

## Can science writing be more readable? THE NEED FOR SCIENCE TO BE SHARED MORE WIDELY WITH LAY PEOPLE HAS BECOME

n 1959, thinker and writer CP Snow, while speaking about people trained almost exclusively in the sciences or in the humanities, said this had created two cultures. "... The great edifice of modern physics goes up, and the majority of the cleverest people in the Western world have about as much insight into it as their Neolithic ancestors..." he said. Since then, however, with the advance of science and its increasing role in daily affairs, there has been a positive effort to communicate scientific knowledge to a larger audience.

For all that, based on a study of the readerfriendliness of the summaries of reports of the Intergovernmental Panel on Climate Change, there has been a remark that the "top level documents of the panel are harder to understand than a paper by Albert Einstein". As the IPCC is UN-sponsored, which is to say a neutral and global agency to study climate change, the criticism is a serious one. But Thomas F Stocker and Gian-Kasper Plattner, researchers in climate change from Switzerland, in a letter to the journal *Nature* disagree with the study and say the features of the latest summaries, which are des-

igned to assist the non-specialist reader, have been overlooked while making the assessment. The study in question is a paper in

*Nature Climate Change*, which notes that the Summary for Policymakers of the IPCC reports was the most widely read part of the reports and acted as the "springboard" for their communication. Building on existing findings, which say that both the IPCC as well as mass media are challenged in conveying the content of the reports to non-scientific and even some scientific audiences, the researchers used popular tools, the *Flesch Reading Ease* algorithm to assess "readability" and

a software, *DICTION*, to assess the "sentiment content" of the SPM of the IPCC reports.

The DICTION software analyses the use of words and word combinations in a piece of text and is able to largely succeed in evaluating the "tone", or, in our context, the "degree of optimism" in what the author is saying. FRE, however, is based on the length of sentences and the number of syllables in the words used. The prin-



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**CP Snow and Rudolf Flesch** 

tence, with only two one-syllable words. The sentence, "The cat sat on the mat" has a score of 116. The general interpretation is shown in the table:

Score	level
90 and above	Very easy, 11-year-old student
80-90	Easy, conversational
70-80	Fairly easy
60-70	Standard — easy for 13- to 15-year-olds
50-60	Fairly difficult
40-50	More difficult – college level
20-50	Very difficult — postgraduates

This simple formula, which yields higher scores for text with short sentences and short words, has been found to correctly reflect how

IPCC reports were thus estimated and compared with the scores of the same matter as reported in popular and scientific publications between 1990 and 2014. The scientific journals were Nature and Science, the quality newspapers were The New York Times, Washington Post, The Independent and The Times and the tabloids were Daily News, The Mirror and The *Sun*. The results of DICTION were that the level of pessimism increased as one passed from SPM to tabloid, which is understandable, as the SPM was only factual, while the other media need to interpret and progressively to sensationalise. The results of FRE, as shown in the bar chart, are that the SPMs have the lowest scores and, worse than that, while the scores of other publications have improved over the years, the scores of the SPMs have gone down.

The findings were thus a serious indictment of the SPMs and a suggestion that improvement of presentation may be of great benefit. Stocker and Plattner, in their letter to *Nature*, have a particular bone to pick about the last of the observations made above, viz, that the SPMs have not improved but have worsened.

While it is evident there would be a less "conversational" style in a scientific journal or even a conservative newspaper, in the case of the SPMs these are documents summarising purely scientific findings and are charged not to be judgmental or show any bias. The authors, nevertheless, have been alive to the fact that an important section of the readers involve nontechnical persons who decide government policy. As it is vital that the import of the reports be communicated to them, the latest of the SPMs have incorporated a new communication tool, so called *headline statements*, in distinct font and colours. While succinct descriptions were there in previous SPMs, too, every section and subsection of the SPM of the report by Working Group No.1 has a headline statement in simple language, without complexity or jargon. Taken together, Stocker and Plattner say, the headline statements provide a coherent summary of the whole 1,535-page scientific report in just two pages.

Headline statements were not used with the SPMs of repots by Working Groups II and III, but have been used for the IPCC Synthesis report, both in the SPM and the full report, they say. The Nature Climate Change paper does not seem to have considered the value of this addition in their analysis, but has routinely subjected the headline statements to the statistical word-counting of FRE, along with the much longer SPM. Stocker and Plattner also compare the FRE of headline statements with the remaining part of the reports and also the reference journals used. They find that the readability score of the headline statements is far superior to the reports and also the mean of the scientific journals and only below the quality newspapers. "This... strongly suggests that carefully crafted, critically discussed and iteratively refined headline statements can indeed be a way to make the major findings collected in the SPM more comprehensible and accessible," the correspondents say. While they do agree with the earlier study that IPCC documents can be improved, they suggest devising a metric that is more sensitive to the complexity of the subject matter.

### PLUS POINTS

TheStatesman

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### **Flexible camera**

A team led by Indian-origin computer science Professor Shree K Nayar at



Columbia University has created a novel sheet camera that can be wrapped around everyday objects to capture images that cannot be taken with one or more conventional

cameras. "Cameras today capture the world from essentially a single point in space. While the camera industry has made remarkable progress in shrinking the camera to a tiny device with ever increasing imaging quality, we are exploring a radically different approach to imaging," he said. "We believe there are numerous applications for cameras that are large in format but very thin and highly flexible."

Nayar graduated from the Birla Institute of Technology, Ranchi, in 1984 and his team designed and fabricated a flexible lens array that adapts its optical properties when the sheet camera is bent. This optical adaptation enables the device to produce high quality images over a wide range of sheet deformations. If such an imaging system could be manufactured cheaply — like a roll of plastic or fabric it could be wrapped around all kinds of things, from street poles to furniture, cars, and even people's clothing, to capture wide, seamless images with unusual fields of view. "The adaptive lens array we have developed is an important step towards making the concept of flexible sheet cameras viable," Nayar noted. The next step will be to develop large format detector arrays to go with the deformable lens array. The amalgamation of the two technologies will lay the foundation for a new class of cameras that expand the range of applications that benefit from imaging.'

### **Readability levels**

One use of reading ease scores is to find what audience would be comfortable with the writing. *Readers' Digest* is said to have FRE score of about 65, Time magazine about 52. Children's books, typically, score above 80. But even easy language can score low by the Flesch formula if the subject matter calls for longer sentences to make the meaning clear.

FRE of any text passage can be calculated by most word processing software, simply by enabling "readability statistics" under "options" The FRE score of this article, for instance, is 42.7. Readers may like to respond to say at what level of difficulty or ease they would place the article, in the categories shown in the table.

ciple, which was laid down by and LA Sherman, an English professor, is that as short sentences and concrete terms, like we use in speech, are easier to understand, writing is easier to read if it is more like speech. A number of researchers, including Rudolf Flesch, analysed universally accepted "highly readable" texts, the *Bible*, for example, and arrived at a formula to assess "readability".

The process is to count the number of sentences and words to work out the Average Sentence Length and then to count the total number of syllables in all the words, to get the ASW — the average number of syllables in a word. FRE, the Flesch Reading Ease score is then given as:

FRE — 206.835 - (1.015 x ASL) - (84.6 x ASW). The scores can be in a range from negative numbers, rising to 120, for the simplest sen-



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# **BREAKDOWN AGENTS**

### PLANT CELLS CONTAIN TYPES OF PEROXISOMES NOT FOUND IN ANIMAL CELLS, WRITES TAPAN KUMAR MAITRA

n plants and algae, peroxisomes are involved in several specific aspects of cellular energy metab-L olism. Let's look at a few plant-specific peroxisomes and briefly describe their functions.

First up are leaf peroxisomes. Cells of leaves and other photosynthetic plant tissues contain characteristically large, prominent leaf peroxisomes, which often appear in close contact with chloroplasts and mitochondria. The spatial proximity of the three organelles probably reflects their mutual involvement in the glycolate pathway, also called the photorespiratory pathway because it involves the light-dependent uptake of oxygen and release of carbon dioxide. Several enzymes of the pathway

called glyoxysomes. They are found only in the tissues in which the fat is stored (endosperm or cotyledons depending on the species) and are present only for the relatively short period of time required for the seedling to deplete its supply of stored fat. Once they fulfill their role in the seedling, the glyoxysomes are converted to peroxisomes.

Glyoxysomes have been reported to appear again in the senescing (aging) tissues of some plant species, presumably to degrade lipids derived from the membranes of the senescent cells. However, the importance of their involvement in senescence is not vet clear.

In addition to their presence in tissues that carry



### 'Alarming' new side effects ROBERTO A FERDMAN REPORTS ON WHY TRADITIONAL FAST FOOD WAS NEVER MEANT TO BE DAILY FARE AND SHOULDN'T BE

ritics of the fast food industry have long warned about the perils of our addiction to processed food. Big Macs and Whoppers might taste good, but put too many of them in your body and it will expand as Violet Beauregard's did in Willy Wonka & The Chocolate Factory (although maybe not quite as fast). The evidence is decades in the making. The rise of processed food, after all, has coincided with an alarming growth in the size of our collective gut.

But there might be some new powerful ammunition for those who could do without the food the fast food industry serves. Researchers at George Washington University have linked fast food consumption to the presence of potentially harmful chemicals, a connection that they argue could have "great public health significance". Specifically, the team found that people who eat fast food tend to have significantly higher levels of certain phthalates, which are commonly used in consumer products like soap and make-up to make them less brittle, but have been linked to a number of adverse health outcomes, including higher rates of infertility, especially



of two separate phthalates — DEHP and DiNP. People who reported eating only a little fast food had DEHP levels that were 15.5 per cent higher and DiNP levels that were 25 per cent higher than those who said they had eaten none. For people who reported eating a sizable amount, the increase was 24 per cent and 39 per cent, respectively.

And the connection held true even after the researchers adjusted for various factors about the participants' habits and backgrounds that might have contributed to the association between fast food consumption and phthalate levels. "We looked at it in so many different ways, and the effect still remains," said Zota.

There is little consensus on the harms of phthalates, which are widely used in commerce and give materials like food packaging added flexibility, except that exposure to them "is widespread". But there is a growing concern that the chemicals could pose a variety of risks, particularly when observed in the sort of levels seen in the study. "There's a vast amount of scientific evidence suggesting certain phthalates can contribute to several adverse health effects," said Zola. While there is less evidence that DiNP is problematic, some recent research suggests it very well could be. A study undertaken last year, for instance, found that exposure to the phthalate was associated with higher blood pressure. For these reasons, many governments have moved to limit exposure to the industrial chemicals. Japan disallowed the use vinyl gloves in food preparation for fear this was compromising health. The European Union, which limits the use of the chemical, has been nudging manufacturers to replace it. And the USA restricted its use in toys. In fact, the US Department of Health and Human Services warns that DEHP is "reasonably anticipated to be a human carcinogen". The reason why people who eat fast food seem to have much higher levels of potentially harmful industrial chemicals is unclear. But it's easy enough to guess: the sheer amount of processing that goes into food served at quick-service restaurants. "I really hope this study helps raise public awareness about the exposure problems caused by our industrialised food system," said Zola.

WASHINGTON POST

IANS

### **Sniffing out TB**

A technology that relies on trained African giant pouched rats — named HeroRATS — to sniff out tuberculosis and



diagnose the disease faster than conventional diagnostic methods is helping save lives in Mozambique and Tanzania. They are among 22 high-burden nations suffering from TB, with 58,270 and 63,151 new cases of the disease detected respectively in 2014, says the World Health Organisation.

The rat technology is being used by Belgian non-governmental organisation Apopo for speedy and cost-effective testing of TB in the two countries' prisons, allowing patients to receive prompt treatments. According to Apopo information sent on 23 March, the project is benefitting from a two-year \$80,000 funding from the United States Agency for International Development awarded in 2015.

SCIDEV.NET

#### **Tumour traps**

For colorectal cancers that have metastasised to the liver, surgeons are often called in to remove tumors. But in the majority of cases, the cancer comes back. Allan Tsung, a cancer surgeon at the University of Pittsburgh School of Medicine, suspected that the procedure



The Glycolate Pathway: Glycolate arises as a result of the oxygenase activity of rubisco. The immediate product is phosphoglycolate, which is converted to free glycolate by a phosphatase localised in the chloroplast membrane (reaction GP-1). Free glycolate diffuses out of the chloroplast stroma and is metabolised by a five-step pathway (GP-2 through GP-6) that occurs partially in the peroxisome and partially in the mitochondrion. Glycerate then diffuses into the chloroplast and is phosphorylated to form 3-phosphoglycerate (reaction GP-7), which enters the Calvin cycle. The oxygen uptake and carbon dioxide evolution characteristic of photorespiration occur in the peroxisome (reaction GP-2) and mitochondrion (reaction GP-4), respectively.

including a peroxide-generating oxidase and two aminotransferases are confined to leaf peroxisomes.

Another functionally distinct type of plant peroxisome occurs transiently in seedlings of plant species that store carbon and energy reserves in the seed as fat (primarily triacylglycerols). In such species, stored triacylglycerols are mobilised and converted to sucrose during early post-germinative development by a sequence of events that includes? oxidation of fatty acids as well as a pathway known as the glyoxylate cycle. All enzymes needed for such processes are localised to specialised peroxisomes

out either photorespiration or ? oxidation of fatty acids, peroxisomes are also found in other plant tissues. For example, another kind of specialised peroxisome is present in nodules, the structures on plant roots in which plant cells and certain bacteria cooperate in the fixation of atmospheric nitrogen (that is, the conversion of nitrogen into its organic form). The peroxisomes in those cells are involved in the processing of fixed nitrogen.

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The danger, the researchers believe, isn't necessarily a result of the food itself, but rather the process by which the food is prepared. The findings were published in *Environmental Health Perspectives*, a journal funded by the National Institutes of Health.

"We're not trying to create paranoia or anxiety, but I do think our findings are alarming," said Ami Zota, an assistant professor of environmental and occupational health at George Washington University, and one of the study's authors. "It's not every day that you conduct a study where the results are this strong." In order to gauge how fast food affects the presence of certain non-natural chemicals, the team analysed data for nearly 9,000 people, collected as part of federal nutrition surveys conducted between 2003 and 2010. The surveys included detailed information about the participants' diets, including what each had eaten in the last 24 hours. They also contained the results of urine samples taken at the same time, which allowed them to measure the levels of three separate chemicals.

The first thing the researchers found was that roughly one-third of the participants said they had eaten some form of fast food over the course of the day leading up to the urine sample collection. That proportion, high as it might seem, is actually in line with government estimates. The second thing they found was that those participants who said they had eaten fast food in the last 24 hours tended to have much higher levels



After surgery, mouse neutrophils send out a tangle of DNA fibres (green; with arrows) called extracellular traps that facilitate the return of a cancer

itself — specifically, the body's own healing response to surgical stress might contribute to recurrence. Immune cells called neutrophils are first responders after injury caused by surgery. The cells are known to spew weblike DNA — Neutrophil Extracellular Traps — into the bloodstream. Nets were initially appreciated for capturing pathogenic bacteria, but are now emerging as important in cancer and other diseases. Tsung and his colleagues found that patients' serum contained Nets after cancer surgery, and the greater the abundance of Nets, the higher the risk of recurrence. Treating mice with DNAse reduced Net levels and metastasis rates. Cancer surgeon Lorenzo Ferri of McGill University, who studies Nets, says circulating cancer cells can be captured by Nets that are decorated with numerous proteins that interact with tumour cells. "Cancer cells are actually activated by the Nets, increasing their ability to live and develop secondary tumours, or metastases," he wrote in an email.



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