The evolution of LGBT labelling words

YAQIAN SHI AND LEI LEI

Tracking 150 years of the interaction of semantics with social and cultural changes

Introduction

Semantic shifts have been explored via a range of methods (Allan & Robinson 2012). Typically, semantic shifts were usually noted or described with methods such as a literature review or dictionary checking (e.g. Blank & Koch, 1999; Stockwell & Minkova, 2001; Williams, 1976), which are very labour-intensive and time-consuming methods. Other more recently developed methods involve sociolinguistic interviews (Robinson, 2012; Sandow & Robinson, 2018). However, with the development of large-sized corpora and computational semantics, diachronic semantic shifts have started to be captured in a data-driven way (Kutuzov et al., 2018). Recently, the word embeddings technique (Mikolov et al., 2013) has been proven to be a promising tool for the tracking of semantic shifts (e.g. Hamilton, Leskovec & Jurafsky, 2016a, 2016b; Kulkarni et al., 2015; Kutuzov et al., 2017). For example, Hamilton et al. (2016b) exemplified how to use the technique to capture the subjectification process of the word 'actually' during the 20th century.

The present study aims to investigate semantic shifts in denotation and/or connotation (Washington, 2010). Changes in denotation alter the literal meaning of a word while changes in connotation affect the sense or the feeling associated with it (Washington, 2010: 19). A positive change in connotation is described as amelioration while a negative change is pejoration (Traugott & Dasher, 2001). More specifically, we explore the possible semantic shifts of six descriptive or labelling words of LGBT from the 1860s to the 2000s: *homosexual*, *lesbian*, *gay*, *bisexual*, *transgender*, and *queer*, with the word embeddings technique. From our intuition, we can say that these six words have experienced semantic shifts in denotation and/or connotation. However, when and how such shifts occurred remains unclear. An investigation into their semantic shifts may address these concerns. In addition, since LGBT has long been a socially and culturally controversial topic the exploration of socio-cultural perceptions accompanying semantic change of LGBT words is worth pursuing.

Based on the foregoing, the purpose of the study is twofold. First, we aim to describe the semantic

YAQIAN SHI is an MA student in applied linguistics at the School of Foreign Languages, Huazhong University of Science and Technology. Her research interests include corpus linguistics, quantitative linguistics, and academic English.

LEI LEI is Professor in Applied Linguistics at the School of Foreign Languages, Huazhong University of Science and Technology. His research interests include corpus linguistics, quantitative linguistics, and academic English. He has published extensively in journals such as Applied Linguistics, International Journal of Corpus Linguistics, *and* Journal of English for Academic Purposes. *Email: leileibama@outlook.com*

doi:10.1017/S0266078419000270
English Today 143, Vol. 36, No. 4 (December 2020). Printed in the United Kingdom

shift of the LGBT words and to reveal how their change reflects changes in social perception over time. Second, we intend to advance the use of the word embeddings technique for research on semantic shifts by showing how a close qualitative analysis of the nearest neighbours extracted via this technique helps to understand societal and cultural contexts accompanying these shifts. In the following section, we introduce the technique, the dataset, and methods before reporting on the results and providing a detailed discussion.

Methodology

Word embeddings and nearest neighbours

The word embeddings technique is a powerful machine-learning method that embeds or labels each word in a text as a high-dimensional vector in space (Mikolov et al., 2013). The distance between any two word vectors is measured in terms of cosine (Turney & Pantel, 2010), which represents their semantic relations (Garg et al., 2017). Since words occurring in similar contexts are assumed to be semantically similar (Kulkarni et al., 2015: 427), the similarity between two words approximates to the cosine distance between their vectors. The closer the distance between two vectors is, the more semantically similar the words are, and vice versa (Collobert et al., 2011). Based on the embedding distance between a particular word and all other words in the text, the 'semantic neighbours' (or 'K-nearest neighbours' in technical terms) can thus be extracted in descending order. The top nearest neighbours are considered to be the most semantically related or similar words to the particular word under investigation.

Recent years has witnessed an increasing number of studies that incorporate the word embeddings technique into research on diachronic semantic shifts (e.g. Hamilton et al., 2016a, 2016b; Kulkarni et al., 2015; Kutuzov et al., 2017). It has been proven that this technique is an effective tool for diachronic semantic shifts, with promising potential of quantifying semantic shifts (Kim et al., 2014), capturing different types of shifts (Hamilton et al., 2016a), or even revealing quantitative laws of semantic shifts (Hamilton et al., 2016b). With the aid of additional data, such as Census data and other literatures, the diachronic semantic shifts captured by word embeddings can detect societal changes and historical trends (Garg et al., 2017), which offers valuable insights into the interaction of semantics with societal and cultural changes.

Hamilton et al. (2016a) proposed two computational measures for semantic shifts. One involves calculating the distance a word has moved in the semantic space between different time stamps. This measure is effective in capturing changes that have occurred due to regular processes of linguistic drift, such as grammaticalization or subjectification, but is not sensitive to changes resulting from cultural shifts, such as technological advancements. In addition, although a change of distance in the semantic space can determine whether a word has experienced a semantic shift, it cannot reveal how the semantic shift has occurred without any contextual information. In other words, it cannot recognize whether the word has shifted in denotation or in connotation. In contrast, the other measure that observes changes in a word's nearest neighbours is useful for detecting semantic changes that have occurred due to cultural shifts. A close analysis of these nearest neighbours may enable the denotation and connotation of the word to be inferred, thus showing how the word has changed. For example, the top three nearest neighbours of 'broadcast' in the 1850s are *sow*, *seeds*, and *sows* while those in the 1990s are *BBC*, *radio*, and *television*, which indicates a semantic shift of the word from casting out seeds to transmitting signals (Hamilton et al., 2016b).

To summarize, the nearest neighbours of a word extracted via the word embeddings technique are indicators of its denotation and connotation since they are most semantically related to this word. More specifically, a word's denotation and connotation are inferred from the semantics of its nearest neighbours. Changes in its nearest neighbours over time may serve as evidence for its semantic shifts. Based on a close examination in the changes of their nearest neighbours over a period of 150 years, the present study uses this technique to capture the possible semantic shifts of six LGBT descriptive or labelling words, i.e., *homosexual*, *lesbian*, *gay*, *bisexual*, *transgender*, and *queer*. We have chosen these words because they have been general terms frequently used to refer to LGBT people. Furthermore, it explores whether their semantic shifts may reveal how the social perception of LGBT has changed over time with a qualitative analysis of the nearest neighbours.

Dataset and method

The dataset used in this study is the Corpus of Historical American English (COHA) (Davies, 2012), which is a 400-million-word corpus of historical American English balanced by both genre and decade. The dataset, organized by decade

https://doi.org/10.1017/S0266078419000270 Published online by Cambridge University Press

into 15 subsets, was trained with *rword2vec*, an R language wrapper for the word embeddings technique (Garg et al., 2017). The 50 nearest neighbours of *homosexual*, *lesbian*, *gay*, *bisexual*, *transgender*, and *queer* were then extracted for each decade from the 1860s to the 2000s. Using the nearest neighbours technique, it is possible to capture the semantic shifts of the words across the span of 150 years. One point worth noting is that not all words always have nearest neighbours in certain decades due to their limited coverage in COHA.

The nearest neighbours of the words were analysed via two steps. First, the neighbours of each word in each decade were closely read and compared to determine whether a word has shifted in denotation, that is, changes from one meaning to another. For example, the top three nearest neighbours of *gay* in the 1860s were *merry*, *gayest*, and *joyous* while those in the 2000s were *lesbian*, *bisexual*, and *transgender*. Changes of its nearest neighbours indicate that *gay* has clearly undergone a shift in denotation. Second, in order to decide whether a word has undergone a shift in connotation, its negative neighbours in each decade were picked out and analysed. A neighbour is taken as negative if (1) it has a negative connotation (e.g. *wrongness*, *egocentric*); (2) it is related to illegal behaviours or is against the social norm (e.g. *truancy*, *incest*); or (3) it is associated with disease, especially mental disease (e.g. *psychotic*, *schizophrenic*). Negative neighbours are in bold font in the *Supporting Materials*. Also, special attention is paid to positive connotation in nearest neighbours evidence.

Results and discussion

Among the six words, five words (*homosexual*, *lesbian*, *gay*, *bisexual*, and *queer*) were found to have experienced semantic shifts, which will be reported on in the following sections. *Transgender* is left unreported due to its limited coverage in COHA.

Shift in denotation: Old words for new meaning

In this section, we report on the findings concerning shifts in denotation. Two words, *gay* and *queer*, were found to have experienced a shift in denotation.

Gay

The word *gay* first occurred in the 1860s in COHA. As shown in Figure 1a, its denotation has probably shifted via three phases. First, from the 1860s to the 1960s, most of its nearest neighbours are positive words expressing happiness and joy, such as *merry*, *blithe*, *cheerful*, and *mirthful*. That is, in this phase, *gay* mainly meant *happy*, with a positive connotation. Nevertheless, in the second phase of the 1970s, *gay* began to have negative neighbours such as *bawdy*, *flirtatious*, and *gullible*, with its connotation starting to become negative. This phase may be a transitional phase when *gay* shifted in denotation, from *happy* to *homosexual*. Such a turning point conforms to the finding made by other studies that it is in the 1970s that *gay* as homosexual 'entered the mainstream discourse' (Robinson, 2012: 47; Wijaya, 2011). Then, in the third phase starting from the 1980s, with *homosexual* as its top nearest neighbour, it has evolved to the semantic meaning of homosexual.

In the 1980s and the 1990s, *gay* was associated with strongly negative words, such as *promiscuous*, *incest*, *kinky*, *psychopath*, and *antigay*. These strongly negative words reflect the fact that during this period, *gay*, starting to refer to *homosexual*, might not have been accepted by society, and gay people were perceived negatively. However, in the 2000s, *gay* gradually lost its negative neighbours, with only four occurring in the list (*stigmatized*, *extramarital*, *perversions*, and *taboo*), which are not as negative as those occurring in the 1980s and 1990s. In addition, neighbours such as *rights* and *legalized* occurred in the 2000s. Thus, the change in its neighbours from the 1980s to the 2000s, especially the positive ones, indicates a positive change in the social perception of the term *gay*. That is, it is increasingly embraced and protected by the public.

Queer

Another word that has experienced a denotative shift is *queer* (see Figure 1b). Similar to *gay*, *queer* has undergone three phases of shifts. From the 1860s to the 1960s, its nearest neighbours in each decade were similar, with words such as *odd*, *queer-looking*, *strange*, *weird*, and *freak* frequently appearing in the list. That is, in the first phase, *queer* mainly meant *strange* and *peculiar*. However, from the 1970s to the 1990s, although most neighbours of *queer* were similar to those occurring between the 1860s and the 1960s, some words such as *faggy* (meaning homosexual) and *lecher* appeared in the list. Such a finding shows that the second phase may be a transitional period when *queer* shifted from its original meaning to a new one. Then, in the third phase of the 2000s, the nearest neighbours of *queer* were clearly different from those found in previous decades, with few neighbours expressing the meaning of

https://doi.org/10.1017/S0266078419000270 Published online by Cambridge University Press

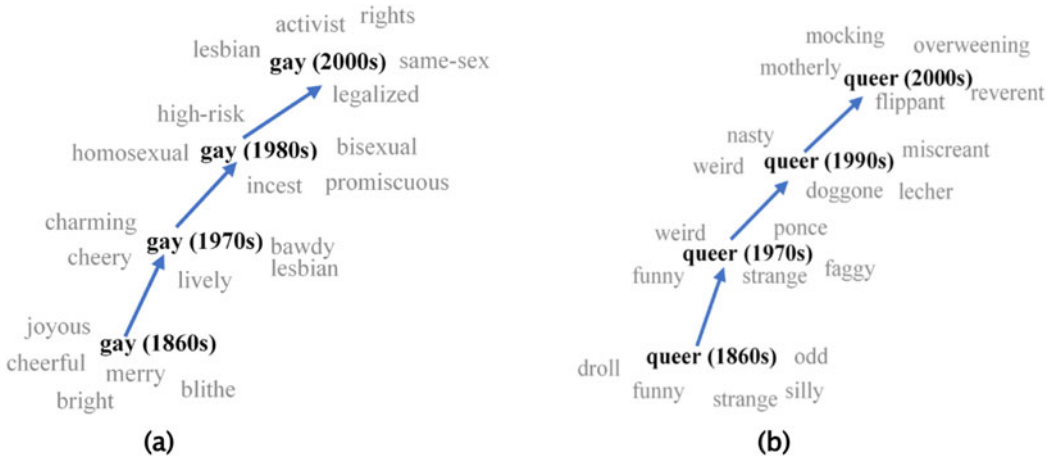

Figure 1. Visualization of semantic shifts of *gay* (a) and *queer* (b)

odd and *peculiar*. Thus, starting from the 2000s, *queer* might have lost its original denotative meaning and evolved to a new one.

A close examination of the nearest neighbours of *queer* in the 2000s shows that almost half of them are negative words. *Queer* was often associated with *flippant*, *overweening*, *bigot*, *bawdy*, etc. However, positive neighbours also existed in this decade, such as *motherly*, *reverent*, *artless*, and *condescending*. The mixture of both negative and positive neighbours indicates that *queer* is not only perceived negatively. Although *queer* is still subject to negative stereotypes, discrimination, and prejudice, its positive semantic meaning has recently been recognized.

Shift in connotation: From negative to neutral

In this section, we report on the findings concerning shifts in connotation. Three words, *homosexual*, *lesbian*, and *bisexual*, were found to have experienced amelioration, shifting from negative to neutral connotation.

Homosexual

Homosexual first occurred in the 1920s, probably due to its limited coverage in COHA. However, most of the 50 nearest neighbours in the 1920s were names of famous figures, such as *Parke*, *Copwer*, and *Molnar*. Given that it is difficult to infer the denotation or connotation of *homosexual* with the names without any contextual information, the 50 nearest neighbours in this decade were excluded from the following analysis. The semantic shift of *homosexual* is observed from the 1930s to the 2000s (see Figure 2a).

Somewhat unexpectedly, *homosexual* is always accompanied with negative neighbours from the 1930s to the 2000s. *Homosexual* was considered inconsistent with traditional values (e.g. *inversion*, *non-human*, *degeneration*, *antisocial*, *deviant*, *culpable*), and was frequently associated with seemingly immoral or illegal behaviours (e.g. *masturbation*, *recidivism*, *truancy*, *incest*, *rape*). From the 2000s, it lost many such neighbours and gained more neutral neighbours. Words such as *legalizing* and *guiltless* first appeared in this decade. The decrease in negative neighbours and increase in neutral ones indicates that *homosexual* became less negative in connotation, and more neutral.

Different from the other four words, *homosexual* has more neighbours related to mental disease (highlighted by underlining in the *Supporting Materials*). For example, from the 1930s to 1960s, many negative neighbours were related to mental disease. This was especially the case in the 1940s, where more than half of them (17 out of 30) were related to mental disease, such as *psychotic*, *phantasies*, *schizophrenic*, *manic-depressive*, *phobias*, and *psychosis*. The large number of neighbours related to mental disease implies that during this period, homosexual people might have been perceived as patients with a mental disorder. However, starting from the 1970s, it lost such neighbours, with only one or two occurring in each decade. This change indicates a positive shift in the social perception of *homosexual*, showing that *homosexual* was no longer considered as a mental disease. Such a positive shift is evidenced by the fact that the American Psychiatric Association removed *homosexual* from the *Diagnostic and Statistical Manual of Mental Disorders* in 1973

https://doi.org/10.1017/S0266078419000270 Published online by Cambridge University Press

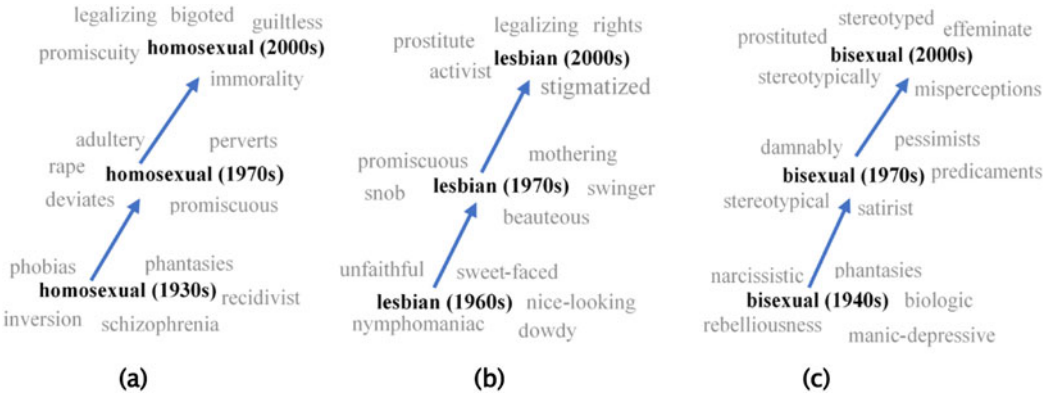

Figure 2. Visualization of semantic shifts of *homosexual* (a), *lesbian* (b), and *bisexual* (c)

(Lamberg, 1998). Therefore, after the 1970s, few neighbours were related to mental disease.

Lesbian

Similar to *homosexual*, *lesbian* has also experienced a semantic shift in connotation from negative to neutral (see Figure 2b). *Lesbian* first appeared in the 1960s in COHA, much later than *homosexual* did. In contrast to the other four words, *lesbian* had positive neighbours such as *sweet-faced*, *nice-looking*, and *demure*. It shows that lesbians were often associated with a beautiful appearance and good characters. This finding is in line with the simplified stereotype of femme lesbians that they exhibit more traditional feminine characteristics (Walker et al., 2012: 91), which may explain why *lesbian* is frequently accompanied by such positive neighbours.

Interestingly, approximately 30% (15 out of 50) of *lesbian*'s nearest neighbours were negative words in the 1960s, such as *nymphomaniac*, *unfaithful*, *dowdy*, and *bitchy*. However, such negative neighbours were decreasing from the 1970s. In the 1990s and the 2000s, only 10% of its neighbours were negative, and most others were neutral. That is, *lesbian* has become less negative and more neutral in connotation. This finding also shows that the social perception of *lesbian* has experienced a positive shift since lesbians were not only perceived as normal in a gradual manner, but also received protection (Faur, 2018). This is particularly true when words such as *activist*, *civil-rights*, *legalizing*, and *rights* appeared as its nearest neighbours in the 1990s and 2000s.

Bisexual

Bisexual is the last word that has experienced a shift in connotation (see Figure 2c). From the 1940s to 1980s, its nearest neighbours were largely medical- or psychological-related words such as *chromosome*, *manic-depressive*, *neurocirculatory*, *psychopath*, and *zygote*. The close association with these medical- or psychological-related words indicates that during this period, *bisexual* might have been used more as a technical term. In particular, many negative neighbours in these decades were disease-related words, such as *manic-depressive*, *lesions*, and *dysfunction*. From the social perspective, similar to *homosexual*, *bisexual* was considered as a physiological or psychological disease during this period. An exception during this period is the 1970s in which *bisexual* only had three medical- or psychological-related neighbours, *protoplasm*, *Jungian*, and *pathologically*. *Bisexual* might have been more neutral in this decade. Then, starting from the 1990s, *bisexual* lost more medical- or psychological-related neighbours. Many neighbours, including negative neighbours, were related to the social humanities. In the 2000s, in particular, its negative neighbours, such as *stereotypes*, *effeminate*, and *misperceptions*, were not as negative as those in previous decades, which shows that *bisexual* became less negative and more neutral in connotation. In addition, the change in its nearest neighbours indicates a shift in the social perception of *bisexual*, from a scientific to a social perspective. That is, bisexuals were probably no longer perceived as patients with physiological or psychological diseases. In contrast, the public was more concerned about bisexuals themselves and their influence on society.

Conclusion

The present study found, based on their nearest neighbours, that *gay* and *queer* have experienced shifts in denotation, and *homosexual*, *lesbian*,

https://doi.org/10.1017/S0266078419000270 Published online by Cambridge University Press

and *bisexual* have undergone shifts in connotation. The two shifts have two points in common. First, both shifts started from the 1970s. Second, both of them have undergone shifts from negative to neutral or positive in denotation or connotation.

Such diachronic changes in these words in both denotation and connotation seem parallel to the societal changes in LGBT. In a society and at a time in which heterosexuality is the norm, homosexuality has long been subject to negative stereotypes, discrimination, and misrepresentation (Connolly, 2018; D'Augelli & Rose, 1990; Della Pelle et al., 2018). To be LGBT used to be regarded as a psychological disorder or abnormality. Consequently, these words were often accompanied with negative neighbours. However, the turning point occurred in 1973 when the American Psychiatric Association excluded it from the *Diagnostic and Statistical Manual of Mental Disorders*, hence excluding homosexuality from being classified as a mental disorder (Lamberg, 1998). Also in the 1970s, the homosexual liberation movement in the wake of the Stonewall riots in 1969 was flowering, and more efforts were made to combat this misrepresentation (Connolly, 2018: 57). In the following decades, more laws and policies were enacted to decriminalize homosexual behaviours and protect LGBT rights in employment, housing, and services (e.g. *Anti-Discrimination Act 1977*). From discrimination to rights protection, the social perception of LGBT has clearly undergone a positive change. Such a societal change is necessarily reflected in language (Downes, 1998; Hudson, 1996). The positive change in the views on LGBT results in a positive change in the nearest neighbours of the LGBT labelling words from negative to neutral or even positive. Our finding of the semantic shifts of these words from negative to neutral corroborates this positive societal change.

The meanings of words are always in flux. To track such semantic shifts of words, previous research largely appealed to literatures and dictionaries. With the development of techniques regarding corpus text analysis and computational semantics, shifts in word meanings can be captured efficiently with such data-driven methods. The present study successfully tracked the possible semantic shifts of five LGBT labelling words across a time span of 150 years with the word embeddings technique. This technique, complemented by qualitative analyses, appears to be effective in efficiently capturing semantic shifts in both the denotation and connotation of words. In addition, a close qualitative analysis of the nearest neighbours further reveals when and how these shifts have occurred and whether such shifts conform to the societal changes. In other words, a fuller picture of semantic shifts may be painted via the word embeddings technique. Hopefully, it may serve as an exemplar for how such techniques can be employed in future research. However, it is worth noting that the technique depends much on the coverage of the corpus. A limited coverage of the diachronic data of certain words, for example *transgender* in this study, may result in the lack of its nearest neighbours in some decades and corresponding failure to infer its semantic meaning in the periods. Future research may adopt a larger diachronic corpus for a fuller picture of the semantic shifts of certain words.

Supplementary material

Supplementary material is available online at https://doi.org/10.1017/S0266078419000270.

References

Allan, K. & Robinson, J. A. (eds.) 2012. *Current Methods in Historical Semantics*. Topics in English Linguistics (73). Berlin/Boston: de Gruyter Mouton.

Blank, A. & Koch, P. 1999. *Historical Semantics and Cognition*. Berlin; New York: Walter de Gruyter.

Collobert, R., Weston, J., Bottou, L., Karlen, M., Kavukcuoglu, K. & Kuksa, P. 2011. 'Natural language processing (almost) from scratch.' *Journal of Machine Learning Research*, 12, 2493–537.

Connolly, M. 2018. 'Liberating the screen: Gay and lesbian protests of LGBT.' *Cinema Journal*, 57(2), 66–88. doi: 10.1353/cj.2018.0003

D'Augelli, A. R. & Rose, M. L. 1990. 'Homophobia in a university community: Attitudes and experiences of heterosexual freshmen.' *Journal of College Student Development*, 31(6), 484–91.

Davies, M. 2012. 'Expanding horizons in historical linguistics with the 400-million-word Corpus of Historical American English.' *Corpora*, 7(2), 121–57. doi: 10.3366/cor.2012.0024

Della Pelle, C., Cerratti, F., Di Giovanni, P., Cipollone, F. & Cicolini, G. 2018. 'Attitudes towards and knowledge about lesbian, gay, bisexual, and transgender patients among Italian nurses: An observational study.' *Journal of Nursing Scholarship*, 50(4), 367–74. doi: 10.1111/jnu.12388

Downes, W. 1998. *Language and Society* (2nd edn.) London: Cambridge University Press.

Faur, E. 2018. 'Contrasting trends in gender and childcare in Argentina: Family policies between LGBT rights and maternalism.' *Current Sociology*, 66(4), 617–28. doi: 10.1177/0011392118765250

Garg, N., Schiebinger, L., Jurafsky, D. & Zou, J. 2017. 'Word embeddings quantify 100 years of gender and ethnic stereotypes.' *Proceedings of the National Academy of Sciences*, 115(16), E3635–E3644. doi: 10.1073/pnas.1720347115

Hamilton, W. L., Leskovec, J. & Jurafsky, D. 2016a. 'Cultural shift or linguistic drift? Comparing two

computational measures of semantic change.' In *Conference on Empirical Methods in Natural Language Processing*, Texas, pp. 2116–21. Online at http://arxiv.org/abs/1606.02821 (Accessed June 18, 2019)
Hamilton, W. L., Leskovec, J. & Jurafsky, D. 2016b. 'Diachronic word embeddings reveal statistical laws of semantic change.' *Proceedings of the 54th Annual Meeting of the Association for Computational Linguistics*, Stroudsburg, pp. 1489–501. doi: 10.18653/v1/P16-1141
Hudson, R. A. 1996. *Sociolinguistics*. Cambridge: Cambridge University Press.
Kim, Y., Chiu, Y. I., Hanaki, K., Hegde, D. & Petrov, S. 2014. 'Temporal analysis of language through neural language models.' *Proceedings of the 52nd Annual Meeting of the Association for Computational Linguistics*, Baltimore, USA, pp.61–5.
Kulkarni, V., Al–Rfou, R., Perozzi, B. & Skiena, S. 2015. 'Statistically significant detection of linguistic change.' *Proceedings of the 24th International Conference on World Wide Web*. Florence, Italy, pp. 625–35.
Kutuzov, A., Øvrelid, L., Szymanski, T. & Velldal, E. 2018. 'Diachronic word embeddings and semantic shifts: a survey.' *Proceedings of COLING*, pp.1384–97. Online at http://arxiv.org/abs/1806.03537 (Accessed August 15, 2018)
Kutuzov, A., Velldal, E. & Øvrelid, L. 2017. 'Tracing armed conflicts with diachronic word embedding models.' *Quantitative Approaches to the Russian Language*, 31, 31–36. doi: 10.18653/v1/W17-2705
Lamberg, L. 1998. 'Gay is okay with APA – Forum honors landmark 1973 events.' *Journal of the American Medical Association*, 280(6), 497–99. doi: 10.1001/jama.280.6.497
Mikolov, T., Sutskever, I., Chen, K., Corrado, G. & Dean, J. 2013. 'Distributed representations of words and phrases and their compositionality.' In C. J. C. Burges, L. Bottou, M. Welling, Z. Ghahramani & K. Q. Weinberger (eds.), *Advances on Neural Information Processing Systems 26*. New York: Curran Associates, Inc., pp. 3111–9.
Robinson, J. A. 2012. 'A gay paper: Why should sociolinguistics bother with semantics?' *English Today*, 28(4), 38–54.
Sandow, R. J. & Robinson, J. A. 2018. '"Doing Cornishness" in the English periphery: Embodying ideology through Anglo–Cornish dialect lexis.' In N. Braber & S. Jansen (eds.), *Sociolinguistics in England*. London: Palgrave Macmillan, pp. 333–61.
Stockwell, R. & Minkova, D. 2001. *English Words: History and Structure*. Cambridge: Cambridge University Press.
Traugott, E. C. & Dasher, R. B. 2001. *Regularity in Semantic Change*. Cambridge: Cambridge University Press.
Turney, P. D. & Pantel, P. 2010. 'From frequency to meaning: Vector space models of semantics.' *Journal of Artificial Intelligence Research*, 37, 141–188.
Walker, J. J., Golub, S. A., Bimbi, D. S. & Parsons, J. T. 2012. 'Butch bottom–femme top? An exploration of lesbian stereotypes.' *Journal of Lesbian Studies*, 16(1), 90–107. doi: 10.1080/10894160.2011.557646
Washington, A. 2010. 'Bad words gone good: Semantic reanalysis in African American English.' PhD thesis. Pittsburgh: University of Pittsburgh.
Wijaya, D. T. 2011. 'Understanding semantic change of words over centuries.' *Proceedings of the 2011 International Workshop on Detecting and Exploiting Cultural Diversity on the Social Web*, New York, USA, pp. 35–40.
Williams, J. M. 1976. 'Synaesthetic adjectives: A possible law of semantic change.' *Language*, 52(2), 461–78.

https://doi.org/10.1017/S0266078419000270 Published online by Cambridge University Press