Our crudest outbursts can unravel ancient links between words and thoughts. They may even hint at our ancestors’ first utterances.

It was the first time one of us swore at Dad. My older sister was 13, and had been looking forward to the school trip to Washington DC for years. It was the pinnacle of middle school – a long bus ride to the capital, two days visiting important sites and an overnight stay in a hotel with her friends.

But as I eavesdropped from the next room, I realised my parents were telling her she couldn't go. A severe asthmatic, she had just recovered from pneumonia, and it wasn't worth the risk. Their voices rose, and she pleaded, implored, screamed. Finally, she thundered past me and ran up the stairs. Dad followed, furious. Then something surreal happened. As he reached the bottom of the stairs, she whirled around to face him from the top: “Fuck you!” she said.

It was as if she had stopped time.

Few words can freeze the moment in quite the same way – yet researchers had been shy about studying swearing. Now, as they overcome their qualms, they are finding that our crudest outbursts could answer questions about the relationship between words and thought. They might even offer clues to humankind's first utterances.

It has long been known that the brain processes swear words differently from more genteel vocabulary. As people lose aspects of higher cognition because of injury or neurodegenerative disease, their ability to issue volleys of profanity often remains intact. That may be because even though the cortex,
which we rely on for more complex (and polite) speech, may be damaged, curses hunker down in areas such as the amygdala and basal ganglia, which are often left intact.

These areas emerged at an earlier point in evolution, and across many species they house automatic responses to stress; if you electrically stimulate this circuit in a cat it will cause an ear-splitting howl. But in humans, the same stimulation "results in rage accompanied by swearing", says psychologist Steven Pinker at Harvard University. It's as if we have overwritten our basic impulses with our saltiest language.

That might explain why curses can be so attention-grabbing, sometimes in our favour. A study of public speaking, for instance, found that individuals who punctuated their remarks with the odd obscenity were viewed as more persuasive in their arguments. "If someone's not listening to you, get some swear words in there – they say, 'Hey, listen up!'" says Catherine Caldwell-Harris, a psychologist at Boston University.

That strategy is best used judiciously. When an expletive is fired at us, it can feel like a slap to the face. "It's almost like a physical act," says psychologist Timothy Jay at the Massachusetts College of Liberal Arts in North Adams. Surprisingly, that visceral feeling might explain another mystery of cursing – why we swear when we are in pain.

The insight came to Richard Stephens in the maternity ward. The psychologist was beside his wife at the birth of their child. "She was in agony, and she was swearing her head off," he says. But each time the contractions eased, she apologised to the doctors and nurses. She needn't have, Stephens recalls. "Swearing is a completely normal part of giving birth," the hospital staff told them.

His wife's outbursts prompted Stephens, of Keele University, UK, to ask why we eff and blind when we are in pain. So he asked some undergraduates to take part in an ice water test. They had to hold one hand in freezing cold water while reciting words from one of two lists – either polite descriptive words, or rude exclamations.

It turned out that those shouting the obscenities held their hands in the icy water for longer and reported experiencing less pain. To rule out the possibility that the colourful language was simply distracting them, Stephens also measured heart rate – which increased when students were issuing aural affronts.

That suggests the swear words were triggering the body's fight or flight response, which is what you might expect of words that tap into the brain's "rage circuit". If so, the physiological changes that normally accompany the fight or flight response, such as the surge of adrenaline, might explain the increased pain tolerance, as the body prepares itself for possible injury. Stephens's most recent experiment, published last year, showed that playing violent video games also increased pain tolerance in the same way – supporting the idea that the fight or flight response lies behind the effect.

But even our sharpest barbs can be dulled by overuse. When Stephens's team ran the same ice water test on people who routinely swear, cursing was less effective at reducing their pain, compared with those who swore less often.

Probing the nature of swearing isn't just an exercise in excusing potty mouths; comparing the effects of different swear words could illuminate the link between language and thought, for instance. Along these lines, Caldwell-Harris has investigated the way bilingual people curse. She has found that obscenities spoken in their native tongue are more offensive, and prompt a sharper physical reaction, as measured by changes in skin conductance, than those spoken in their second language – even though they were fluent. For this reason, she thinks the power of swear words comes from associations forged at a young age in the mother tongue. "When we use language, everything that is going on around us becomes associated with those phrases," she says.

Hostility and lust

A similar explanation might apply to the work of Jeff Bowers and his team at the University of Bristol, UK. He recently investigated whether euphemisms – such as "f-word" or "c-word" – provoke the same physical response as the terms they dance around. They don't. "You can say the same thing by using a euphemism and it doesn't offend you," Bowers says. "The form of the word
Caldwell-Harris and Bowers both think that this illuminates the role of language in the brain. In the past, many philosophers and scientists had thought that language is simply a kind of "mental algebra", where words just stand in for ideas but are effectively interchangeable. But the fact that two words representing the same idea can produce different responses in our feelings and behaviour might suggest that the terms themselves are central to the underlying processes of thought.

If that seems a stretch, linking swearing to the origins of language is even more tenuous – though there are some arguments in its favour. Charles Darwin once speculated that our earliest vocalisations expressed hostility and lust – two of the things that we tend to use profanities for today. Linguists Ljiljana Progovac at Wayne State University in Detroit, Michigan, and John Locke at the City University of New York take this argument further by suggesting that our ancestors' crude tirades fuelled the construction of grammar.

To understand why, consider a certain type of grammatical construction called an exocentric compound. This involves cramming a noun and a verb together to create a new term, but without one necessarily modifying the other. As Progovac puts it, "A scatter brain is neither a type of scatter, nor a type of brain". Conjuring the idea of this person's disorganised thoughts requires an extra leap in logic compared to a phrase like "navy blue" – in which "navy" more straightforwardly modifies the description of the colour. Exocentric constructions are rare now, but were thought to be more common in the past, leading some to consider them linguistic fossils of our first stabs at grammar.

But when Locke and Progovac examined these fossils in English and Progovac's native Serbian, they found that they were often teasing or downright insulting. "Fuckwit" and "shithed" are two examples that survive in English, while they found insults like "shit-sword", "fart-rabbit" and "no-wash-underpants" in Serbian. As a result, the researchers wonder if the construction first evolved in verbal duels, as our ancestors competed to come up with more creative curses. "What we are saying is that the ability to build abstract words was enhanced by the creation of these types of insults," Progovac says.

They point out that the practice of "flyting" – exchanging humorous insults in public – has been recorded throughout history in works such as the Iliad and Beowulf. In some ways, they say, it is simply an extension of the vocal duels shown by other primates, in which the males size each other up with their calls. If the most creatively vulgar men were viewed as more dominant, sexual selection might have pushed us through further linguistic evolution.

Without strong evidence for the idea, it's fair to assume that the bold hypothesis might provoke some linguists to turn the air blue. Still, the notion that swear words contributed to our linguistic success may lend a certain nobility to my sister's utterance all those years ago. At least, that's what she's telling my dad.

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Tiffany O'Callaghan's byline is unprintable

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