box containing a few thumbtacks, a book of matches, and a candle. They are told to attach the candle to a piece of corkboard so that it can burn properly. Nearly ninety per cent of people pursue the same two strategies. They try to tack the candle directly to the board, which causes the candle wax to shatter. Or they try melting the candle with the matches, so that it sticks to the board; but the wax doesn't hold and the candle falls. Only four per cent of people manage to come up with the solution, which involves attaching the candle to the cardboard box and tacking the cardboard box to the corkboard.

To isolate the brain activity that defined the insight process, Jung-Beeman needed to develop a set of puzzles that could be solved either by insight or by analysis. Doing so was a puzzle in itself. "It can get pretty frustrating trying to find an experimentally valid brainteaser," Jung-Beeman said. "The puzzles can't be too hard or too easy, and you need to be able to generate lots of them." He eventually settled on a series of verbal puzzles, based on ones used by a psychologist in the early nineteen-sixties, which he named the Compound Remote Associate Problems, or CRAP. (The joke is beginning to get old, and in his scientific papers Jung-Beeman decorously leaves off the final "P.")

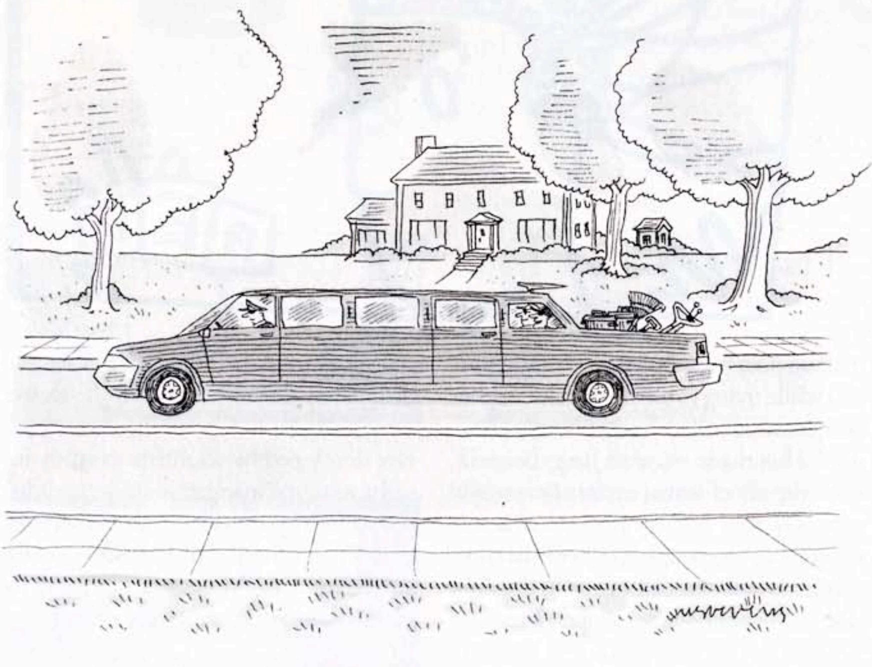
In a C.R.A. word puzzle, a subject is given three words, such as "pine," "crab," and "sauce," and asked to think of a word that can be combined with all three—in this case, "apple" ("pineapple," "crab apple," "apple sauce"). The subjects have up to thirty seconds to solve the puzzle. If they come up with an answer, they press the space bar on the keyboard and say whether the answer arrived via insight or analysis. When I participated in the experiment in Jung-Beeman's lab, I found that it was surprisingly easy to differentiate between the two cognitive paths. When I solved puzzles with analysis, I tended to sound out each possible word combination, cycling through all the words that went with "pine" and then seeing if they also worked with "crab" or "sauce." If I worked toward a solution, I always double-checked it before pressing the space bar. An insight, on the other hand, felt instantaneous: the answer arrived like a revelation.

Jung-Beeman initially asked his subjects to solve the puzzles while inside an fMRI machine, a brain scanner that monitors neural activity by tracking changes in blood flow. But fMRI has a three-to-five-second delay, as the blood diffuses across the cortex. "Insights happen too fast for fMRI," Jung-Beeman said. "The data was just too messy." Around this time, he teamed up with John Kounios, a cognitive neuroscientist at Drexel University, who was interested in insight largely because it seemed to contradict the classic model of learning, in which the learning process was assumed to be gradual. Kounios, a man with a shock of unruly wavy hair and an affinity for rumpled button-up vests, had been working with electroencephalography, or EEG, which measures the waves of electricity produced by the brain by means of a nylon hat filled with greased electrodes. (The device looks like a bulky shower cap.) Because there is no time delay with EEG, Kounios thought it could be useful for investigating the fleeting process of insight. Unfortunately, the waves of electricity can't be traced back to their precise source, but Kounios and Jung-Beeman saw that combining EEG with fMRI might allow them to construct a precise map, both in time and space, of the insight process.

The resulting studies, published in 2004 and 2006, found that people who solved puzzles with insight activated a specific subset of cortical areas. Although the answer seemed to appear out of nowhere, the mind was carefully preparing itself for the breakthrough. The first areas activated during the problem-solving process were those involved with executive control, like the prefrontal cortex and the anterior cingulate cortex. The scientists refer to this as the "preparatory phase," since the brain is devoting its considerable computational power to the problem. The various sensory areas, like the visual cortex, go silent as the brain suppresses possible distractions. "The cortex does this for the same reason we close our eyes when we're trying to think," Jung-Beeman said. "Focus is all about blocking stuff out."

What happens next is the "search phase," as the brain starts looking for answers in all the relevant places. Because Jung-Beeman and Kounios were giving people word puzzles, they saw additional activity in areas related to speech and language. The search can quickly get frustrating, and it takes only a few seconds before people say that they've reached an impasse, that they can't think of the right word. "Almost all of the possibilities your brain comes up with are going to be wrong," Jung-Beeman said. "And it's up to the executive-control areas to keep on searching or, if necessary, change strategies and start searching somewhere else."

But sometimes, just when the brain is about to give up, an insight appears.



"Lawn care has been good to us, Ed."