Another Agent's Utility. Open Mind 2025; 9 169–188.



4

Varia

Research Grants

We are very happy that our researchers have been awarded prestigious grants! The funding institutions include the Austrian Science Fund (FWF), the Simons Foundation, and the Austrian Federal Ministry of Women, Science and Research (BMFWF).

Special Research Area Project

The Special Research Area project, funded by the **Austrian Science Fund FWF**, unites an interdisciplinary network of researchers from two CEU departments: Ágnes Melinda Kovács, Natalie Sebanz, and Eva Wittenberg from CEU's Department of Cognitive Science; Marc Kaufmann and Adam Szeidl from CEU's Department of Economics; and Susann Fiedler from the Vienna University of Economics and Business. The project will tackle the processes of belief formation, belief update failures, and their far-reaching societal implications.

The research brings together expertise from psychology, cognitive science, linguistics, and economics, integrating formal models with emotional, cognitive, and social dimensions, to build a comprehensive framework for understanding belief dynamics. The team will investigate how deeply rooted core beliefs, tied to identity, interact with inferred beliefs shaped by experience and reason.

Key areas of focus include examining how beliefs form and evolve from childhood to adulthood; understanding how social factors and linguistic structures influence the persistence and coherence of beliefs; and analyzing the effects of false and contradictory beliefs.

The research findings promise to shed light on the cognitive and societal processes that underpin belief persistence and change, offering insights into pressing societal challenges such as polarization, misinformation, and the erosion of social trust.

Simons Collaboration On Ecological Neuroscience (SCENE)

The Simons Collaboration on Ecological Neuroscience (SCENE) aims to bridge the gap between controlled laboratory experiments and the complexity

of real-world behavior. By investigating how internal brain models evolve and adapt in dynamic, unpredictable environments, SCENE researchers hope to uncover principles that not only explain natural intelligence but could also inform the development of next-generation AI systems. Research teams in SCENE will integrate experiments across different species, naturalistic settings, and theoretical frameworks. The collaboration is generously funded by the **Simons Foundation** and is expected to run for ten years.

Jonathan Kominsky, Assistant Professor at the Department of Cognitive Science, will also contribute to SCENE's groundbreaking research: it takes humans much longer than most species to develop basic motor skills like grasping objects or moving ourselves around. The way an infant can interact with the objects, spaces, and people around them is very different at 4 months old compared to 6 months old, or 6 months old compared to 12 months old. For the SCENE project, this offers a unique opportunity to examine how infants' internal models of the world change as they gain new ways of affecting it, and as they gain experience with their new motor skills over weeks and months.

In addition to Central European University, participating institutions include New York University, University of Pittsburgh, Yale University, University of Cambridge, École Polytechnique Fédérale de Lausanne, Johns Hopkins University, University of Oregon, University of Minnesota, Carnegie Mellon University, Technical University of Darmstadt, Google DeepMind, Columbia University, Duke University, Stanford University, and the Weizmann Institute of Science.

Marietta-Blau-Grant

The Marietta-Blau-Grant offers financial support for six- to twelve-month study periods abroad for doctoral or PhD students at Austrian universities. It serves to optimize their dissertations and to support junior researchers in their further careers. **Bartug Celik** has been awarded this grant and will spend half a year working at the **Infant Mind & Cognition Lab** in the Department of Psychology at Yale University directed by Dr. Nicolò Cesana-Arlotti.



Events

ORF

Kiko Was Featured In Nano, The Science Magazine



Last summer, an ORF film team came to CEU to interview participants, researchers, and staff about our studies in developmental psychology. It was very exciting to be filmed while testing, and of course, we had families who volunteered with their kids. They were super patient and cooperative, even the camera team was highly impressed!

You can watch the short report [here](#) (from minute 20:00).

CDC TRIP

Trip To Balaton



Last year's trip took us to Lake Balaton in Hungary to beautifully remodelled horse stables turned into comfortable guest homes. We had an amazing time swimming, kayaking, and sailing. Some did yoga under the trees and received a massage on the premises. Others visited a nearby fortress, went for wine-tasting, or shopped at the farmer's market. We thank Edit, our coordinator, and Andrea, our former coordinator and owner of the guesthouse, for organising this varied trip!

If you would like to visit the place, we can highly recommend it!

Find more information [here](#).

Events

DEBIAS CENTER

Launch Event Of Interdisciplinary Grant On Belief Systems



On September 29th, 2025, the launch event for the FWF-funded Special Research Area interdisciplinary grant: “Why do coherent belief systems tolerate incoherence? Belief update failure in society”, and of the newly founded interdisciplinary unit at CEU **The Center for Belief Updating and Debiasing (CEU De-Bias)** took place.

A roundtable discussion with the project’s Principal Investigators **Ágnes Melinda Kovács** and **Adam Szeidl**, journalist and author **Ingrid Brodnig**, and Ákos Szegőfi, PhD student at the Cognitive Science Department, was moderated by **Susann Fiedler**. The panel explored why individuals and societies often maintain conflicting beliefs and what this reveals about how we process information.

DAUGHTERS

Kiko Research Center Takes Part In The Wiener Töchertag 2025



The **Töchertag** is an initiative by Deputy Mayor and City Councilor for Women's Affairs Kathrin Gaál and the Vienna Women's Service in cooperation with the Vienna Chamber of Commerce and the Vienna Board of Education. It is inspired by the “Take your Daughter to Work Day” that was introduced in the 90s in the US. The main idea is to familiarize girls with professions in which women were underrepresented. In Vienna the initiative started in 2002 and has since grown in number of participants (3000 girls) and participating institutions (200 companies).

Last year we participated for the first time and welcomed a group of interested girls aged 15 to 18 years to the research center. The team consisting of Jonathan Kominsky, our PhD students, and research assistants prepared a program that shed light on questions such as: How do you study a baby? How do researchers come up with a research question? After introducing them to several research methods, the girls came up with a research question themselves and designed an experiment based on everything they heard during their visit. Together with the team, they discussed possible challenges and learned how much there is to consider when preparing a study.

Cooperations

COMPARATIVE STUDIES

Collaborations With The Clever Dog Lab At Vetmeduni



Image © Thomas Suchanek, Vetmeduni Vienna

Since last year, the collaborations with the **Clever Dog Lab** at Vetmeduni have grown. We are happy to contribute to these comparative studies conducted by Leslie-Ann Eickhoff, Lucrezia Lonardo and Christoph Völter. You can read more about the results in our research summaries section!

NHM

Closer Cooperation With The Natural History Museum



From fall 2024, the long-standing partnership with Vienna's Natural History Museum (NHM) entered an exciting new phase. Our teams began co-designing activities linked to the museum's exhibits that not only engage children but also provide experimental data on key questions in developmental psychology.

A central focus of this collaboration is on children's intuitions about the biological world. What kinds of intuitions do children spontaneously generate about biological entities? Which aspects of the living world do they readily grasp, and which require explicit instruction? Investigating these questions serves a dual purpose: deepening our understanding of the developing mind and generating insights to improve educational materials for teaching children about biology.

Cooperations

DEEPENING CONNECTION

Teach For Austria



We are very happy that the cooperation with **Teach for Austria** deepens every year!

Like in the year before, the CDC collaborated with Teach for Austria (TfA), a non-profit organization dedicated to training individuals to serve as mentors and teacher assistants in underprivileged areas. This partnership aims to help TfA's mission to equalize educational opportunities for all children.

Liza Vizmathy, a member of the CDC and co-founder of **MindThings** (a non-profit organisation focused on bringing cognitive science to education), led several workshops for TfA fellows working in kindergartens and school, focusing on findings relevant to childrens' learning and self-regulation skills. Once more, the workshops proved to be a two-way learning street. Liza shared insights from scientific research, while fellows highlighted their on-the-ground strategies. During the discussions, TfA fellows devised strategies inspired by the research presented, exploring ways to enhance and broaden their teaching methods related to the topic.

EEG STUDY

First EEG Study In Collaboration With iSearch



Last year we ran the first EEG study in collaboration with Yilin Li who is a postdoctoral researcher with the iSearch lab. Many parents were excited to try this method with their children to study how infants explore their environment. More specifically, this project investigated what happens when infants' predictions about the world are contradicted and how this shapes their learning and exploration. Read more about this study in our research summaries section.

Social Engagement

EDUCATIONAL ACTIVITIES

Lab Tours For Highschools



We did it again! Another class of 11th graders came to learn about developmental psychology, and our team demonstrated not only methods but also studies that we were currently conducting in the lab. This way both teachers and pupils could get an up-to-date impression of modern cognitive science focusing on infants.

MULTILINGUALISM

Parent-Infant-Cafés At The Kiko Lab



We are very happy about the continuation of our Parent-Infant Cafés! Again, enthusiastic moms from the Vienna Family Network reached out and helped organize three (!) parental lectures on three different topics: multilingualism, screentime, and self-regulation. The idea behind this format is to link scientific findings to practical applications. Liza Vizmathy spoke about scientific findings pertaining to those topics, and parents could pose questions that arise in their daily life as a parent.

If you are interested in a particular topic and would like to organize a similar event, feel free to reach out to us!

Defenses

PHD STUDENTS

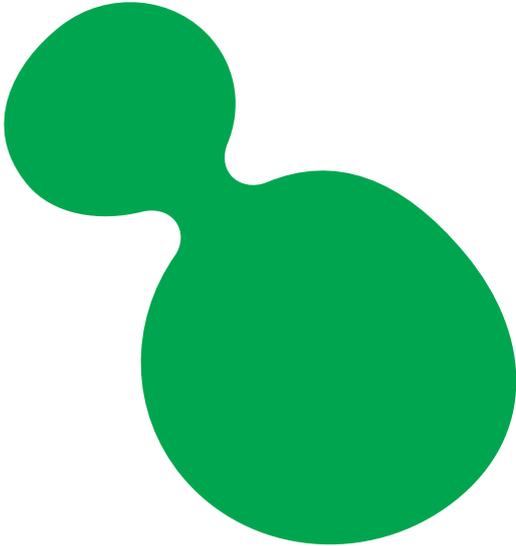
Doctoral Thesis

Congratulations to Magdalena Roszkowski who studied how children acquire plural expressions in her PhD thesis titled *The Acquisition of Plural Expressions. How children learn to navigate the logical space in the realm of pluralities*.

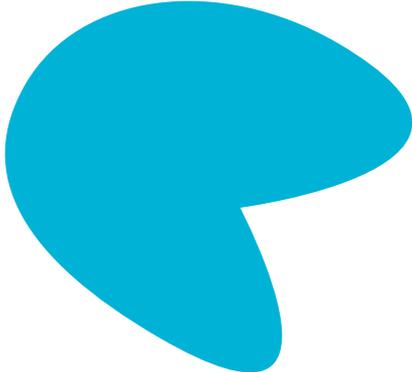
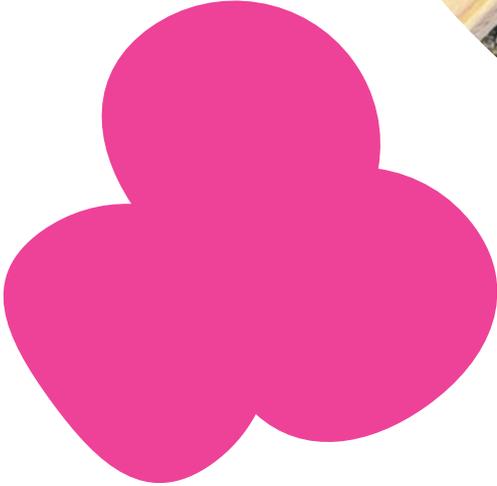
We also congratulate Balint Varga on the successful defense of his doctoral thesis! *His empirical work* investigates whether infants can intuit when and why others pursue information, exploring the foundations that allow infants to interpret epistemic actions in their social environment.

Finally, we are very proud of our colleague Katharina Wenig who received her PhD in cognitive biology on the topic of the ontogeny and measurement of emotional contagion in common ravens (*Corvus corax*).





See you
soon in
the lab!



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