# Do authors prefer to use 'impact' over 'effect'?

Uma Shaanker[1] asks in a recent commentary, 'Do authors prefer to use impact over effect?' A global search prompt using the word 'impact' in the *Current Science* (*CS*) home page indicated an exponential increase in the frequency of finds for this word in titles (including all categories of submission like research article, correspondence, research communication, editorial, etc.) of papers published in the journal.

He asks a related question: 'Would replacing the word "impact" with the word "effect" significantly alter the message conveyed by the titles?' He also offers a ready answer: 'Perhaps not', before asking, 'So why do authors prefer impact over effect?'

A critic being a critic, I repeated Uma Shaanker's exercise to observe what the use of the word 'effect' in the same global search prompt would lead to. Figures 1 and 2 display the answers. Figure 1 shows the frequency occurrence of the words 'impact' and 'effect' in titles of papers published in *CS* from 1932 to 2016. It is interesting to note that 'effect' went out of fashion suddenly around 1990 and then began picking up slowly again. Figure 2 is an alternative representation of Figure 1. We now see that only briefly was 'impact' more likely to appear in a *CS* title than 'effect' and that in the early years, from 1932 to 2005, the reverse was true.

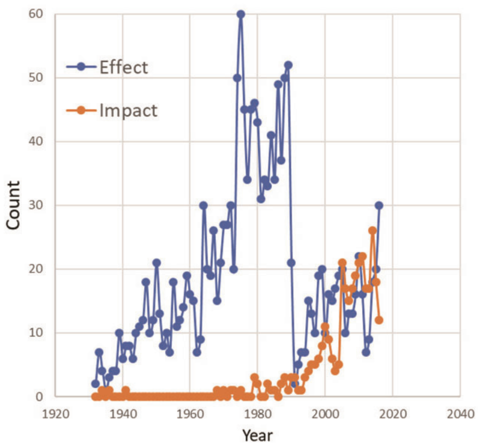


**Figure 1.** Frequency occurrence of the words 'impact' and 'effect' in titles of papers published in *Current Science*.

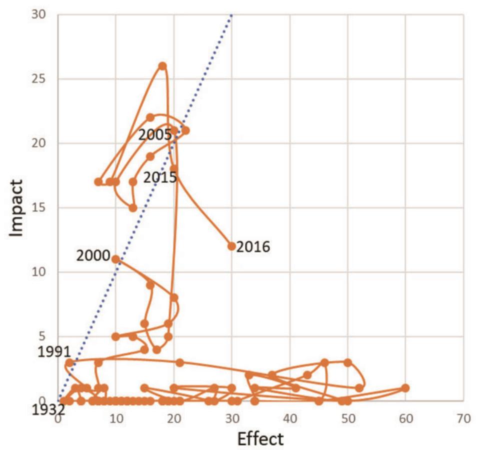


**Figure 2.** Frequency occurrence of the words 'impact' and 'effect' in titles of papers published in *Current Science*.


1. Uma Shaanker, R., *Curr. Sci.*, 2017, **113**(5), 851–852.



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# A quiet but deep trouble in Tonga subduction zone

The Tonga subduction zone marks the convergent plate boundary between the Pacific and Australian plates, and it produces more large-magnitude deep earthquakes (depth >300 km) than anywhere else in the world. Deep earthquakes constitute less than 1% of the total earthquakes ($M > 6$) of the world and among them, ~66% are hosted by the Tonga subduction zone alone. On 19 August 2018, it produced globally the second largest deep earthquake (*Mw* 8.2, depth ~580 km) in the instrumentally recorded history of earthquakes. The 24 May 2013 Okhotsk earthquake with *Mw* 8.3 still holds the record for being the largest magnitude deep earthquake. A tiny earthquake (magnitude 4.2) on 8 April 2004 near Vanuatu subduction zone with a depth of 736 km holds the record for being the deepest earthquake. However, among the large events, the 680 km deep 30 May 2015 (*Mw* 7.9) Ogasawara (Bonin, Japan) Islands earthquake is considered as the deepest recorded earthquake. It is not that all deep earthquakes occur in subduction zones only; a

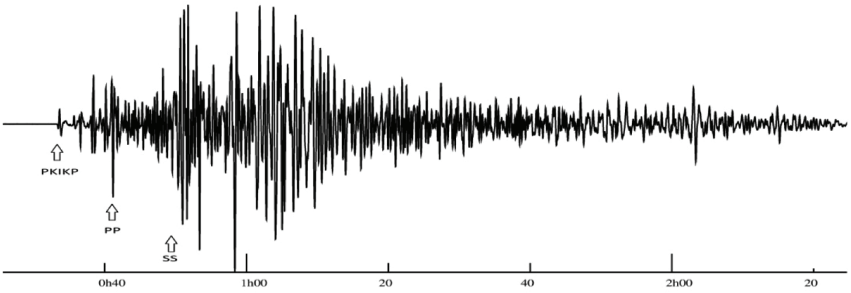


**Figure 1.** Vertical component of seismic record of the 19 August 2018 earthquake (*Mw* 8.2) at Delhi. Unfortunately, for this earthquake the Indian region falls under the shadow zone, where we have no direct arrivals of seismic waves. The first arrival is the reflected *P*-wave (PKIKP) from the inner core.

few of them have actually occurred in isolated regions as well, the most remarkable among them being the 29 March 1954 Spain earthquake (*Mw* 7.9) that occurred at a depth of 630 km and in the region of almost no seismic history. Fortunately, these deeper events, even those with high magnitudes, do not pose any significant hazard, but they may cause mild to moderate shaking in a relatively large region. The 9 June 1994 Bolivia earthquake (*Mw* 8.2 and depth 631 km) was felt by many in USA, which is more than 6000 km from its epicentre. Deep earthquakes provide the most reliable information about the deep earth structures (Figure 1) and geodynamic processes occurring at plate margins. They are ideal in such studies because they generally do not cause high-amplitude surface waves which contaminate the later arrivals. In fact, these earthquakes are considered ideal for the receiver function analysis, a powerful technique that helps in delineating earth structure below the observation point. These earthquakes have a few similarities, e.g. majority of them occur through normal motion on either subhorizontal or subvertical planes; they all are of intraslab type, i.e. they occur within the subducted plate; the aftershock productivity of these earthquakes is relatively less, etc. At the same time, their occurrence at great depths is very enigmatic. In the early part of 20th century, scientists like Harold Jeffreys had tough time in accepting that earthquakes can actually occur at such great depths. Initial works of Fusakichi Omori, Kiyoo Wadati and Jeffreys enhanced our knowledge about these earthquakes. In fact, it was Wadati who convinced Charles Richter about incorporating features of deep earthquakes while he was formulating the Richter scale for earthquake magnitude. As these earthquakes occur at depths where the earth's pressure exceeds 18 GPa and temperature exceeds 1600°C, we do not fully understand the process of rock failure leading to earthquake. However, it is certain that shear failure accompanies these events (against the earlier anticrack hypothesis), as confirmed by the models derived from surface deformation pattern (a rarity in deep earthquakes) in case of the 2013 Okhotsk earthquake which occurred at a depth of 611 km. Several physical mechanisms for shear failure at great depths have been proposed, which include phase transformational faulting, shear melting, reactivation of faults established earlier in the subduction process, dehydration of minerals that are brought to depth from the surface by the subduction process, and strong anisotropy at depth which may explain the non-double couple pattern during these earthquakes. Even now we do not quite understand the failure mechanism of deep earthquakes. Even more enigmatic is the occurrence of isolated earthquakes. Such earthquakes probably hint towards mantle heterogeneity at depth, possibly arising due to fossil slab of an ancient subduction.

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