THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Early Cognitive Development Centre
School of Psychology

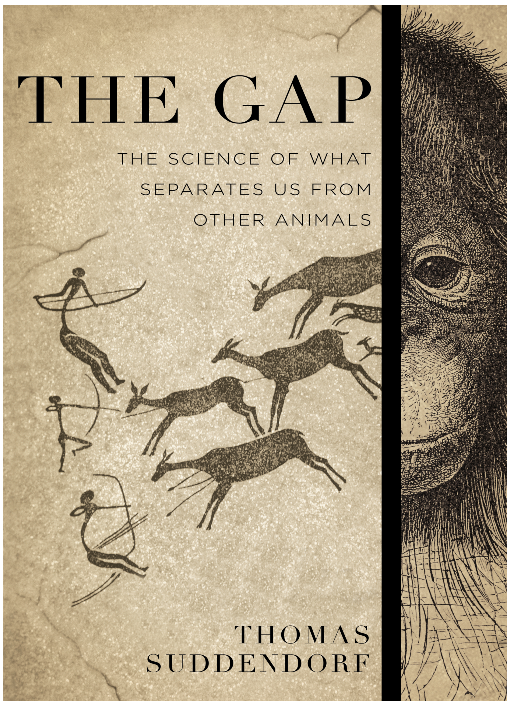
2013 Edition

2013 ECDC NEWSLETTER

Prof. Thomas Suddendorf's new book on the development and evolution of human minds.

In this Issue:

ECDC's Professor Thomas Suddendorf launches new book



After over a decade of work on the development of mental capacities in human children at the ECDC and on the capacities of chimpanzees and other animals in various zoos, Professor Thomas Suddendorf has published a book that makes the science of what separates us from other animals accessible and entertaining for a general audience.

Thomas is deeply grateful to all the parents and children who have donated their time to our research over the years (and is happy to sign any copies at your next visit). For details about the book please visit :

http://thegap.psy.uq.edu.au/

"Beautifully written, well researched and thought provoking, The Gap searches for key differences between humans and the rest of the animal kingdom, and presents a balanced overview of the current status of our understanding of the mental abilities of animals. I found it fascinating and strongly recommend it to everyone who is curious as to how we have evolved to become the dominant species in the world today. Thank you, Thomas Suddendorf, for writing this book."

—Jane Goodall, UN Messenger of Peace

"Suddendorf takes the reader on a journey through evolutionary time, back to the beginnings of our hominid ancestors and through to modern human children, to answer the deepest question our species alone can ask: what makes us different to all other species? … A provocative and entertaining gem of a book."

—Simon Baron-Cohen, Professor of Developmental Psychopathology, Cambridge University

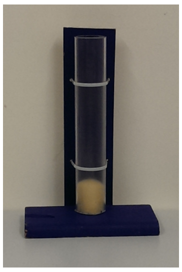
"A reader-friendly examination of the great gap that exists between human beings and the rest of the animal world and an explanation of how our minds came to be unique… His descriptions of the many ingenious tests to assess the capabilities of various species and of human children make for fascinating reading…A fine example of science made accessible for general readers, combining history, personal anecdotes, clear accounts of research and a broad picture of human evolution."

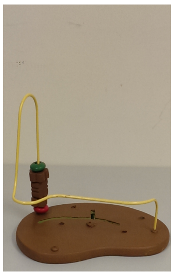
—Kirkus Reviews

2013 ECDC Research Results

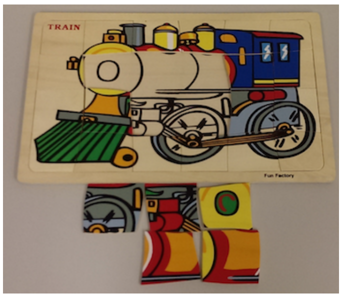
As 2013 draws to a close, all of us at the ECDC would like to sincerely thank you for participating in our studies. You have not only increased our knowledge about children's development, but also assisted our students in obtaining their degrees at both the postgraduate and undergraduate levels. We hope you enjoy reading about our recent research results for 2013 in this edition of our newsletter.

Do 4-year-old children keep trying when it's irrational?





"4-year-olds were more likely to switch to the easier version after spending longer trying to complete the difficult version."



Humans are not always rational. We know from previous research into adult decision-making that we will sometimes continue to invest in endeavours despite the presence of better alternatives.

Although the decision to continue should be logically based on future benefits we often base our decisions on irrelevant factors (such as prior investments). This can lead businesses and governments to invest large sums of money into failing projects, yet we don't know why humans develop such biases.

To see whether children are susceptible to this bias (known as the sunk-cost effect), we created a number of behavioural tasks that required the expenditure of time and effort. More specifically, children were presented with three different tasks to complete and instructed to complete them before a sand-timer had completed a cycle.

After investing a pre-determined amount of time into each task, children were then presented with the opportunity to switch to an easier version of that task. The interesting question then is, will children switch to an easier task after having already spent time completing a difficult one?

The results showed that children were more likely to switch to the easier version after spending longer trying to complete the difficult version. This is in stark contrast to what is observed in adults and suggests that young children are not susceptible to the sunk-cost effect.

Unlike previous studies, we used tasks that required children to make decisions in a behavioural context. This will hopefully lead to a number of other exciting studies, looking at how humans become rational (or irrational) decision-makers.

Do 3- to 5-year-old children value objects that are special to them?

"When do 3- to 5-year-olds decide to value objects that are special to them?"

We are interested in determining at what point in typical development children begin to use cues that we adults take for granted.

Many objects and ideas in our daily lives are special - from sentimental keepsakes to religious icons, from gifts we have received to books we hold dear.

The way we treat these objects is often different from the way we treat other more ordinary objects.

While many adults take for granted the ability to determine an object's 'specialness' or status by observing how others interact with it, it is less clear at what point children begin to do the same.

Our study - 'The Development of Ritual' - is an attempt to pin down when children do this, and what in an adult's behaviour indicates this quality.

Why don't 2-year-olds recognise themselves on video?

Young children typically start to recognize their reflections in mirrors by the age of 18 to 24 months old. However, past research has revealed it takes another year before they self-recognize in live video. Given that a child's live-video image and their mirror image provide them with equivalent information about their appearance, this discrepancy seems surprising. The current study therefore aimed to find out why 2-year-olds have difficulty with live video.

It has been proposed that children may simply not have sufficient exposure to live-video feedback. In order to test this, we asked half the parents who participated in the study to provide their child with experience with their live-video image before they came in for testing. This involved parents doing a daily activity with their child in front of a live video for 3 minutes everyday for 2 weeks.

We asked them to do any of the activities they usually do with their child in front of a mirror, such as the brushing of teeth.

The other half of the children did not receive any additional exposure.

Both groups of 2-year-olds were then tested on the live-video version of the standard test of self-recognition, known as the mark task.

This task involves placing a sticker on the child's forehead without their knowledge and then presenting them with a live-video feedback. Children demonstrated live-video self-recognition if they reached for the sticker on their head upon seeing their marked image. We predicted that 2-year-olds who were given prior experience with their live-video image would be able to recognize their image more easily than the toddlers who did not receive prior exposure.

The results of the study provided preliminary support for this idea, with two thirds of the toddlers who received experience demonstrating live-video self-recognition. This is more than was observed in the control group (50%) and in previous research on live-video self-recognition (35%).

This suggests that the apparent video deficit is little more than a function of differential prior experience.

"2-year-olds who receive prior experience with live video recognise themselves on video more easily."

Do 4- and 5-year-old children follow the majority?

It has long been established that children have the propensity and motivation to imitate those around them, but how do children decide who to copy from? We know that one strategy children use is to copy the majority, but to what extent does this bias persist?

This study investigated 4 and 5 year old children's willingness to copy the method used by a group of 3 adults to open a puzzle box and attain a reward compared to the method used by a single individual.

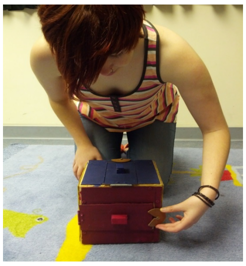
We manipulated whether the group was successful or unsuccessful (the individual was always successful), and whether children were affiliated with the group (we did this by having children wear stickers that were the same as those worn by the group).

Overall, the results showed that children are more likely to copy a group rather than an individual - but only if what they do is successful.

Children will not copy an unsuccessful method, even when they are affiliated with the group.

This indicates that children do not just blindly copy: from a young age they have the ability to critically appraise their surroundings and make decisions irrespective of social pressure.

"4- and 5-year-old children preferred the group method when the group was successful."



Can 3-year-olds recognise changes to their image in a mirror?

"3-year-olds are able to recognize themselves in the mirror based on previous exposure to a novel outfit."

An integral component of human life is the way in which we think about ourselves in the past and in the future; for instance, remembering whether or not we turned off the stove or thinking about how we might spend the weekend.

Key to this behaviour is an understanding of our personal continuity through time, i.e. that these activities will be happening to *us*, albeit temporally removed from our present state.

Research suggests that children develop the capacity to think about themselves in the past and future between the third and fourth year of their life, which represents a crucial step towards independence and a coherent, stable identity.

One way to measure how children think about themselves is to use a test of visual self-recognition: the mirror mark test.

This involves exposing children to a mirror, placing a sticker in a visible location on their face (or leg) while they are distracted, and then seeing if the children are able to recognize themselves in the mirror and retrieve the sticker. However, passing this test only tells us that children know what they look like *currently*.

This study sought to test whether 3-year-olds were capable of recognizing their mirror image based on a memory of what they *did* look like, thus representing an ability to link aspects of the past to the present.

To do this, children were placed in a pair of puffy track pants while sitting in a high chair.

The children were then given 30 seconds to examine the pants they were in. This allowed the children to update their expectations of what they now looked like.

After this period, the children were taken out of the chair to a separate room to play another game for 3 minutes. Following this, children returned to the testing room and were surreptitiously placed back into the chair and the puffy track pants (without actually seeing them). Then, while children were distracted, I would place a sticker on one of their legs. A mirror in front of the chair was revealed and children were given an opportunity to inspect their image.

Two thirds of the 3-year-olds tested were able to retrieve the sticker after a 3-minute delay between familiarizing themselves with the puffy pants and completing the self-recognition test.

This suggests that children may develop a capacity to think about themselves in the past in a visual capacity at around 3 years of age.

This contrasts directly with previous research which has used delayed-video footage and found that only 4-year-olds could recognize themselves, suggesting that children may have difficulty interpreting different visual mediums and pointing to previously undocumented abilities in young children to link the past and present.

We are now on Facebook – Like us now!

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We currently have studies in progress involving children aged from newborn to 5 years. If your child/ren falls into any of these ages, we would love to have you participate in our studies again. If you have friends with children aged from newborn to 5 years who might like to get involved, we would appreciate it if you would refer us to them.
Please visit us on Facebook to see what studies we are currently running and if you are interested in participating with your child, you can also register your interest on our website below.

Do newborns imitate as a way of communicating with their parents?

Previous research has suggested that newborn imitation serves a social function, and that it is a fundamental capacity for various later developments in social cognition. Other competing interpretations for newborn imitation include that it is a reflex triggered when a particular stimulus is viewed, or that it reflects an increase in arousal response that is driven by visual interest.

We expected that, if imitation of tongue protrusion is related to social interaction, then infants who showed greater imitation at one week of age would respond more strongly to a measure of social interaction at 18 weeks of age.

Our longitudinal imitation project (see article below), demonstrated that infants at one week of age poke-out their tongue when they see an adult doing the same. In a current project, we used more in-depth analyses to examine whether this imitation behaviour serves as a social function.

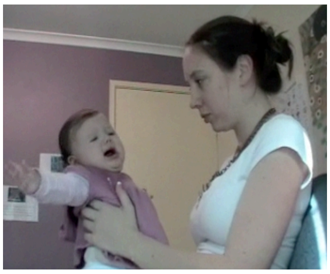
This study employed a common early, non-verbal measure of infant-caregiver interaction patterns: the still-face procedure.

In this paradigm, the caregiver interacts with their infant until, upon a signal, they stop interacting and present a neutral facial expression (known as the "still-face"). Infants typically respond by frowing, whimpering, and looking away from their caregivers, suggesting that they have an understanding of natural interaction patterns and have some expectations of caregivers when engaging in communication with them.

Behaviour of infants in the longitudinal study that completed both imitation at one week of age, and the still-face procedure at eighteen weeks of age, were correlated to see if a relationship between the two measures exist. No relationship between the two measures was found, suggesting that imitation at one week of age is not related to infant-caregiver social interaction as measured by the still-face procedure.

This suggests that imitation might be a reflexive or arousal response.

Normal-interaction and still-face



"It may be possible that infant imitation may be a reflexive or arousal response."

Can newborns be trained to copy their parent's gestures?

Previously, researchers have argued that newborns are born with an ability to imitate adult gestures, specifically tongue poking and mouth opening.

In order to try and understand more about whether this ability is innate or learned, my study involves training newborns on gestures to see if they are more likely to imitate these gestures after a two-week training period. In my study, infants and parents are separated into one of three training groups: Tongue Poking, Mouth Opening and Hand Grasping.

Firstly, the baby's baseline imitative abilities are tested when they are approximately one-week-old.

Over the next two weeks, parents practice their gestures (either Tongue Pokes, Mouth Opening or Hand Grasps) with their baby. When the baby is approximately three-weeks-old their imitative abilities are tested again. If imitation is learned, we would expect that infants in the Tongue Poking group, for example, would be more likely to imitate an adult poking their tongue than infants in the Hand Grasping group.

This research will help us to determine what role parents might play in the development and frequency of neonatal imitation.

Siobhan is still looking for parents and babies to participate in this study. If you or someone you know is pregnant and interested, please contact Siobhan on 0430 383 983 or s.kennedy@uq.edu.au.

"It may be possible that infants are not born with the ability to imitate but rather learn this skill in the first few weeks of life."

Can 2 to 4-year-olds solve a problem with two solutions?

"Preschool children are beginning to understand that single events can have more than one outcome and prepare appropriately."

Adults know that undetermined events can have more than one outcome, and so we are able to prepare for these alternative outcomes. We pack the car with towels, hats and sunscreen for a successful trip to the beach, but we also carry a spare tyre in case of a breakdown on the way.

This study examined children's ability to prepare for alternative outcomes of a very simple event.

The apparatus was a pipe with a single opening at the top and two openings at the bottom. When a bouncy ball was dropped into the top of the pipe it could come out either of the two bottom openings. 2-, 3-, and 4-year-old children were instructed to catch the ball to stop it from falling out of the pipe and rolling away.

We were interested in whether children covered one or two of the bottom holes when trying to catch the ball.

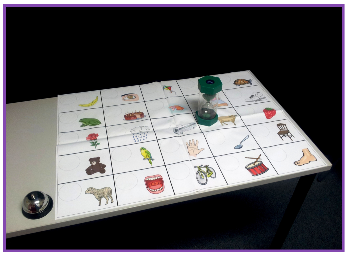
Nearly all 2-year-olds covered only one hole when trying to catch the ball, even over a number of trials.

Most 3-year-olds learned to cover two holes, and most 4-year-olds covered two holes even on the first trial.

These results suggest that preschool children are beginning to understand that single events can have more than one outcome and prepare appropriately!

In the future we will be testing animals with the apparatus to see whether this is a uniquely human capacity.

When can children remember to perform a future task?



"Preschool children will struggle remembering to perform tasks in the future unless there is an external cue (such as a parental request!) to remind them."

Adults often have to remember to perform tasks in the future, such as buying milk next time you are at the shop or getting the washing out of the machine at 10:00. Sometimes we are reminded of these tasks by external cues (e.g. the shop, or a clock), but sometimes we are able to remind ourselves internally. This study examined children's ability to remember to perform a task in the future in the presence and absence of external cues.

The basic task required 3-, 4-, and 5-year-old children to ring a bell whenever a 1-minute sand-timer had completed a cycle. Sometimes the children could see the sand, but other times the sand was hidden by a sock placed over the timer and the children had to guess when they *thought* the timer had finished.

Sometimes this was the only task, but other times the timer was moved around a picture board and the children had to name the pictures while also remembering to ring the bell.

Nearly all 3-year-olds remembered to ring the bell when the timer was uncovered and there was no ongoing task, suggesting they were able to internally maintain the instructions for over 1 minute! When the timer was hidden or being moved around the board, however, most 3-year-olds did not remember to ring the bell and improvements were seen throughout the age groups.

On the hardest task, when the timer was covered and being moved around the picture board, even the 5-year-olds struggled, with less than half of them remembering to ring the bell.

These results suggest that preschool children will struggle remembering to perform tasks in the future unless there is an external cue (such as a parental request!) to remind them.

Do children know how learning can improve their skills?

Young children are avid information seekers, as any parent of a child who won't stop asking questions can tell you! As they move into the school years, however, children will be required to favour information that will be useful in the future.

Children should study and do their homework because the information learned will be useful on a specific future test or at specific points during their adult lives. This study examined children's ability to seek information with a specific future episode in mind. Two paradigms were used to answer this question.

In the first paradigm, 4- and 5-year-old children were introduced to a number of puppets, each living in a different coloured box (red, blue, or yellow). The children were invited to guess the puppets' favourite food in return for a sticker but found they were unable to do so correctly. Two of the boxes were packed away, and the children were told that they would return to the room later on to sit in front of the remaining box again. 15 minutes later in another room, the children were asked which puppet's food they would like to know. 5-year-olds, but not 4-year-olds, tended to choose the correct puppet (the one that lived in the appropriate box).

In the second paradigm, 4- and 5-year-old children were shown some blue cards and red cards with animal characters on the front. On the back were pictures of these animals' favourite foods or favourite toys. The children were told that, in the future, they would have to guess what was on the back of the blue cards or the red cards in return for stickers. Before this, however, they were given the chance to study the cards for one minute. 4-year-olds tended to study all the cards equally, but 5-year-olds tended to focus on the cards that would be played with in the future.

Overall, these results suggest that 5-year-olds are better than 4-year-olds at seeking information that will be useful in the future - a very helpful skill to have as they begin school!

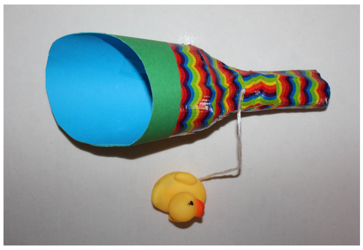
"5-year-olds are better than 4-year-olds at seeking information that will be useful in the future - a very helpful skill to have as they begin school."

Can 5-year-olds improve their coordination skills by watching themselves or others on video?

Video self-modelling (VSM) interventions, which involve watching oneself on video performing at one's best, have proved particularly effective at improving a range of skills and behaviours. Much of this research has been done in the behavioural arena, and VSM has proved effective in promoting a range of pro-social behaviours and skills, particularly in young children with autism. Little, however, has been done to date with normally-developing young children in a physical skill context.

In this study, 5-year old children completed three 'tricky' games designed to be at a difficulty level greater than they could normally achieve. Two were hand and eye coordination type tasks, and a third was a ball and cup game which would typically improve with practice. VSM videos were then created using the feed-forward paradigm to depict each child performing perfectly in the target game. The other-model video was created with an adult woman performing a game perfectly. After completing the games in session one, children then went home to watch each video for seven days before returning to play the games again. In line with previous research, it was expected that children would improve most in the game in which the VSM video was used, followed by the game in which someone else was performing well.

Contrary to expectations, no differences in the level of improvement were found whether the children watched themselves performing well in the game, another person performing well, or no video at all. No support, therefore, was found to suggest that video-modelling using the self, or another model could be useful for the acquisition of new physical skills in young children.



"It doesn't appear that 5-year-olds acquire any new physical skills by watching themselves or others perform well on video."

"18-month-olds are able to tell the difference between correct and incorrect counting sequences, even before they can count all by themselves"

" 18-month-olds who are raised in ***multilingual*** *environments may come to grips with the logic of counting at an earlier age than those who are exposed to one language."*

15 to 18-month-olds Understanding of Counting

How early does it emerge?

Being able to understand the logic of counting is an important skill that must be acquired before children learn more advanced mathematical knowledge.

In this study, we are interested in the early development of the ability to recognise the difference between correct and incorrect counting. Specifically, do infants understand that, when counting is done properly, the count words are always recited in the same invariable order?

Last year, we started to investigate this question by introducing a new button-pressing game. Infants were given the opportunity to press the buttons on their own, and we observed whether they had a preference for the correct counting sequence over the incorrect one, or vice versa.

So far, we've had 15- and 18-month-olds take part in the Magic Buttons Game and we've found that the 18-month-olds show a strong preference for the correct counting sequence, but the 15-month-olds do not seem to prefer one over the other.

This suggests that the ability to differentiate between correct and incorrect counting sequences emerges at around 18 months of age, even before infants can reliably count on their own.

By recognising and paying attention to the correct counting sequence, infants most efficiently develop the full-fledged ability to count on their own.

How deep is their understanding?

At 18 months of age, infants are able to distinguish between correct and incorrect counting sequences in their native language. But does this mean that, by 18 months of age, infants have a true understanding of the *logic* of counting? That, in any language, correct counting entails reciting the count words in the same order each time?

To answer this question, we've had an additional group of 18-month-old infants take part in the Magic Buttons Game, but this time, we presented them with correct and incorrect counting sequences that were recited in Japanese.

When 18-month-olds were presented with the Magic Buttons Game in Japanese, those who were raised in a monolingual, English–speaking environment did not differentiate between the correct and incorrect counting sequences. Interestingly, however, we found that 18-month-olds who were raised in a multilingual environment did seem to differentiate between the correct and incorrect counting sequences that were recited in a language to which that they had no exposure (i.e., Japanese).

By 18 months, therefore, infants who are raised in a monolingual environment prefer to hear the correct counting sequence over an incorrect one when recited in their native language, but this is likely due to their sensitivity to what is familiar to them.

In contrast, infants of the same age who are raised in a multilingual environment seem to have a deeper understanding of the logic of counting—that, when counting is done properly, the count words are always recited in the same invariant order.

Count words across different languages are associated with each other at an abstract level, namely, by the core concept of counting. Infants who are exposed to counting sequences in more than one language are faced with the challenge of deriving this concept from an early age.

This could be a reason for why infants who are raised in multilingual environments may come to grips with the logic of counting at an earlier age than those who are exposed to one language.

What do 18-month-olds know about counting sets of objects?

Learning to count is very important, as counting underpins all of the mathematical reasoning children do in primary and high school. This study looked at whether or not infants can recognize the difference between puppets that correctly and incorrectly count sets of objects.

Following from some of our previous research, we used a fun button-pressing game to find out if infants understand that, when we count, the last count word has a special status, in that it represents the total amount of items.

Two buttons, one orange and one blue, controlled a TV screen, such that pressing the buttons cued different video clips of hand puppets counting fish. When one button was pressed, the TV played a video in which a cockatoo puppet counted a set of fish, and after counting, said the correct number of fish (e.g., “1,2,3,4… There are 4 fish!”). When the other button was pressed a parrot puppet counted a set of fish, but at the end, said the incorrect number of fish (e.g., “1,2,3,4… There are 3 fish!”).

When allowed to press the buttons on their own, we found that 18-month-olds preferred to press the correct button more than the incorrect button.

However, when we tested 2- and 3-year-olds, we found that these infants did not prefer either button; instead they enjoyed viewing the puppet counting correctly as much as a puppet counting incorrectly.

Interestingly, we found that 2- and 3-year-old infants who preferred to watch the parrot count incorrectly showed signs of understanding that the parrot had, indeed, said the incorrect number after counting. We think this might be because these older infants have a more nuanced knowledge of the importance of the last count word, and thus is fascinated by the unfamiliar incorrect counting (we know the little children enjoyed being tricksters!)

Counting with your children is important from a young age, and our research shows that even at 18 months, babies are beginning to understand counting!

“Counting with your children is important from a young age, and our research shows that even at 18 months, babies are beginning to understand counting.”

When do infants consider what others are thinking”

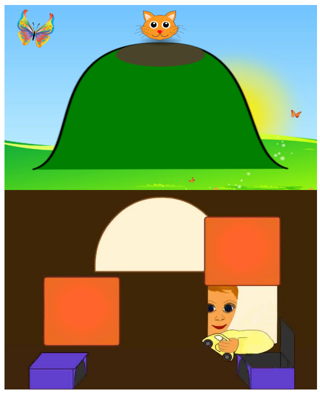
Infants from a very young age are able to predict how others will behave based on what they have seen in the past. For example, if an infant sees his or her mum place the car keys in a box by the door and retrieve them on numerous occasions when leaving the house, the infant might begin to look towards the box, even before mum reaches into the box.

But what if one day, when mum is not watching, the infant sees his or her sibling move the keys from the box into dad's shoe. Now, the infant knows that the keys are not in the original location anymore, but mum does not—so where would we expect mum to look when leaving the house?

As adults, we understand that what *I* know can be different to what *you* know, and this understanding allows us to accurately predict how others might behave.

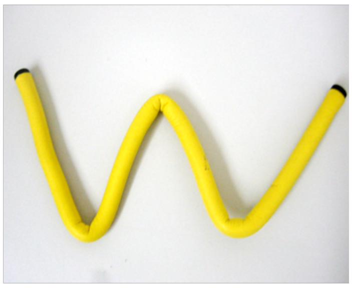
In this example, therefore, we would expect mum to search for the keys in the box, even though the infant knows otherwise. The question is, *at what age do infants understand that other people's knowledge may differ from their own?*

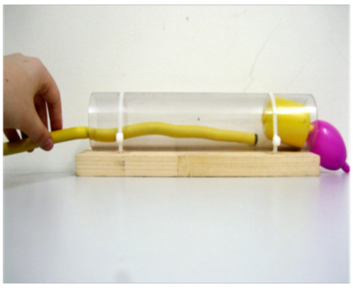
To investigate this question, we showed 15-month-olds to 2½-year-old infants cartoon videos of situations similar to the one described above. Since infants cannot tell us what their predictions are, we observed their eye gaze as a measure of their predictions. For example, if the situation above was presented as a cartoon video, would infants look more towards the box or towards dad's shoe when mum gets ready to look for the keys? Does this change depending on the infants' knowledge of the keys' location? We are currently in the process of finishing up the data collection for this study.



“At what age do infants understand what others are thinking?”

Can 4-year-olds make tools?





"4-year-olds may learn to solve a problem on their own by seeing a demonstration of what type of tool is needed to complete a task".

While children are competent tool users, there has been little research on whether children can make, or innovate tools.

The present study, therefore, aimed to investigate tool innovation in 4-year-old children.

Previous studies have found that children struggle greatly with innovation tasks. We, therefore, wanted to see what would happen if children were given a variety of different tasks requiring different types of tool making, and included a demonstration in which children observed a similar tool being used to complete a task.

The present study included two types of tool making; reshaping (where an object has to be bent from its initial shape into another) and subtraction (where parts of an object have to be removed).

A good example of the type of task used is the Horizontal Tube task (see picture). Children were shown a horizontal tube with a toy inside it and a malleable tool bent into a "W" shape. In order to push out the toy, children had to reshape the tool to make it straight.

Given that children have previously struggled with innovation tasks, we also wanted to see if showing them a demonstration of what type of tool was required to complete the task would help them.

For example, for the Horizontal Tube task, children saw a puppet using a long, straight piece of pipe to push the toys out. This was designed to show them that they had to make a long, straight tool.

Half of the children saw this full demonstration before given the chance to innovate in the four tasks.

The other half of the sample saw a partial demonstration. This was identical to the full demonstration, however, the puppet completed the action on the floor next to the apparatus. This was included so we could see if children need to see the actual goal completed to help them innovate.

Children performed equally well in both subtracting and reshaping tasks. Also, while the innovation rates in the present study were much higher than previous studies, suggesting that both demonstrations helped innovation, we did not see an overall difference between the two.

An unexpected observation, however, was that children appeared to be getting better at innovation across the four trials.

Upon further investigation, we found that this was being driven in those children in the Full Demonstration condition with these children innovating more in the fourth trial compared to the first trial.

Given that the order of the four apparatuses was counterbalanced, this suggests a true improvement. Interestingly, no improvement was seen in the Partial Demonstration condition.

This finding suggests that while children indeed struggle with innovation, seeing a demonstration of what kind of tool is required AND seeing it used to complete the goal of a task may help children learn to become more innovative.

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