

A psycholinguistic exploration of disfluency behaviour during the tip-of-the-tongue phenomenon

Megan Drevets and Robin Lickley

Clinical Audiology, Speech and Language Research Centre, Queen Margaret University, Edinburgh, UK

Abstract

A tip-of-the-tongue state (TOT) occurs when a speaker knows a word but cannot retrieve its phonological form from memory. While previous studies have found that disfluencies are related to lexical retrieval difficulties, the literature lacks studies which have specifically investigated the impact of TOTs on disfluency. This study explores the relationship between TOTs and such disfluency behaviours as hesitations and target approximations (i.e. incorrect attempts to produce targets). TOTs were induced using the TOTimal method (Smith, Brown & Balfour, 1991), where participants memorised and retrieved the names of imaginary animals. Speech samples were analysed for TOTs and disfluencies. Disfluency rates increased with retrieval times during resolved TOTs. Additionally, target approximation rates correlated with the rates of both TOTs and “Don’t Know” responses, suggesting that target approximations are not unique to TOTs but are indicative of general uncertainty during lexical retrieval.

Introduction

The tip-of-the-tongue state (TOT) is the feeling that accompanies an attempt to retrieve a word that is known but temporarily inaccessible from memory. TOTs reflect a failure in the process of lexical retrieval, as speakers in TOTs know the meaning of the word they are searching for yet are unable to retrieve the phonological representation of that word (Levelt, 1989). Two competing theoretical accounts to explain TOTs are the inhibition hypothesis and the transmission deficit hypothesis. The inhibition hypothesis holds that word retrieval is prevented or delayed by the retrieval of phonologically similar targets, and that the presence of these so-called “blockers” leads to a TOT (Jones, 1989). The transmission deficit hypothesis, on the other hand, maintains that a TOT exists when the target is of insufficient memory strength to be retrieved, despite the partial information recalled (Burke et al., 1991). Both theories centre around the observation that speakers in TOT frequently generate phonologically and semantically related words in lieu of the target (known in this study as “target approximations”). The critical difference between the two accounts is that the inhibition

theory holds that these related forms are inhibitory to retrieval, while the transmission deficit theory states that they facilitate TOT resolution.

TOTs have been an area of extensive study since Brown and McNeill (1966) induced TOTs in a laboratory setting for the first time. The bulk of TOT research since has focused on the cognitive processes of speech production during TOTs, with less research investigating the outward processes of speech that occur during this phenomenon. One of these outward processes is disfluency.

Disfluencies are breaks in the continuous production of speech and are associated with both normal and abnormal motor speech and linguistic functioning (Lickley 2015). There is some evidence that specific types of disfluencies can be associated with the different levels that make up traditional psycholinguistic models of speech production. For example, filled pauses have been associated with difficulties at the early level of semantic message planning (e.g., Clark & Fox Tree, 2002; Fraundorf & Watson, 2014), while some repetitions are thought to be associated with the late level of speech error correction when an error has been detected after articulation has already begun (e.g., Postma 2000; Fraundorf & Watson, 2014). There is less available research investigating how difficulties at the intermediary stages of speech processing (e.g. lexical retrieval) can affect disfluency production. Schnadt (2009), for example, found that lexical retrieval difficulties (as demonstrated by picture naming latencies) are closely related to the likelihood of producing associated disfluencies. The literature lacks studies, however, which have specifically looked at the incidence of disfluencies during the most extreme example of lexical retrieval – namely, the TOT.

Research questions and paradigm

The main question of this study is whether there is a relationship between TOTs and both lexical retrieval times and disfluency behaviours. It was hypothesised that the number of TOTs experienced would correlate positively with the number of disfluency behaviours (e.g., target approximations) produced. Additionally, it was hypothesised that the time taken to both retrieve the correct targets and to resolve TOTs would correlate positively with the number of disfluency behaviours produced.

To this end, an experiment was designed that would induce TOTs in participants and allow the disfluency behaviours produced during lexical retrieval to be recorded and analysed. This elicitation method was based on the TOTimal method, in which participants memorise and then try to recall the names of imaginary animals (Smith, Brown & Balfour, 1991). While this elicitation method utilises newly learnt pseudowords as targets, most studies which induce TOTs experimentally employ obscure real words as targets. These semantic paradigm studies have historically induced low TOT rates (13%), however, and have had to rely heavily on participants' prior experience with certain words – a variable which is difficult to control for (Brown, 1991). Pseudoword paradigms like the TOTimal method, on the other hand, induce comparatively high TOT rates (40%) and have a greater ability to control for participants' exposure to targets, as they have only just been learnt (Smith, Brown & Balfour, 1991). One of the main assumptions of the TOTimal method is that the TOTs experienced for newly learnt targets are comparable with those experienced for real words that are already known but temporarily inaccessible. Smith, Brown and Balfour (1991) found that participants experiencing TOTs elicited using the TOTimal method were more likely to report “feeling of knowing” states and to recall partial phonological information about the targets. These studies support the idea that the TOTs elicited using the TOTimal method are akin to naturalistic stimuli and are therefore appropriate to use in TOT experiments. Lexical retrieval comparisons between male and female participants were made post-hoc after perceptually significant gender differences were apparent after the initial analyses.

Methodology

A sample of 28 participants (16 women and 12 men) took part in the study. All participants were aged between 18 and 40, proficient in English, and had either completed or were currently enrolled in tertiary education. Additionally, participants did not have a hearing or visual impairment that could not be corrected by a hearing aid or glasses, nor a communication disorder such as stammering or dyslexia. Informed consent was provided in accordance with Queen Margaret University ethics procedures.

The 20 TOTimal names used as stimuli in the present study were generated from the ARC Nonword Database (Rastle, Harrington & Coltheart, 2002) with respect to the rules of Standard Southern British English phonology, phonotactics and orthography.

To control for specific pseudoword features, all TOTimal names were monosyllabic and had CVC structure, three phonemes, four letters and a different initial phoneme each. Each TOTimal name was paired with a randomly allocated diet and a drawing resembling a real animal, in order to facilitate learning (see Figure 1).



PAKE
Diet: Seeds

Figure 1: Example of TOTimal stimuli: Illustration by Daniela Barreto (2016)

Participants were asked to memorise the names of the 20 TOTimals in two sets of 10 stimuli. An audio clip of the TOTimal's name played while participants viewed each TOTimal picture and its corresponding written name and diet in a PowerPoint presentation. Participants viewed each TOTimal four times in total, with each slide presented for 15 seconds. Participants then took part in a naming exercise based on the newly memorised words. The TOTimal pictures and diets were presented in a second PowerPoint presentation without the audio and written names. Participants had 30 seconds per slide to attempt to retrieve and produce the name of each presented TOTimal. The naming phase of the experiment was audio recorded and then transcribed orthographically.

These transcriptions were then perceptually analysed for filled pauses (uh, um), prolongations, repetitions, repairs and target approximations (i.e., incorrect attempts to produce the target). If participants did not retrieve a target after 30 seconds, they were asked whether they were experiencing a TOT (as defined prior to starting the experiment as being the state “when you feel you know the name and that you might recall it any minute, but you cannot think of the name at the moment”). If participants responded affirmatively, these responses were coded as unresolved TOTs. If they responded that they were not experiencing a TOT but did not know the word, this response was coded as a “Don't Know” response. As in Beattie and Coughlin (1999), resolved TOTs were

coded when participants exhibited word-finding verbal behaviours, facial expressions, or gestures (e.g. wincing, head in hands, etc.) prior to retrieving the target.

Spearman’s rank-order correlations were used to test for associations between rates of disfluency behaviours and rates of TOTs and “Don’t Know” responses, as well as between disfluency rates and retrieval times during resolved TOTs. A series of t-tests was also used to investigate perceived differences in lexical retrieval between male and female participants.

Results

Audio recordings of participant responses were analysed for disfluencies and TOTs.

TOTs and disfluencies

Overall, for successful retrievals, participants who took longer to retrieve words also produced more disfluencies. A strong positive correlation was found between average retrieval times per participant and disfluency rates (Spearman’s $r_s = .7$, $N = 28$, $p < .001$) and between average retrieval times per TOTimal stimulus and disfluency rates ($r_s = .84$, $N = 20$, $p < .001$). In addition, an expected positive correlation was found between retrieval times during resolved TOTs and disfluency rates ($r_s = .37$, $p < .001$).

It was hypothesised that TOT rates would correlate positively with disfluency rates and they did ($r_s = .84$, $N = 28$, $p < .001$). However, a positive correlation was also found between the rate of “Don’t Know” responses and disfluency rates ($r_s = .46$, $N = 28$, $p = .015$).

More specifically, TOT rates correlated positively with the rates of target approximations ($r_s = .60$, $N = 28$, $p = .001$, Figure 2). As before, however, the number of “Don’t Know” responses was also correlated with the number of target approximations ($r_s = .65$, $p < .001$, Figure 3).

Gender differences in lexical retrieval

A series of post-hoc independent-samples t-tests revealed significant differences in lexical retrieval between male and female participants. Male participants experienced more TOTs and had longer and more disfluent retrieval times than female participants (Table 1).

Discussion

This study supports the notion that there is a relationship between retrieval time and disfluencies, as the longer it took participants to remember the name of a TOTimal, the more disfluent they came.

This correlation also applies to TOTs, as the longer it took participants to resolve TOTs, the more disfluency behaviours they produced. The study also provides evidence that uncertainty regarding targets during lexical retrieval is associated with an increase in disfluency behaviours.

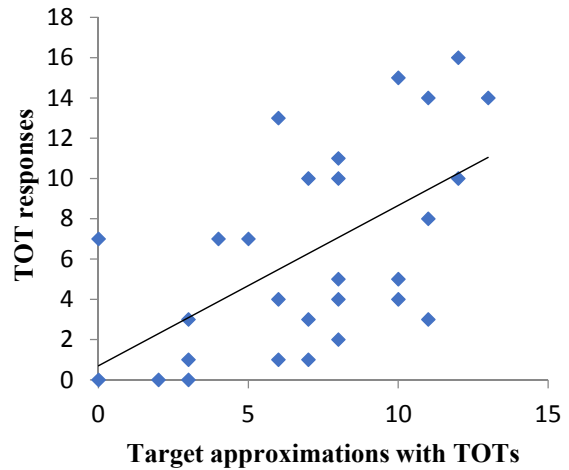


Figure 2: Number of target approximation disfluencies correlates positively with TOT rates by participants ($N = 28$)

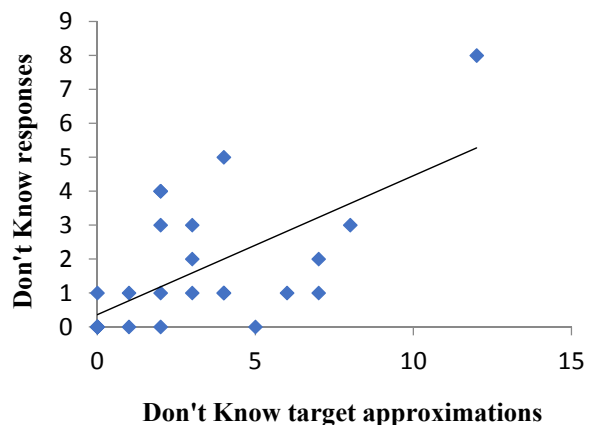


Figure 3: Number of target approximation disfluencies with “Don’t Know” responses correlates positively with rate of “Don’t Know” responses.

Table 1: Male vs female participants for retrieval time (RT), disfluency and TOTs.

Gender	N	Mean	St. Deviation
RT* Male	12	17.83	7.14
Female	16	9.52	6.11
Disfluency Male	12	37.67	15.11
Female	16	18.31	15.26
TOT Male	12	9.42	2.64
Female	16	6.44	3.58

* Retrieval time

This increase in disfluencies existed regardless as to whether the retrieval uncertainty was due to the participant experiencing a TOT or the participant simply not knowing the target.

Additionally, target approximations were a disfluency behaviour of interest due to their resemblance to the “blockers” held responsible for TOTs in the inhibition theory (Jones, 1989). Retrieval times were longer when participants spontaneously produced target approximations during retrieval. Additionally, a significant positive correlation was found between the rates of target approximations and TOTs, suggesting that target approximations are either the cause or consequence of TOTs. However, a significant positive correlation was also found between the rates of target approximations and “Don’t Know” responses to TOTimal stimuli. These combined results indicate that target approximations (i.e. blockers) are more likely to be the cause or consequence of lexical retrieval difficulty in general, and are not — contrary to popular belief — exclusive to the TOT phenomenon. The present study acknowledges that retrieval was more difficult when participants produced target approximations. It does not provide evidence, however, that target approximations (i.e. blockers) cause TOTs, thus adding to the increasing number of studies that have not found evidence to support the widely-accepted inhibition hypothesis (e.g., Kornell & Metcalfe, 2006).

Finally, this study has identified significant differences in the way male and female participants experience lexical retrieval. As these findings were discovered post-hoc, they were not the main focus of analysis. Therefore, future research would be required to further investigate the incidence and cause of these gender differences.

Note

This work was completed as part of the first author’s Master’s Dissertation, contributing to her MSc degree in Speech and Language Therapy at Queen Margaret University, Edinburgh, UK. The dissertation was supervised by the second author. Address for correspondence is rlickley@qmu.ac.uk

References

- Barreto, D. 2016. *Set of fantastical animals* [online]. [viewed 21 October 2016]. Available from: https://www.shutterstock.com/g/Daniela+Barreto?searchterm=fantastical+animals&sort=popular&search_source=base_gallery
- Beattie, G. & J. Coughlin. 1999. An experimental investigation of the role of iconic gestures in lexical access using the tip-of-the-tongue phenomenon. *British Journal of Psychology* 90(1):35–56.
- Brown, A. S. 1991. A review of the tip-of-the-tongue experience. *Psychological Bulletin* 109(2):204–223.
- Brown, R. & McNeill, D. 1966. The “tip of the tongue” phenomenon. *Journal of Verbal Learning and Verbal Behavior* 5(4):325–337.
- Burke, D. M., D. G. MacKay, J. S. Worthley & E. Wade. 1991. On the tip of the tongue: what causes word finding failures in young and older adults? *Journal of Memory and Language* 30(5):542–579.
- Clark, H. H. & J. E. Fox Tree,. 2002. Using uh and um in spontaneous speaking. *Cognition* 84(1):73–111.
- Fraundorf, S. H. & D. G. Watson. 2014. Alice’s adventures in um-derland: psycholinguistic sources of variation in disfluency production. *Language, Cognition and Neuroscience* 29(9):1083–1096.
- Jones, G. V. 1989. Back to Woodworth: role of interlopers in the tip-of-the-tongue phenomenon. *Memory and Cognition* 17(1):69–76.
- Kornell, N. & J. Metcalfe. 2006. “Blockers” do not block recall during tip-of-the-tongue states. *Metacognition and Learning* 1(3):248–261.
- Levelt, W. J. 1989. *Speaking: From intention to articulation*. London: MIT Press.
- Lickley, R. J. 2015. Fluency and disfluency. In M.A. Redford (ed.), *The Handbook of Speech Production*, Chichester, UK: John Wiley & Sons, 445–469.
- Postma, A. 2000. Detection of errors during speech production: a review of speech monitoring models. *Cognition* 77(2):97–132.
- Rastle, K. G., J. Harrington & M. Coltheart,. 2002. 358,534 nonwords: the ARC nonword database. *The Quarterly Journal of Experimental Psychology: Section A* 55(4):1339–1362.
- Schnadt, M. J. 2009. *Lexical influences on disfluency production*. PhD thesis, University of Edinburgh.
- Smith, S. M., J. M. Brown & S. P. Balfour 1991. TOTimals: a controlled experimental method for studying tip-of-the-tongue states. *Bulletin of the Psychonomic Society* 29(5):445–447.