Causal reasoning: the 'magical number' three

Before you continue reading this column, I would like you to ponder for a while about the possible causes of any of the following phenomena: human altruism, the growth of scientific knowledge, the increase in the number of divorces in Western societies and the fall of communism in Europe. In case you are from my region of the world, you might also include the causes of two other events: the disintegration of the Czech and Slovak Federal Republic in 1992, and the rise of Prime Minister Vladimír Mečiar to autocratic power in Slovakia from 1991 to 1998. Feel free to list as many causes as you consider to be relevant.

Not long ago, I addressed the same request to 26 individuals, who were all academics and included scientists, university teachers and students, with an average age of 47.1 from an age range of 18–70 years. My hypothesis was that the number of causes for any event or phenomenon given by a respondent would be about seven. Cognitive psychologist George Miller at Princeton University (NJ, USA) reported in a famous paper that seven is the maximum number of classes to which a normal adult human is able to assort alternative stimuli, and it is also the maximum number of decimal digits, or other 'chunks of information', that he or she can repeat without errors and confusion (Miller, 1956). The number seven therefore reflects the limited capacity of the human mind for ranging perceptual data and for short-term memory.

Surprisingly, the average number of causes for any of the events or phenomena given by any of the respondents that I asked was only three, within the range of 2.00 ± 0.98 and 3.15 ± 1.41 . There was a single exception: one female respondent, who was herself divorced, gave 18 causes for divorce. This exceptional response has been omitted from the analysis.

The responses were largely specific for each respondent so that all respondents together presented a total of 17 to 27 different causes for each individual phenomenon.

I could not believe my eyes; I took recourse to the internet and used Google to search for 'x causes of y', randomly choosing y to cover psychological, social and historical items as disparate as happiness, unhappiness, love, crime, conflict, violence, terrorism, the French revolution, and the First and Second World Wars. My search for causes resulted in hits in which x consistently peaked at the number three. I repeated the search in January 2009 and the outcome was the same.

This survey and my recounting of it are not a mere academic exercise: the results have implications that are pertinent both to science and the real world. Consider, for example, one current scourge, the phenomenon of global terrorism: it has triggered scores of attempts to identify its 'root causes'. Obviously, knowing the causes of terrorism is essential for taking efficient political and other actions against it. So, what are the causes of terrorism according to certain politicians who ought to know? The former US Vice President Al Gore cited poverty and ignorance, disease and environmental disaster, and corruption and political oppression as 'another axis of evil in the world'. The former President of Pakistan, Pervez Musharraf, pointed to three causes of terrorism: political disputes, poverty and illiteracy. Osama bin Laden gave three quite different causes for the terrorist attacks on the morning of 11 September 2001: the presence of US troops on the Arab peninsula; the sanctions against Iraq, which allegedly caused the death of hundreds of thousands of Iraqi children; and the US government's "backing of Zionist colonization" (Radu, 2007; Pakistan Observer, 2007; Clock 2006). Incidentally, former US President George W. Bush might have been an exception to the rule of three: according to a US political scholar (Phillips, 2005), Bush monocationally considered terrorism to be part of bin Laden's strategy to impose a harsh Islamic ideology on the world.

Causal reasoning, based on the conviction that every event in the world has a cause, must have been essential for the survival of our species—as might have been its apparent limitation. It seems likely that the ability to swiftly specify a single cause, or a few causes,

rather than to ponder a web of many possible causes, was a precondition for successful action in the hunt for food, for seeking shelter from predators, and for social interactions within and among small bands of hunter-gatherers in our natural niche in the African savannah. Our mind may not have evolved much since those early days; therefore, contemporary humans might differ little from our forbears when it comes to making causal inferences. The human individual might not be appropriately equipped for comprehending the complex networks unravelled by contemporary science; but, unfortunately, this also applies to our judgements and actions in the modern, complicated niche that is imposed on us by the autonomous dynamic of our cultural and technological evolution. There is small solace, however: pooling individual judgements might partly alleviate this deficiency.

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