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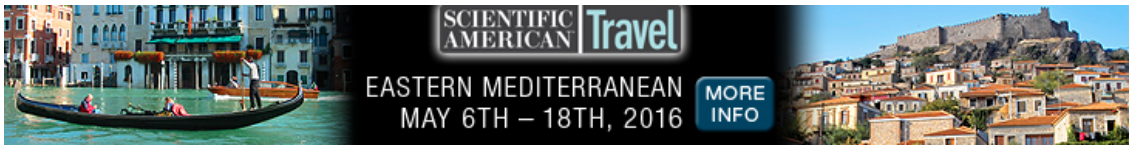

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The Advantages of Being Helpless

Human brains are slow to develop--a secret, perhaps, of our success

By Melody Dye | February 9, 2010 | 0

Jamey Ekins

At every stage of early development, human babies lag behind infants from other species. A kitten can amble across a room within moments of birth and catch its first mouse within weeks, while its wide-eyed human counterpart takes months to make her first step, and years to learn even simple tasks, such as how to tie a shoelace or skip a rope, let alone prepare a three-course meal. Yet, in the cognitive race, human babies turn out to be much like the tortoise in Aesop's fable: emerging triumphant after a slow and steady climb to the finish. As adults, we drive fancy sports cars, leap nimbly across football fields and ballet stages, write lengthy dissertations on every conceivable subject, and launch rockets into space. We have a mastery over our selves and our environments that is peculiar to our species.

Yet, this victory seems puzzling. In the fable, the tortoise wins the race because the hare takes a nap. But, if anything, human infants nap even more than kittens! And unlike the noble tortoise, babies are helpless, and more to the point, *hopeless*. They could not learn the basic skills necessary to their independent survival even if they tried. How do human babies manage to turn things around in the end?

In a recent article in *Current Directions in Psychological Science*, Sharon Thompson-Schill, Michael Ramscar and Evangelia Chrysikou make the case that this very helplessness is what allows human babies to advance far beyond other animals. They propose that our delayed cortical development is precisely what enables us to acquire the cultural building blocks, such as language, that make up the foundations of human achievement. Indeed, the trio makes clear that our early vulnerability is an evolutionary "engineering trade-off," much like the human larynx—which, while it facilitates the intricate productions of human speech, is actually quite a precarious adaptation for anyone trying to swallow safely. In the same way, they suggest, our ability to learn language comes at the price of an extended period of cognitive immaturity.

This claim hinges on a peculiar and unique feature of our cognitive architecture: the stunningly slow development of the prefrontal cortex (PFC). While other animals' brain regions development in synchrony, in humans, the development of the PFC lags far behind that of other areas. The PFC is the swath of gray matter that makes up the anterior frontal lobes, and functionally, it appears to be heavily implicated in a wide-range of sophisticated planning and attention driven behaviors. Indeed, it is often referred to as the "control" center of the brain. One of its main functions appears to be that of selectively filtering information from the senses, allowing us to attend to specific actions, goals, or tasks. For this reason, "cognitive control" tasks are thought to be one of the best assessors of PFC function and maturity, and they are tests that young children reliably, and ignominiously, fail.

The Stroop task serves as a simple assessor of PFC function in adults. The task involves naming the *ink* color of a contrasting color word: for example, you might see the word "red" written in green ink, in which case you have to say "green." The task is tricky since it demands that we override a well learned response (saying "red" in response to seeing the word red) with a new response specific to the task (naming the conflicting ink color). Tricky or not, healthy adults can successfully complete the task with only minor hesitation.

Children, with their immature PFC's, are a different story. Typically, the younger children are, the worse they are at solving Stroop-like tasks, and under the age of four, they outright fail them. While young children are sensitive, apt learners, and often appear to fully understand what is being asked of them, they are unable to mediate the conflicting demands present in these sorts of tasks, and thus fail them, time and time again. Three-year olds simply cannot direct how they attend to or respond to the world.

Thompson-Schill and her colleagues suggest that this *in*ability to direct attention has important consequences when it comes to learning about uncertain events. To explain this, it helps to imagine you are playing a guessing game: You have to choose one of two options, either A or B, one of which leads to a prize, and one of which does not. After a few rounds, you notice that about three fourths of the time the prize is at A, and the rest of the time it is at B, so you decide to guess "A" 75 percent of the time and "B" 25 percent of the time. This is called probability matching, and it is the response pattern most adults tend to adopt in these circumstances. However, if the goal is to win the most prizes, it is not the best strategy. In fact, to maximize the number of correct predictions, you should always pick the more frequent outcome (or, in this case, always pick "A").

Interestingly, if you were playing this kind of guessing game with a toddler, you would see that they would employ the maximization strategy almost immediately. Thompson-Schill and her colleagues suggest that this is because toddlers lack the cognitive flexibility that would allow them to alternate between A and B. Since young children are unable to selectively switch between responses, they can *only* choose the most likely option. Fortunately for them, in this guessing game scenario, maximization is the right choice.

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While it may not be immediately obvious what this has to do with language learning, it just might have *everything* to do with it, because language relies on conventions. In order for language to work, speakers and listeners have to have the same idea about what things mean, and they have to use words in similar ways. This is where toddlers come in. Young children, as it turns out, act like finely tuned antennas, picking up the dominant frequency in their surroundings and ignoring the static. Because of this – because toddlers tend to pick up on what is common and consistent, while ignoring what is variable and unreliable – they end up homing in on and reproducing only the most frequent patterns in what they hear. In doing so they fail to learn many of the subtleties and idiosyncrasies present in adult speech (they will come to learn or invent those later). However, this one-track learning style means that what they do learn is highly conventionalized.

The superiority of children's convention learning has been revealed in a series of ingenious studies by psychologists Carla Hudson-Kam and Elissa Newport, who tested how children and adults react to variable and inconsistent input when learning an artificial language. Strikingly, Hudson-Kam and Newport found that while children tended to ignore "noise" in the input, systematizing any variations they were exposed to, adults did just the opposite, and reproduced the variability they encountered.

So, for example, if subjects heard "elle va à *la* fac" 60% of the time and "elle va à fac" 40% of the time, adult learners tended to probability match and include "la" about 60% of the time, whereas younger learners tended to maximize and include "la" all of the time. While younger learners found the most consistent patterns in what they heard, and then conventionalized them, the adults simply reproduced what they heard. In William James' terms, the children made sense of the "blooming, buzzing confusion" they were exposed to in the experiment, whereas the adults did not.

Children's inability to filter their learning allows them to impose order on variable, inconsistent input, and this appears to play a crucial part in the establishment of stable linguistic norms. Studies of deaf children have shown that even when parental attempts at sign are error-prone and inconsistent, children still extract the conventions of a standard sign language from them. Indeed, the variable patterns produced by parents who learn sign language offers insight into what might happen if children did not maximize in learning: language, as a system, would become *less* conventional. What words meant and the patterns in which they were used would become more

idiosyncratic and unstable, and *all* languages would begin to resemble pidgins.

While no language is completely stable, there is a balance to be struck between an individual's expressivity and the conventions that underpin it, and children clearly play an important role in maintaining this balance. Children may learn the established idiosyncrasies of their community (saying "eggplant" instead of "aubergine" or "parking lot" for "car park," for example), but they do so only because these forms are stable in their input. They are unlikely to adopt highly unusual or idiosyncratic forms or sequences that they've heard only rarely, and when they themselves make errors, they are similarly unlikely to incorporate these errors into their language use over the long run.

Individual societies are built upon these kinds of cultural and linguistic conventions, and a vast array of them. As social animals, human babies must somehow master not just "culture and language," but the specifics of *their* culture, and *their* language. Explaining how babies manage to learn all of this information is a formidable task. The research reviewed here reveals one advantage that nature may have conferred on human infants: when it comes to convention learning, children's inability to think unconventionally or flexibly may be of huge benefit. Indeed, a number of neurological studies suggest that autistic children, who often exhibit marked language delays and idiosyncratic language development, experience a massive overgrowth of the prefrontal cortex over the first two years of life. It might be that if children were able to think like adults, they simply could not learn conventions in the same way, if at all. If that were the case, we might not be winning any races after all.

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ABOUT THE AUTHOR(S)

Melody Dye is a freelance writer and researcher in cognitive science at Stanford University in the Cognition, Language & Learning Lab. With Professor Michael Ramscar, she studies language acquisition, development and use.