Scientometrics (2017) 112:1065–1068
DOI 10.1007/s11192-017-2326-x

Who woke the sleeping beauties in psychology?

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Received: 17 February 2017 / Published online: 7 March 2017

Abstract In an earlier paper we identified three 'sleeping beauties' in Psychology, that is three important papers that were not cited by others for many years before becoming much later citation classics. In this paper we identify the 'princes' that alerted psychologists to these 'sleeping beauties', and we show how new computer-based techniques now help us to locate princes as well as sleeping beauties.

Keywords Sleeping beauties · Princes · New technology · Citation rates

In an earlier paper (Ho and Hartley 2017) we identified three 'sleeping beauties' in Psychology. As is well known, 'sleeping beauties' are papers that are hardly cited at all for many years but then are suddenly referred to and, from that date, become citation classics in their own right. In our particular paper we discussed the sleeping beauties in Psychology exemplified by Stroop (1935), Maslow (1943), and Simon (1956). But a second question now arises—who were the 'princes' that awoke them? Who alerted researchers to the value of these papers after such periods of time? And are these people important too?

Background

Several authors have commented on the problems of identifying 'princes' and there has been much discussion concerning their role and characteristics. One of the earliest researchers to comment on these issues was Van Raan (2004) who distinguished between four measures—the depth of sleep (defined by the number of citations), the length of sleep

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(defined by the number of years without being cited), the time period the article was awakened following the length of sleep period (the awake period), and the intensity of the awakening (the number of citations within specific periods).

Braun et al. (2010) elaborated on these issues by examining 50 scientific papers that were not highly cited for 3 or 4 years but were then cited much more after this initial period. Braun et al. found that these later citations were made in articles published in journals with a higher impact than the originals, thus suggesting that *where* the sleeping beauties were cited was important.

Wang et al. (2012) outlined at least three different reasons for awakening a paper—its relevance, a new use for the information, and its availability—facilitated by new technology. Van Raan (2015) also suggested that sleeping beauties were action-oriented and thus relevant to future innovations.

Today new technology and changes in our publication processes may make it easier to detect sleeping beauties. For example, Huang et al. (2015) reported that from 2010 to 2014 the *Journal of Medical and Biological Engineering* published more than twice as many articles as it did during the previous 5-year period. Further, they argue, somewhat intriguingly, that as 95% of articles published in the *JMBE* were not cited elsewhere, some of these articles could possibly be sleeping beauties since they could provide potential value to researchers if they were 'awakened'. These authors describe a computer-based methodology for detecting likely princes, based on authors' h-indexes (Hirsch 2005), and on the use of keywords.

Du and Wu (2016) proposed that princes must have four criteria. They must publish their papers near the time when the sleeping beauty began to attract attention; they must be highly cited themselves; they must receive a high number of co-citations along with citations to the sleeping beauty, and that their citations rates must initially be higher than that of the sleeping beauty itself.

Finally, and most recently, Teixeira et al. (2017) reported on their success in finding sleeping beauties in the social sciences by aggregating the three measures outlined by Van Raan (2004)—the depth of sleep, the length of sleep, and the 'intensity of the awakening'. Van Raan identified papers with 6 sleeping periods—with lengths of 5, 6, 7, 8, 9, and 10 years, respectively—all starting in 1980. The authors then identified all of the articles that were either in 'deep sleep' or in 'less deep sleep' in all of these sleeping periods. Next they investigated the extent to which these articles had been cited in a 4-year period immediately following each of the six sleeping periods (excluding self-citations).

Identifying the princes for our sleeping beauties in psychology

In this letter we describe how we identified the 'princes' for our three psychology sleeping beauties. We reasoned that one way to do this was be to look for the authors of papers that cited the original sleeping beauty paper some years later after its initial publication, and that were in themselves highly cited. To do this we examined the Web of Science Core Collection since its publication to the end of 2015 (Chuang et al. 2011).

This procedure gave us the following results.

1. It seems likely that Stroop's paper (Stroop 1935) was given prominence some 30 years later by Jensen and Rohwer's (1966) review, 'The Stroop color-word test: A review' published in *Acta Psychologica*. This review paper was cited 476 times in the Web of Science Core Collection since its publication to the end of 2015 (TC_{2015}) (Chuang

et al. 2011). Furthermore, citations to Stroop were boosted yet again another 30 years later by MacLeod's (1991) 'Half a century of research on the Stroop effect: an integrative review', published in the *Psychological Bulletin.* This paper was cited almost 2400 times by 2015 ($TC_{2015} = 2395$ times).

2. Similarly, it is possible that the initial spurt in the 1970s of citations to Maslow's (1943) paper stemmed from Hackman and Lawler's (1971) 'Employee reactions to job characteristics', in the *Journal of Applied Psychology* ($TC_{2015} = 993$ times) and Salancik and Pfeffer's (1978) 'Social information processing approach to job attitudes and task design', in the *Administrative Science Quarterly* ($TC_{2015} = 1304$ times). And it is indeed further possible that another major spurt in citations to Maslow's paper can be attributed to the reviews by Austin and Vancouver (1996) ($TC_{2015} = 640$ times) and Ryan and Deci (2000) ($TC_{2015} = 1384$ times).
3. Finally it appears that Simon's (1956) paper enjoyed a meteoric rise in citations, possibly stemming from being cited in two major *Psychological Review* papers by Gigerenzer and Hoffrage (1995) ($TC_{2015} = 710$ times) and Gigerenzer and Goldstein (1996) ($TC_{2015} = 997$ times).

Conclusions

So thus we come full circle: new technology allows researchers today both to detect and predict sleeping beauties more easily than before. Indeed, there may be many more than we think.

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